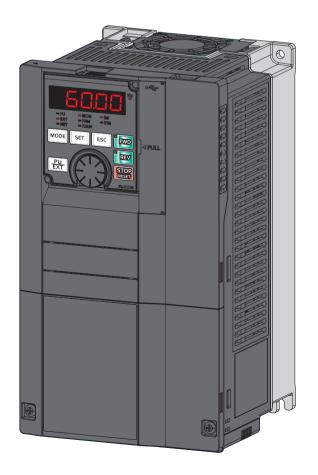




INVERTER FR-F800 INSTRUCTION MANUAL (DETAILED)

Inverter for fans and pumps

FR-F820-00046(0.75K) to 04750(110K) FR-F840-00023(0.75K) to 06830(315K) FR-F842-07700(355K) to 12120(560K) FR-F846-00023(0.75K) to 03610(160K)



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Safety instructions

Thank you for choosing Mitsubishi Electric inverter.

This Instruction Manual provides detailed instructions for advanced settings of the FR-F800 series inverters.

Incorrect handling might cause an unexpected fault. Before using this product, read all the relevant instruction manuals carefully to ensure proper use.

Do not attempt to install, operate, maintain or inspect this product until you have read the Instruction Manuals and supplementary documents carefully. Do not use this product until you have a full knowledge of this product mechanism, safety information and instructions.

Installation, operation, maintenance and inspection must be performed by qualified personnel. Here, qualified personnel means a person who meets all the following conditions:

- A person who possesses a certification in regard with electric appliance handling, or person took a proper engineering training. Such training may be available at your local Mitsubishi Electric office. Contact your local sales office for schedules and locations.
- A person who can access operating manuals for the protective devices (for example, light curtain) connected to the safety control system, or a person who has read these manuals thoroughly and familiarized themselves with the protective devices.

In this Instruction Manual, the safety instruction levels are classified into "WARNING" and "CAUTION".

Incorrect handling may cause hazardous conditions, resulting in death or severe injury.

Incorrect handling may cause hazardous conditions, resulting in medium or slight injury, or may cause only material damage.

Note that even the A CAUTION level may lead to a serious consequence depending on conditions. Be sure to follow the instructions of both levels as they are critical to personnel safety.

Electric shock prevention

- Do not remove the front cover or the wiring cover while the power of this product is ON, and do not run this product with the front cover or the wiring cover removed as the exposed high voltage terminals or the charging part of the circuitry can be touched. Doing so may cause an electric shock.
- Even if power is OFF, do not remove the front cover except for wiring or periodic inspection as the inside of this product is charged. Doing so may cause an electric shock.
- Before wiring or inspection, check that the LED display of the operation panel is OFF. Any person who is involved in wiring or inspection shall wait for 10 minutes or longer after the power supply has been cut off, and check that there are no residual voltage using a tester or the like. The capacitor is charged with high voltage for some time after power OFF, and it is dangerous.
- This product must be earthed (grounded). Earthing (grounding) must conform to the requirements of national and local safety regulations and electrical code (NEC section 250, IEC 61140 class 1 and other applicable standards). A neutral-point earthed (grounded) power supply must be used for 400 V class of this product to be compliant with EN standard.
- Any person who is involved in wiring or inspection of this product shall be fully competent to do the work.
- This product must be installed before wiring. Otherwise you may get an electric shock or be injured.
- Do not touch the setting dial or keys with wet hands. Doing so may cause an electric shock.
- Do not subject the cables to scratches, excessive stress, heavy loads or pinching. Doing so may cause an electric shock.
- Do not change the cooling fan while power is ON as it is dangerous.
- Do not touch the printed circuit board or handle the cables with wet hands. Doing so may cause an electric shock.
- Never touch the motor terminals, etc. right after powering OFF as the DC voltage is applied to the motor for 1 second at powering OFF if the main circuit capacitor capacity is measured. Doing so may cause an electric shock.
- Before wiring or inspection for a PM motor, confirm that the PM motor is stopped as a PM motor is a synchronous motor with high-performance magnets embedded inside and high-voltage is generated at the motor terminals while the motor is running even after the power of this product is turned OFF. In an application, such as fan and blower, that the motor may be driven by the load, connect a low-voltage manual contactor at the output side of this product and keep it open during wiring and inspection of this product. Otherwise you may get an electric shock.

Fire prevention

- This product must be installed on a nonflammable wall without any through holes so that nobody touches the heat sink, etc. on the rear side of this product. Installing it on or near flammable material may cause a fire.
- If this product has become faulty, the product power must be switched OFF. A continuous flow of large current may cause a fire.
- Do not connect a resistor directly to the DC terminals P/+ and N/-. Doing so could cause a fire.
- Be sure to perform daily and periodic inspections as specified in the Instruction Manual. There is a possibility of explosion, damage, or fire if this product is used without inspection.

Injury prevention

- The voltage applied to each terminal must be as specified in the Instruction Manual. Otherwise burst, damage, etc. may occur.
- The cables must be connected to the correct terminals. Otherwise burst, damage, etc. may occur.
- The polarity (+ and -) must be correct. Otherwise burst, damage, etc. may occur.
- While power is ON or for some time after power-OFF, do not touch this product as it will be extremely hot. Doing so may cause a burn.

Additional instructions

The following instructions must be also followed. If this product is handled incorrectly, it may cause unexpected fault, an injury, or an electric shock.

Transportation and installation

- Any person who is opening a package using a sharp object, such as a knife or cutter, must wear gloves to prevent injuries caused by the edge of the sharp object.
- This product must be transported in correct method that corresponds to the weight. Failure to do so may lead to injuries.
- Do not stand or place any heavy object on this product.
- Do not stack the boxes containing this product higher than the number recommended.
- When carrying this product, do not hold it by the front cover. Doing so may cause a fall or failure of the product.
- During installation, caution must be taken not to drop this product as doing so may cause injuries.
- This product must be installed on the surface that withstands the weight of the product.
- Do not install this product on a hot surface.
- The installing orientation of this product must be correct.
- This product must be installed on a strong surface securely with screws so that it does not drop.
- Do not install or operate this product if it is damaged or has parts missing.
- Foreign conductive objects must be prevented from entering this product. That includes screws and metal fragments or other flammable substance such as oil.
- As this product is a precision instrument, do not drop or subject it to impact.
- The surrounding air temperature must be between -10°C and +50°C (non-freezing) for this product at LD (light duty) rating or between -10°C and +40°C (non-freezing) for this product at SLD (super light duty) rating. Otherwise the product may be damaged.
- The ambient humidity must be 95% RH or less (non-condensing) for this product. Otherwise the product may be damaged. (Refer to page 36 for details.)
- The temporary storage temperature (applicable to a short limited time such as a transportation time) must be between 20°C and +65°C. Otherwise this product may be damaged.
- This product must be used indoors (without corrosive gas, flammable gas, oil mist, dust and dirt). Otherwise the product may be damaged.
- Do not use this product at an altitude above 2500 m. Vibration should not exceed 5.9 m/s^{2*1} at 10 to 55 Hz in X, Y, and Z directions. Otherwise the product may be damaged. (For installation at an altitude above 1000 m, consider a 3% reduction in the rated current per 500 m increase in altitude.)
- If halogens (including fluorine, chlorine, bromine, and iodine) contained in fumigants for wood packages enter this product, the product may be damaged. Prevent the entry of fumigant residuals or use an alternative method such as heat disinfection. Note that sterilization or disinfection of wood packages should be performed before packing the product.

Wiring

- Do not install a power factor correction capacitor, surge absorber, or radio noise filter on the output side of this product. These devices may overheat or burn out.
- The output terminals (terminals U, V, and W) must be connected to a motor correctly. Otherwise the motor rotates inversely.
- Even after the power of this product is turned OFF, a PM motor is running for a while and the output terminals U, V, and W of this product wired to the PM motor hold high voltages all that while. Before wiring other terminals, be sure that the PM motor is stopped. Otherwise you may get an electric shock.
- Never connect a PM motor to the commercial power supply. Applying the commercial power to the input terminals (U, V, W) on a PM motor will burn the PM motor. The PM motor must be applied a power from this product with the output terminals (U, V, W).

Test operation

• Before starting the test operation, confirm or adjust the parameter settings. Failure to do so may cause some machines to make unexpected motions.

^{*1 2.9} m/s^2 or less for the FR-F840-04320(185K) or higher.

Usage

- Stay away from the equipment after using the retry function in this product as the equipment will restart suddenly after the output shutoff of this product.
- Depending on the function settings of this product, the product does not stop its output even when the STOP/RESET key on the operation panel is pressed. To prepare for it, provide a separate circuit and switch (to turn OFF the power of this product, or apply a mechanical brake, etc.) for an emergency stop.
- Be sure to turn OFF the start (STF/STR) signal before clearing the fault as this product will restart the motor suddenly after a fault is cleared.
- Do not use a PM motor for an application that the motor may be driven by the load and run at a speed higher than the maximum motor speed.
- Use only a three-phase induction motor or PM motor as a load on this product. Connection of any other electrical equipment to the output of this product may damage the equipment.
- Do not modify this product.
- Do not remove any part which is not instructed to be removed in the Instruction Manuals. Doing so may lead to a failure or damage of this product.

Usage

- The electronic thermal O/L relay function may not be enough for protection of a motor from overheating. It is recommended to install an external thermal relay or a PTC thermistor for overheat protection.
- Do not repeatedly start or stop this product with a magnetic contactor on its input side. Doing so may shorten the life of this product.
- Use a noise filter or other means to minimize the electromagnetic interference with other electronic equipment used nearby this product.
- Appropriate precautions must be taken to suppress harmonics. Otherwise harmonics in power systems generated from this product may heat/damage a power factor correction capacitor or a generator.
- To drive a 400 V class motor with this product, use an insulation-enhanced motor, or take measures to suppress surge voltage. Otherwise surge voltage, which is attributed to the length and thickness of wire, may occur at the motor terminals, causing the motor insulation to deteriorate.
- As all parameters return to their initial values after the Parameter clear or All parameter clear is performed, the needed parameters for this product operation must be set again before the operation is started.
- This product can be easily set for high-speed operation. Therefore, consider all things related to the operation such as the performance of a motor and equipment in a system before the setting change.
- This product's brake function cannot be used as a mechanical brake. Use a separate device instead.
- Perform an inspection and test operation of this product if it has been stored for a long period of time.
- To avoid damage to this product due to static electricity, static electricity in your body must be discharged before you touch this product.
- Only one PM motor can be connected to a single unit of this product.
- A PM motor must be used under PM motor control. Do not use a synchronous motor, induction motor, or synchronous induction motor.
- Do not connect a PM motor to this product at a setting for the induction motor control (initial setting). Do not connect an induction motor to this product at a setting for PM motor control. Doing so will cause a failure.
- As a process of starting a PM motor, turn ON the power of this product first, and then close the contactor on the output side of this product.
- To maintain the security (confidentiality, integrity, and availability) of the inverter and the system against unauthorized access, DoS^{*1} attacks, computer viruses, and other cyberattacks from external devices via network, take appropriate measures such as firewalls, virtual private networks (VPNs), and antivirus solutions. We shall have no responsibility or liability for any problems involving inverter trouble and system trouble by DoS attacks, unauthorized access, computer viruses, and other cyberattacks.
- When the emergency drive function is enabled, the operation is continued or the retry operation (automatic reset and restart) is repeated even if a fault occurs, which may damage or burn this product and the motor. Before restarting the normal operation after the operation using the emergency drive function, make sure that this product and the motor have no fault.

Emergency stop

- A safety backup such as an emergency brake must be provided for devices or equipment in a system to prevent hazardous conditions in case of failure of this product or an external device controlling this product.
- If the breaker installed on the input side of this product trips, check for wiring faults (such as short circuits) and damage to internal parts of this product. Identify and remove the cause of the trip before resetting the tripped breaker (or before applying the power to this product again).
- When any protective function is activated, take an appropriate corrective action before resetting this product to resume the operation.

Maintenance, inspection and parts replacement

- Do not carry out a megger (insulation resistance) test on the control circuit of this product. Doing so will cause a failure. Disposal
 - This product must be treated as industrial waste.

*1 DoS: A denial-of-service (DoS) attack disrupts services by overloading systems or exploiting vulnerabilities, resulting in a denial-of-service (DoS) state.

General instruction

• For clarity, illustrations in this Instruction Manual may be drawn with covers or safety guards removed. Ensure all covers and safety guards are properly installed prior to starting operation. For details on the PM motor, refer to the Instruction Manual of the PM motor.

MEMO

CHAPTER 1 INTRODUCTION

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1 INTRODUCTION

The contents described in this chapter must be read before using this product.

Always read the instructions before use.

For the separated converter type, refer to the "INTRODUCTION" in the FR-F802 (Separated Converter Type) Instruction Manual (Hardware).

For the IP55 compatible model, refer to the "INTRODUCTION" in the FR-F806 (IP55/UL Type 12 specification) Instruction Manual (Hardware).

Abbreviations

| Item | Description | | |
|---|---|--|--|
| DU | Dperation panel (FR-DU08) | | |
| Operation panel | Operation panel (FR-DU08) and LCD operation panel (FR-LU08) | | |
| Parameter unit | Parameter unit (FR-PU07) | | |
| PU | Operation panel and parameter unit | | |
| Inverter | Mitsubishi Electric inverter FR-F800 series | | |
| Pr. | Parameter number (Number assigned to function) | | |
| PU operation | Operation using the PU (operation panel/parameter unit) | | |
| External operation | Operation using the control circuit signals | | |
| Combined operation | Combined operation using the PU (operation panel/parameter unit) and External operation | | |
| Mitsubishi Electric standard motor | SF-JR | | |
| Mitsubishi Electric constant- torque motor | SF-HRCA | | |
| Mitsubishi Electric IPM motor | MM-EFS motor and MM-THE4 motor | | |
| MM-EFS 1500 r/min spec. | MM-EFS motor with speed rating of 1500 r/min | | |
| MM-EFS 3000 r/min spec. | MM-EFS motor with speed rating of 3000 r/min | | |

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- Other company and product names herein are the trademarks and registered trademarks of their respective owners.

Notes on descriptions in this Instruction Manual

• Connection diagrams in this Instruction Manual appear with the control logic of the input terminals as sink logic, unless otherwise specified. (For the control logic, refer to page 64.)

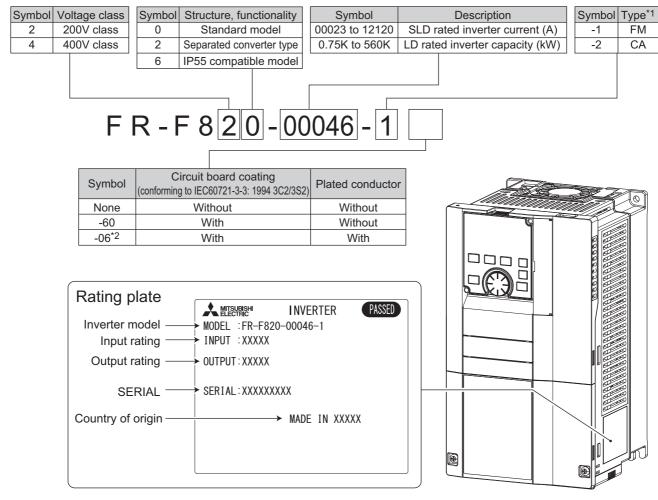
Harmonic suppression guidelines

All the models of the inverters used by specific consumers are covered by "the Harmonic Suppression Guidelines for Consumers Who Receive High Voltage or Special High Voltage". (For details, refer to page 98.)

1.1 Product checking and accessories

Unpack the product and check the rating plate and the capacity plate of the inverter to ensure that the model agrees with the order and the product is intact.

Inverter model



*1 Specification differs by the type. Major differences are shown in the following table.

| | | Initial setting | | | | |
|---------------------------------|--|------------------------|---------------|--------------------|---|-----------------------------------|
| Туре | Monitor output | Built-in EMC filter | Control logic | Rated frequency | Pr.19 Base frequency voltage | Pr.570 Multiple rating setting |
| FM (terminal FM equipped model) | Terminal FM (pulse train output) Terminal AM (analog voltage output (0 to ±10 VDC)) | OFF | Sink logic | 60 Hz | 9999 (same as the power supply voltage) | 1 (LD rating) |
| CA (terminal CA equipped model) | Terminal CA (analog current output (0 to 20 mADC)) Terminal AM (analog voltage output (0 to ±10 VDC)) | ON | Source logic | 50 Hz | 8888 (95% of the power supply voltage) | 0 (SLD rating) |

*2 Applicable for the FR-F820-00340(7.5K) or higher, and the FR-F840-00170(7.5K) or higher.

NOTE

 In this Instruction Manual, the inverter model name consists of the inverter rated current and the applicable motor capacity. Example) FR-F820-00046(0.75K)



· Fan cover fixing screws

These screws are necessary for compliance with the EU Directives. (Refer to the Instruction Manual (Startup).)

| Capacity | Screw size (mm) | Quantity |
|--|-----------------|----------|
| FR-F820-00105(2.2K) to FR-F820-00250(5.5K) FR-F840-00083(3.7K), FR-F840-00126(5.5K) | M3 × 35 | 1 |
| FR-F820-00340(7.5K), FR-F820-00490(11K) FR-F840-00170(7.5K), FR-F840-00250(11K) | M3 × 35 | 2 |
| FR-F820-00630(15K) to FR-F820-00930(22K) FR-F840-00310(15K) to FR-F840-00620(30K) | M4 × 40 | 2 |

· Eyebolt for hanging the inverter

| Capacity | Eyebolt size | Quantity |
|--|--------------|----------|
| FR-F840-04320(185K) to FR-F840-06830(315K) | M12 | 2 |

SERIAL number

 Symbol
 Year
 Month
 Control number

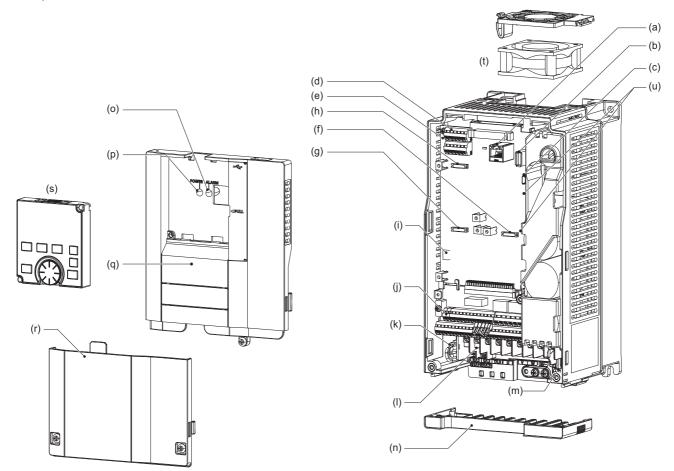
 SERIAL
 SERIAL

The SERIAL consists of one symbol, two characters indicating the production year and month, and six characters indicating the control number.

The last digit of the production year is indicated as the Year, and the Month is indicated by 1 to 9, X (October), Y (November), or Z (December).

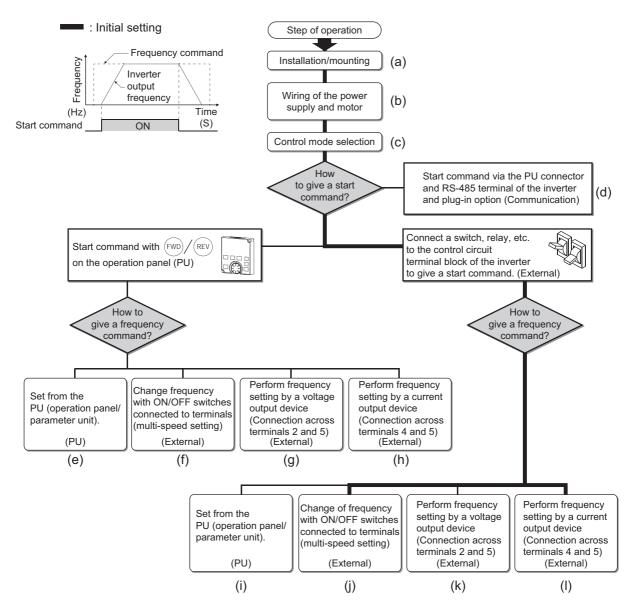
1.2 Component names

Component names are as follows.



| Symbol | Name | Description | | |
|--------|---|--|-------------|--|
| (a) | PU connector | Connector for the operation panel or the parameter unit. Also used for RS-485 communication. | 77 | |
| (b) | USB A connector | Connector for a USB memory device. | 78 | |
| (c) | USB mini B connector | Connector for a personal computer. Enables communication with FR Configurator2. | 78 | |
| (d) | RS-485 terminals | Enable RS-485 communication. | 79 | |
| (e) | Terminating resistor selection switch (SW1) | Select whether or not to use the terminating resistor for RS-485 communication. | 79 | |
| (f) | Plug-in option connector 1 | | Instruction | |
| (g) | Plug-in option connector 2 | Connector for a plug-in option or a communication option. | Manual of | |
| (h) | Plug-in option connector 3 | | the option | |
| (i) | Voltage/current input selection switch assembly (SW2) | Select voltage or current for the input via terminals 2 and 4. | 349 | |
| (j) | Control circuit terminal block | Connect cables for the control circuit. | 60 | |
| (k) | EMC filter ON/OFF connector | Turn ON/OFF the switch to enable/disable the EMC filter. | 95 | |
| (I) | Main circuit terminal block | Connect cables for the main circuit. | 49 | |
| (m) | Charge lamp | Stays ON while the power is supplied to the main circuit. | 50 | |
| (n) | Wiring cover | This cover is removable without unplugging cables (FR-F820-00930(22K) or lower, FR-F840-00620(30K) or lower) | 52 | |
| (0) | Alarm lamp | Turns ON when the protective function of the inverter is activated. | 50 | |
| (p) | Power lamp | Stays ON while the power is supplied to the control circuit (via terminals R1/L11 and S1/L21). | 50 | |
| (q) | Upper front cover | Remove this cover for the installation of the product, installation of a plug-in (communication) option, RS-485 terminal wiring, switching of the voltage/ current input selection switch assembly (SW2), etc. | 32 | |
| (r) | Lower front cover | Remove this cover for wiring. | | |
| (s) | Operation panel (FR-DU08) | Used to operate or monitor the inverter. | | |
| (t) | Cooling fan | Cools the inverter (provided for FR-F820-00105(2.2K) or higher, FR-F840-00083(3.7K) or higher). | | |
| (u) | Switches (SW3 and SW4) for manufacturer setting | Do not change the initial setting (OFF \square_{OFF}^{OFF}). | | |

1.3 Operation steps



| Symbol | Overview | Refer to page |
|--------|---|---------------|
| (a) | Install the inverter. | 36 |
| (b) | Perform wiring for the power supply and the motor. | 50 |
| (c) | Select the control method (V/F control, Advanced magnetic flux vector control, or PM motor control). | 177 |
| (d) | Give the start command via communication. | 495 |
| (e) | Give both the start and frequency commands from the PU. (PU operation mode) | 123 |
| (f) | Give the start command from the PU and the frequency command via terminals RH, RM, and RL. (External/PU combined operation mode 2) | 125 |
| (g) | Give the start command from the PU and the frequency command by voltage input via terminal 2. (External/PU combined operation mode 2) | 126 |
| (h) | Give the start command from the PU and the frequency command by current input via terminal 4. (External/PU combined operation mode 2) | 127 |
| (i) | Give the start command via terminal STF or STR and the frequency command from the PU. (External/PU combined operation mode 1) | 129 |
| (j) | Give the start command via terminal STF or STR and the frequency command via terminals RH, RM, and RL. (External operation mode) | 130 |
| (k) | Give the start command via terminal STF or STR and the frequency command by voltage input via terminal 2. (External operation mode) | 131 |
| (I) | Give the start command via terminal STF or STR and the frequency command by current input via terminal 4. (External operation mode) | 134 |

1.4 Related manuals

Manuals related to the FR-F800 inverter are shown in the following table.

| Name | Manual number |
|---|----------------|
| FR-F800 Instruction Manual (Startup) | IB-0600545 |
| FR-F802 (Separated Converter Type) Instruction Manual (Hardware) | IB-0600550ENG |
| FR-CC2 (Converter unit) Instruction Manual | IB-0600543ENG |
| FR-F806 (IP55/UL Type 12 specification) Instruction Manual (Hardware) | IB-0600676ENG |
| FR Configurator2 Instruction Manual | IB-0600516ENG |
| FR-A800/F800 PLC Function Programming Manual | IB-0600492ENG |
| FR-A800/F800 Safety Stop Function Instruction Manual | BCN-A23228-001 |

CHAPTER 2 INSTALLATION AND WIRING

| 2.1 | Peripheral devices | 25 |
|-----|---|----|
| 2.2 | Removal and reinstallation of the operation panel or the front covers | 32 |
| 2.3 | Installation of the inverter and enclosure design | 36 |
| 2.4 | Terminal connection diagrams | 45 |
| 2.5 | Main circuit terminals | 49 |
| 2.6 | Control circuit | 60 |
| 2.7 | Communication connectors and terminals | 77 |
| 2.8 | Connection of stand-alone option units | 80 |

2 INSTALLATION AND WIRING

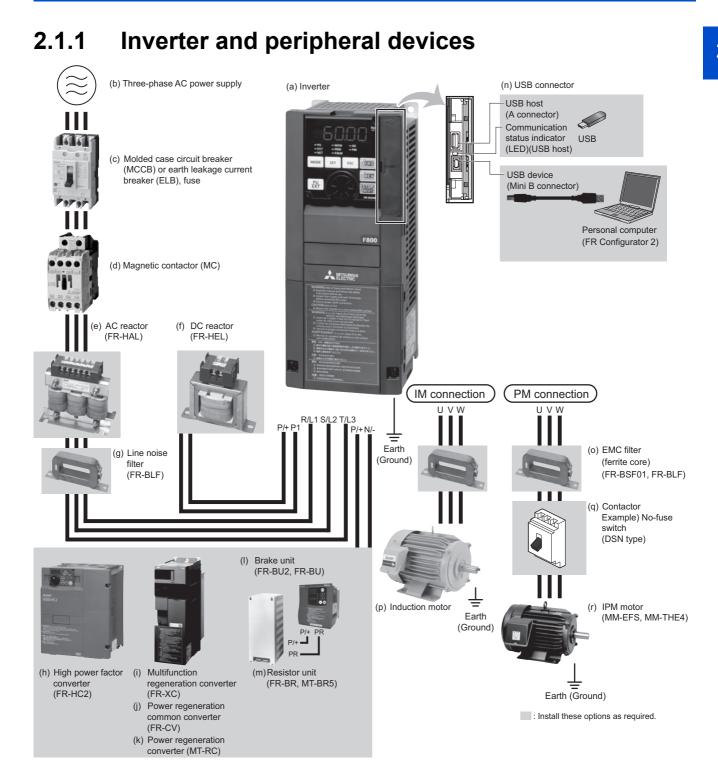
This chapter explains the installation and the wiring of this product.

Always read the instructions before use.

For the separated converter type, refer to the "INSTALLATION AND WIRING" in the FR-F802 (Separated Converter Type) Instruction Manual (Hardware).

For the IP55 compatible model, refer to the "INSTALLATION AND WIRING" in the FR-F806 (IP55/UL Type 12 specification) Instruction Manual (Hardware).

2.1 Peripheral devices



| Symbol | Name | Overview | Refer to page | |
|--------|---|--|---------------|--|
| (a) | Inverter (FR-F800) | The life of the inverter is influenced by the surrounding air temperature. The surrounding air temperature should be as low as possible within the permissible range. This must be noted especially when the inverter is installed in an enclosure. Incorrect wiring may lead to damage of the inverter. The control signal lines must be kept fully away from the main circuit lines to protect them from noise. The built-in EMC filter can reduce the noise. | | |
| (b) | Three-phase AC power supply | Must be within the permissible power supply specifications of the inverter. | 638 | |
| (c) | Molded case circuit breaker (MCCB), earth leakage circuit breaker (ELB), or fuse | Must be selected carefully since an inrush current flows in the inverter at power ON. | 28 | |
| (d) | Magnetic contactor (MC) | Install this to ensure safety. Do not use this to start and stop the inverter. Doing so will shorten the life of the inverter. | 102 | |
| (e) | AC reactor (FR-HAL) | Install this to suppress harmonics and to improve the power factor. An AC reactor (FR-HAL) (option) is required when installing the inverter near a large power supply system (1000 kVA or more). Under such condition, the inverter may be damaged if you do not use a reactor. Select a reactor according to the applied motor capacity. | 101 | |
| (f) | DC reactor (FR-HEL) | Install this to suppress harmonics and to improve the power factor. Select a reactor according to the applied motor capacity. For the FR-F820-03160(75K) or higher and the FR-F840-01800(75K) or higher, always connect the FR-HEL. When using the DC reactor with the FR-F820-02330(55K) or lower, or the FR-F840-01160(55K) or lower, remove the jumper across terminals P/+ and P1 before connecting the DC reactor to the inverter. | 101 | |
| (g) | Noise filter (FR-BLF) | The FR-F820-02330(55K) or lower and the FR-F840-01160(55K) or lower are equipped with the common mode choke. | 93 | |
| (h) | High power factor converter (FR-HC2) | Suppresses the power supply harmonics significantly. Install this as required. | | |
| (i) | Multifunction regeneration converter (FR-XC) ^{*1} | | 84 | |
| (j) | Power regeneration common converter (FR-CV) ^{*1} | Provides a large braking capability. Install this as required. | | |
| (k) | Power regeneration converter (MT-RC) ^{*1} | | 87 | |
| (I) | Brake unit (FR-BU2, FR-BU, BU) ^{*1} | Allows the inverter to provide the optimal regenerative braking capability. | | |
| (m) | Resistor unit (FR-BR, MT-BR5) ^{*1} | Install this as required. | 80 | |
| (n) | USB connection Connect between the inverter and a personal computer with a USB 1.1) cable. Use a USB memory device to copy parameter settings or use the tr function. | | 78 | |
| (0) | Noise filter (FR-BSF01/FR-BLF) | BLF) Install this to reduce the electromagnetic noise generated from the inverter. BLF) The noise filter is effective in the range from about 0.5 to 5 MHz. A wire should be wound four turns at maximum. | | |
| (p) | Induction motor | Connect a squirrel-cage induction motor. | — | |
| (q) | Contactor Example) No-fuse switch (DSN type) | the inverter is running (outputting). | | |
| (r) | IPM motor (MM-EFS/MM-THE4) | Use the specified motor. An IPM motor cannot be driven by the commercial power supply. | 641 | |

*1 To select a stand-alone option, refer to the Instruction Manual of each option.



- To prevent an electric shock, always earth (ground) the motor and inverter.
- Do not install a power factor correction capacitor, surge suppressor, or capacitor type filter on the inverter's output side. Doing so will cause the inverter shut off or damage the capacitor or surge suppressor. If any of the above devices is connected, immediately remove it. When installing a molded case circuit breaker on the output side of the inverter, contact the manufacturer of the molded case circuit breaker.
- Electromagnetic wave interference: The input/output (main circuit) of the inverter includes high frequency components, which may interfere with the communication devices (such as AM radios) used near the inverter. To minimize interference, enabling the built-in EMC filter or installing an external EMC filters is effective. (Refer to page 95.)
- For details of options and peripheral devices, refer to the respective Instruction Manual.
- A PM motor cannot be driven by the commercial power supply.
- A PM motor is a motor with permanent magnets embedded inside. High voltage is generated at the motor terminals while the motor is running. Before closing the contactor at the output side, make sure that the inverter power is ON and the motor is stopped.

2.1.2 Peripheral devices

Check the model of the inverter you purchased. Appropriate peripheral devices must be selected according to the capacity. Refer to the following table for right selection.

LD rating (Pr.570 Multiple rating setting = "1")

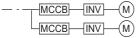
• 200 V class

| Motor output | Inverter model ^{*1} | Molded case circuit breaker (MCCB) or earth leakage circuit breaker (ELB) (NF or NV type) ^{*1} Power factor improving AC/DC reactor | | Magnetic contactor (MC) ^{*1} on inverter input side Power factor improving AC/DC reactor | |
|-----------------|------------------------------|--|-----------|---|-----------|
| (kW) | inverter model | | | | |
| () | | Not installed | Installed | Not installed | Installed |
| 0.75 | FR-F820-00046(0.75K) | 10 A | 10 A | S-T10 | S-T10 |
| 1.5 | FR-F820-00077(1.5K) | 15 A | 15 A | S-T10 | S-T10 |
| 2.2 | FR-F820-00105(2.2K) | 20 A | 15 A | S-T10 | S-T10 |
| 3.7 | FR-F820-00167(3.7K) | 30 A | 30 A | S-T21 | S-T10 |
| 5.5 | FR-F820-00250(5.5K) | 50 A | 40 A | S-T25 | S-T21 |
| 7.5 | FR-F820-00340(7.5K) | 60 A | 50 A | S-T35 | S-T25 |
| 11 | FR-F820-00490(11K) | 75 A | 75 A | S-T35 | S-T35 |
| 15 | FR-F820-00630(15K) | 125 A | 100 A | S-T50 | S-T50 |
| 18.5 | FR-F820-00770(18.5K) | 150 A | 125 A | S-T65 | S-T50 |
| 22 | FR-F820-00930(22K) | 175 A | 125 A | S-T100 | S-T65 |
| 30 | FR-F820-01250(30K) | 225 A | 150 A | S-T100 | S-T100 |
| 37 | FR-F820-01540(37K) | 250 A | 200 A | S-N150 | S-N125 |
| 45 | FR-F820-01870(45K) | 300 A | 225 A | S-N180 | S-N150 |
| 55 | FR-F820-02330(55K) | 400 A | 300 A | S-N220 | S-N180 |
| 75 | FR-F820-03160(75K) | — | 400 A | — | S-N300 |
| 90 | FR-F820-03800(90K) | — | 400 A | — | S-N300 |
| 110 | FR-F820-04750(110K) | — | 500 A | — | S-N400 |

*1 Assumes the use of a Mitsubishi Electric standard 4-pole motor with the power supply voltage of 200 VAC 50 Hz.

NOTE

- · Select an MCCB according to the power supply capacity.
- Install one MCCB per inverter. For the use in the United States or Canada, refer to "Instructions for UL and cUL" in the Instruction Manual (Startup) or Instruction Manual (Hardware) to select an appropriate fuse or MCCB.



- When the inverter capacity is larger than the motor capacity, select the MCCB and the MC according to the inverter model, and select cables and the reactor according to the motor output.
- When the breaker installed on the inverter input side is shut off, check for the wiring fault (short circuit), damage to internal parts of the inverter etc. The cause of the output shutoff must be identified and removed before turning ON the power of the breaker.
- The matrix shows the MC selected according to the standards of Japan Electrical Manufacturers' Association (JEM standards) for AC-1 class. The electrical durability of magnetic contactor is 500,000 times. When the MC is used for emergency stops during motor driving, the electrical durability is 25 times. If using the MC for emergency stop during motor driving, select the MC for the inverter input current according to the rated current against JEM 1038 standards for AC-3 class. When installing an MC on the inverter output side to switch to the commercial-power supply operation while running a general-purpose motor, select the MC for the rated motor current according to the rated current against JEM 1038 standards for AC-3 class.
- When the inverter capacity is larger than the motor capacity, select the MCCB and the MC according to the inverter model, and select cables and the reactor according to the motor output.

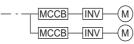
400 V class

| Motor | ut Inverter model ^{*1} | Molded case circuit breaker (MCCB) or earth leakage circuit breaker (ELB) (NF or NV type) ^{*1} | | Magnetic contactor (MC) ^{*1} on inverter input side | |
|----------------|---------------------------------|---|-----------|--|-----------|
| output (kW) | | Power factor improving AC/DC reactor | | Power factor improving AC/DC reactor | |
| (111) | | Not installed | Installed | Not installed | Installed |
| 0.75 | FR-F840-00023(0.75K) | 5 A | 5 A | S-T10 | S-T10 |
| 1.5 | FR-F840-00038(1.5K) | 10 A | 10 A | S-T10 | S-T10 |
| 2.2 | FR-F840-00052(2.2K) | 10 A | 10 A | S-T10 | S-T10 |
| 3.7 | FR-F840-00083(3.7K) | 20 A | 15 A | S-T10 | S-T10 |
| 5.5 | FR-F840-00126(5.5K) | 30 A | 20 A | S-T21 | S-T12 |
| 7.5 | FR-F840-00170(7.5K) | 30 A | 30 A | S-T21 | S-T21 |
| 11 | FR-F840-00250(11K) | 50 A | 40 A | S-T21 | S-T21 |
| 15 | FR-F840-00310(15K) | 60 A | 50 A | S-T35 | S-T21 |
| 18.5 | FR-F840-00380(18.5K) | 75 A | 60 A | S-T35 | S-T35 |
| 22 | FR-F840-00470(22K) | 100 A | 75 A | S-T35 | S-T35 |
| 30 | FR-F840-00620(30K) | 125 A | 100 A | S-T50 | S-T50 |
| 37 | FR-F840-00770(37K) | 150 A | 100 A | S-T65 | S-T50 |
| 45 | FR-F840-00930(45K) | 175 A | 125 A | S-T100 | S-T65 |
| 55 | FR-F840-01160(55K) | 200 A | 150 A | S-T100 | S-T100 |
| 75 | FR-F840-01800(75K) | — | 200 A | — | S-T100 |
| 90 | FR-F840-02160(90K) | — | 225 A | — | S-N150 |
| 110 | FR-F840-02600(110K) | — | 225 A | — | S-N180 |
| 132 | FR-F840-03250(132K) | — | 350 A | — | S-N220 |
| 150 | FR-F840-03610(160K) | — | 400 A | — | S-N300 |
| 160 | FR-F840-03610(160K) | — | 400 A | — | S-N300 |
| 185 | FR-F840-04320(185K) | — | 400 A | — | S-N300 |
| 220 | FR-F840-04810(220K) | — | 500 A | — | S-N400 |
| 250 | FR-F840-05470(250K) | — | 600 A | — | S-N600 |
| 280 | FR-F840-06100(280K) | — | 600 A | — | S-N600 |
| 315 | FR-F840-06830(315K) | — | 700 A | — | S-N600 |

*1 Assumes the use of a Mitsubishi Electric standard 4-pole motor with the power supply voltage of 400 VAC 50 Hz.

NOTE

- Select an MCCB according to the power supply capacity.
- Install one MCCB per inverter. For the use in the United States or Canada, refer to "Instructions for UL and cUL" in the Instruction Manual (Startup) or Instruction Manual (Hardware) to select an appropriate fuse or MCCB.



- When the inverter capacity is larger than the motor capacity, select the MCCB and the MC according to the inverter model, and select cables and the reactor according to the motor output.
- When the breaker installed on the inverter input side is shut off, check for the wiring fault (short circuit), damage to internal parts of the inverter etc. The cause of the output shutoff must be identified and removed before turning ON the power of the breaker.
- The matrix shows the MC selected according to the standards of Japan Electrical Manufacturers' Association (JEM standards) for AC-1 class. The electrical durability of magnetic contactor is 500,000 times. When the MC is used for emergency stops during motor driving, the electrical durability is 25 times. If using the MC for emergency stop during motor driving, select the MC for the inverter input current according to the rated current against JEM 1038 standards for AC-3 class. When installing an MC on the inverter output side to switch to the commercial-power supply operation while running a general-purpose motor, select the MC for the rated motor current according to the rated current against JEM 1038 standards for AC-3 class.

SLD rating (Pr.570 Multiple rating setting = "0")

• 200 V class

| Motor | Applicable inverter | Molded case circuit breaker (MCCB) or earth leakage circuit breaker (ELB) (NF or NV type) Power factor improving AC/DC reactor | | Magnetic contactor (MC) on inverter input side Power factor improving AC/DC reactor | |
|----------------|----------------------|--|-----------|---|-----------|
| output (kW) | model | | | | |
| () | | Not installed | Installed | Not installed | Installed |
| 0.75 | FR-F820-00046(0.75K) | 10 A | 10 A | S-T10 | S-T10 |
| 1.5 | FR-F820-00077(1.5K) | 15 A | 15 A | S-T10 | S-T10 |
| 2.2 | FR-F820-00105(2.2K) | 20 A | 15 A | S-T10 | S-T10 |
| 3.7 | FR-F820-00167(3.7K) | 30 A | 30 A | S-T21 | S-T10 |
| 5.5 | FR-F820-00250(5.5K) | 50 A | 40 A | S-T25 | S-T21 |
| 7.5 | FR-F820-00340(7.5K) | 75 A | 50 A | S-T35 | S-T35 |
| 11 | FR-F820-00490(11K) | 100 A | 75 A | S-T50 | S-T35 |
| 15 | FR-F820-00630(15K) | 125 A | 100 A | S-T65 | S-T50 |
| 18.5 | FR-F820-00770(18.5K) | 150 A | 125 A | S-T65 | S-T50 |
| 22 | FR-F820-00930(22K) | 175 A | 150 A | S-T100 | S-T65 |
| 30 | FR-F820-01250(30K) | 225 A | 175 A | S-N150 | S-T100 |
| 37 | FR-F820-01540(37K) | 300 A | 225 A | S-N150 | S-N150 |
| 45 | FR-F820-01870(45K) | 350 A | 250 A | S-N180 | S-N150 |
| 55 | FR-F820-02330(55K) | 400 A | 350 A | S-N220 | S-N180 |
| 75 | FR-F820-03160(75K) | — | 500 A | — | S-N300 |
| 90 | FR-F820-03800(90K) | — | 500 A | — | S-N400 |
| 110 | FR-F820-03800(90K) | — | 500 A | — | S-N400 |
| 132 | FR-F820-04750(110K) | — | 600 A | — | S-N600 |

NOTE

- · Select an MCCB according to the power supply capacity.
- Install one MCCB per inverter. For the use in the United States or Canada, refer to "Instructions for UL and cUL" in the Instruction Manual (Startup) or Instruction Manual (Hardware) to select an appropriate fuse or MCCB.



- When the inverter capacity is larger than the motor capacity, select the MCCB and the MC according to the inverter model, and select cables and the reactor according to the motor output.
- When the breaker installed on the inverter input side is shut off, check for the wiring fault (short circuit), damage to internal parts of the inverter etc. The cause of the output shutoff must be identified and removed before turning ON the power of the breaker.
- The matrix shows the MC selected according to the standards of Japan Electrical Manufacturers' Association (JEM standards) for AC-1 class. The electrical durability of magnetic contactor is 500,000 times. When the MC is used for emergency stops during motor driving, the electrical durability is 25 times. If using the MC for emergency stop during motor driving, select the MC for the inverter input current according to the rated current against JEM 1038 standards for AC-3 class. When installing an MC on the inverter output side to switch to the commercial-power supply operation while running a general-purpose motor, select the MC for the rated motor current according to the rated current against JEM 1038 standards for AC-3 class.

400 V class

| Motor output Applicable inverter | | Molded case circuit breaker (MCCB) or earth leakage circuit breaker (ELB) (NF or NV type) | | Magnetic contactor (MC) on inverter input side | |
|-------------------------------------|----------------------|--|--------------------|---|---------------------|
| (kW) | model | Power factor impro | ving AC/DC reactor | Power factor impro | oving AC/DC reactor |
| ((())) | | Not installed | Installed | Not installed | Installed |
| 0.75 | FR-F840-00023(0.75K) | 5 A | 5 A | S-T10 | S-T10 |
| 1.5 | FR-F840-00038(1.5K) | 10 A | 10 A | S-T10 | S-T10 |
| 2.2 | FR-F840-00052(2.2K) | 10 A | 10 A | S-T10 | S-T10 |
| 3.7 | FR-F840-00083(3.7K) | 20 A | 15 A | S-T10 | S-T10 |
| 5.5 | FR-F840-00126(5.5K) | 30 A | 20 A | S-T21 | S-T12 |
| 7.5 | FR-F840-00170(7.5K) | 30 A | 30 A | S-T21 | S-T21 |
| 11 | FR-F840-00250(11K) | 50 A | 40 A | S-T21 | S-T21 |
| 15 | FR-F840-00310(15K) | 60 A | 50 A | S-T35 | S-T21 |
| 18.5 | FR-F840-00380(18.5K) | 75 A | 60 A | S-T35 | S-T35 |
| 22 | FR-F840-00470(22K) | 100 A | 75 A | S-T35 | S-T35 |
| 30 | FR-F840-00620(30K) | 125 A | 100 A | S-T50 | S-T50 |
| 37 | FR-F840-00770(37K) | 150 A | 125 A | S-T65 | S-T50 |
| 45 | FR-F840-00930(45K) | 175 A | 150 A | S-T100 | S-T65 |
| 55 | FR-F840-01160(55K) | 200 A | 175 A | S-N150 | S-T100 |
| 75 | FR-F840-01800(75K) | — | 225 A | — | S-N150 |
| 90 | FR-F840-01800(75K) | — | 225 A | — | S-N150 |
| 110 | FR-F840-02160(90K) | — | 225 A | — | S-N180 |
| 132 | FR-F840-02600(110K) | — | 350 A | — | S-N220 |
| 150 | FR-F840-03250(132K) | — | 400 A | — | S-N300 |
| 160 | FR-F840-03250(132K) | — | 400 A | — | S-N300 |
| 185 | FR-F840-03610(160K) | — | 400 A | — | S-N300 |
| 220 | FR-F840-04320(185K) | — | 500 A | — | S-N400 |
| 250 | FR-F840-04810(220K) | — | 600 A | — | S-N600 |
| 280 | FR-F840-05470(250K) | — | 600 A | — | S-N600 |
| 315 | FR-F840-06100(280K) | — | 700 A | — | S-N600 |
| 355 | FR-F840-06830(315K) | — | 800 A | — | S-N800 |

- NOTE

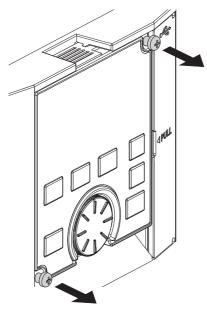
- Select an MCCB according to the power supply capacity.
- Install one MCCB per inverter. For the use in the United States or Canada, refer to "Instructions for UL and cUL" in the Instruction Manual (Startup) or Instruction Manual (Hardware) to select an appropriate fuse or MCCB.

- When the inverter capacity is larger than the motor capacity, select the MCCB and the MC according to the inverter model, and select cables and the reactor according to the motor output.
- When the breaker installed on the inverter input side is shut off, check for the wiring fault (short circuit), damage to internal parts of the inverter etc. The cause of the output shutoff must be identified and removed before turning ON the power of the breaker.
- The matrix shows the MC selected according to the standards of Japan Electrical Manufacturers' Association (JEM standards) for AC-1 class. The electrical durability of magnetic contactor is 500,000 times. When the MC is used for emergency stops during motor driving, the electrical durability is 25 times. If using the MC for emergency stop during motor driving, select the MC for the inverter input current according to the rated current against JEM 1038 standards for AC-3 class. When installing an MC on the inverter output side to switch to the commercial-power supply operation while running a general-purpose motor, select the MC for the rated motor current according to the rated current against JEM 1038 standards for AC-3 class.

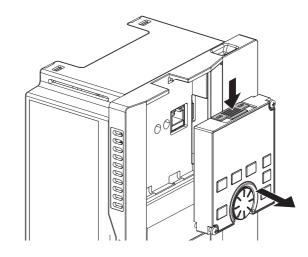
2.2 Removal and reinstallation of the operation panel or the front covers

Removal and reinstallation of the operation panel

• Loosen the two screws on the operation panel. (These screws cannot be removed.)

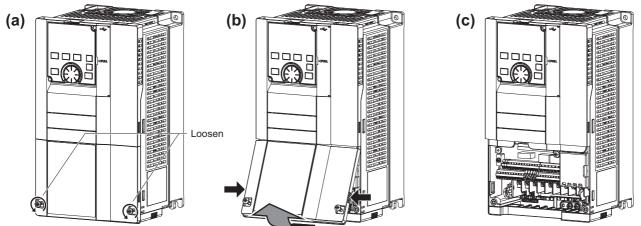


• Press the upper edge of the operation panel while pulling out the operation panel.



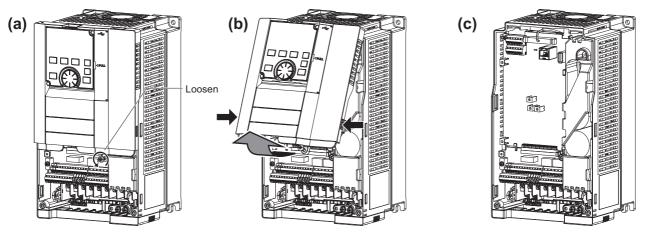
To reinstall the operation panel, align its connector on the back with the PU connector of the inverter, and insert the operation panel. After confirming that the operation panel is fit securely, tighten the screws. (Tightening torque: 0.40 to 0.45 N·m)



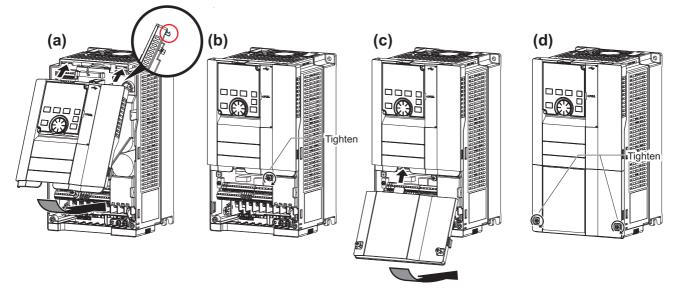


- (a) Loosen the screws on the lower front cover. (These screws cannot be removed.)
- (b) While holding the areas around the installation hooks on the sides of the lower front cover, pull out the cover using its upper side as a support.
- (c) With the lower front cover removed, the main circuit and the control circuit can be wired.

Removal of the upper front cover (FR-F820-01540(37K) or lower, FR-F840-00770(37K) or lower)



- (a) With the lower front cover removed, loosen the screws on the upper front cover. (These screws cannot be removed.) (FR-F820-00340(7.5K) to FR-F820-01540(37K) and FR-F840-00170(7.5K) to FR-F840-00770(37K) have two mounting screws.)
- (b) While holding the areas around the installation hooks on the sides of the upper front cover, pull out the cover using its upper side as a support.
- (c) With the upper front cover removed, the RS-485 terminals can be wired and the plug-in option can be installed.
- Reinstallation of the front covers (FR-F820-01540(37K) or lower, FR-F840-00770(37K) or lower)



(a) Clip on the upper front cover as illustrated.

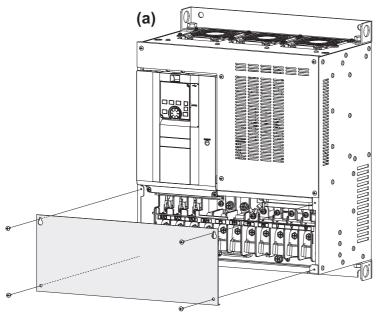
Securely install the cover to the inverter by fixing the hooks on the sides of the cover into place.

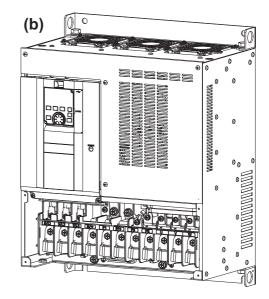
- (b) Tighten the screws on the lower part of the cover. (FR-F820-00340(7.5K) to FR-F820-01540(37K) and FR-F840-00170(7.5K) to FR-F840-00770(37K) have two mounting screws.)
- (c) Install the lower front cover by inserting the upper hook into the socket of the upper front cover.
- (d) Tighten the screws on the lower part of the lower front cover.

NOTE

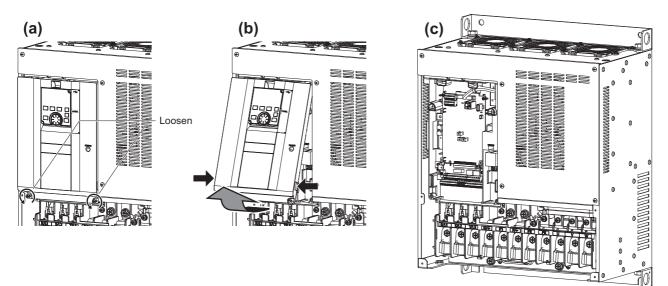
• When installing the upper front cover, fit the connector of the operation panel securely along the guides of the PU connector.

Removal of the lower front cover (FR-F820-01870(45K) or higher, FR-F840-00930(45K) or higher)



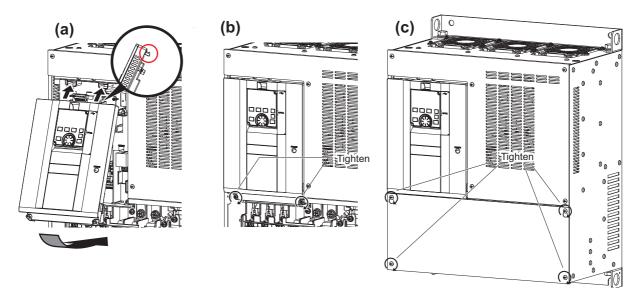


- (a) Remove the mounting screws to remove the lower front cover.
- (b) With the lower front cover removed, the main circuit can be wired.
- Removal of the upper front cover (FR-F820-01870(45K) or higher, FR-F840-00930(45K) or higher)



- (a) With the lower front cover removed, loosen the screws on the upper front cover. (These screws cannot be removed.)
- (b) While holding the areas around the installation hooks on the sides of the upper front cover, pull out the cover using its upper side as a support.
- (c) With the upper front cover removed, the control circuit and the RS-485 terminals can be wired and the plug-in option can be installed.

Reinstallation of the front covers (FR-F820-01870(45K) or higher, FR-F840-00930(45K) or higher)



- (a) Clip on the upper front cover as illustrated.
 Securely install the cover to the inverter by fixing the hooks on the sides of the cover into place.
- (b) Tighten the screws on the lower part of the cover.
- (c) Attach the lower front cover using the screws.
- NOTE

• Fully make sure that the front cover has been reinstalled securely. Always tighten the installation screws of the front cover.

2.3 Installation of the inverter and enclosure design

When designing or manufacturing an inverter enclosure, determine the structure, size, and device layout of the enclosure by fully considering the conditions such as heat generation of the contained devices and the operating environment. An inverter unit uses many semiconductor devices. To ensure higher reliability and long period of operation, operate the inverter in the ambient environment that completely satisfies the equipment specifications.

2.3.1 Inverter installation environment

The following table lists the standard specifications of the inverter installation environment. Using the inverter in an environment that does not satisfy the conditions deteriorates the performance, shortens the life, and causes a failure. Refer to the following points, and take adequate measures.

Standard environmental specifications of the inverter

| | Item | | Description |
|--------------------|--------|--|--|
| Surrounding | LD | -10°C to +50°C (non-freezing) | × S cm Inverter x 5 cm Keasurement |
| air temperature | SLD | -10°C to +40°C (non-freezing) | Measurement 5 cm position x |
| Ambient humic | lity | With circuit board coating (conform or less (non-condensing), Without circuit board coating: 90% | ing to class 3C2/3S2 in IEC 60721-3-3:1994): 95% RH RH or less (non-condensing) |
| Storage tempe | rature | -20°C to +65°C ^{*1} | |
| Atmosphere | | Indoors (free from corrosive gas, fla | ammable gas, oil mist, dust and dirt) |
| Altitude | | Maximum 2500 m ^{*2} | |
| Vibration | | 5.9 m/s ² or less ^{*3} at 10 to 55 Hz (di | irections of X, Y, Z axes) |

*1 Temperature applicable for a short time, for example, in transit.

*2 For the installation at an altitude above 1000 m, consider a 3% reduction in the rated current per 500 m increase in altitude.

*3 2.9 m/s² or less for the FR-F840-04320(185K) or higher.

Temperature

The permissible surrounding air temperature of the inverter is between -10°C and +50°C (-10°C and +40°C at the SLD rating). Always operate the inverter within this temperature range. Operation outside this range will considerably shorten the service lives of the semiconductors, parts, capacitors and others. Take the following measures to keep the surrounding air temperature of the inverter within the specified range.

■ Measures against high temperature

- Use a forced ventilation system or similar cooling system. (Refer to page 40.)
- · Install the enclosure in an air-conditioned electric chamber.
- · Block direct sunlight.
- · Provide a shield or similar plate to avoid direct exposure to the radiated heat and wind of a heat source.
- Ventilate the area around the enclosure well.

Measures against low temperature

- Provide a space heater in the enclosure.
- Do not power OFF the inverter. (Keep the start signal of the inverter OFF.)

■ Sudden temperature changes

- · Select an installation place where temperature does not change suddenly.
- · Avoid installing the inverter near the air outlet of an air conditioner.
- If temperature changes are caused by opening/closing of a door, install the inverter away from the door.



• For the amount of heat generated by the inverter unit, refer to page 39.

♦ Humidity

Operate the inverter within the ambient air humidity of usually 45% to 90% (up to 95% with circuit board coating). Too high humidity will pose problems of reduced insulation and metal corrosion. On the other hand, too low humidity may cause a spatial electrical breakdown. The humidity conditions for the insulation distance defined in JEM 1103 standard "Insulation Distance from Control Equipment" is 45% to 85%.

Measures against high humidity

- · Make the enclosure enclosed, and provide it with a hygroscopic agent.
- Provide dry air into the enclosure from outside.
- Provide a space heater in the enclosure.

Measures against low humidity

Air with proper humidity can be blown into the enclosure from outside. Also, when installing or inspecting the unit, discharge your body (static electricity) beforehand, and keep your body away from the parts and patterns.

Measures against condensation

Condensation may occur if frequent operation stops change the in-enclosure temperature suddenly or if the outside air temperature changes suddenly.

Condensation causes such faults as reduced insulation and corrosion.

- Take the measures against high humidity.
- Do not power OFF the inverter. (Keep the start signal of the inverter OFF.)

♦ Dust, dirt, oil mist

Dust and dirt will cause such faults as poor contacts, reduced insulation and cooling effect due to the moisture-absorbed accumulated dust and dirt, and in-enclosure temperature rise due to a clogged filter. In an atmosphere where conductive powder floats, dust and dirt will cause such faults as malfunction, deteriorated insulation and short circuit in a short time. Since oil mist will cause similar conditions, it is necessary to take adequate measures.

■ Countermeasure

- Place the inverter in a totally enclosed enclosure.
- Take measures if the in-enclosure temperature rises. (Refer to page 40.)
- Purge air.

Pump clean air from outside to make the in-enclosure air pressure higher than the outside air pressure.

♦ Corrosive gas, salt damage

If the inverter is exposed to corrosive gas or to salt near a beach, the printed board patterns and parts will corrode or the relays and switches will result in poor contact.

In such places, take the measures given in the previous paragraph.

Explosive, flammable gases

As the inverter is non-explosion proof, it must be contained in an explosion-proof enclosure. In places where explosion may be caused by explosive gas, dust or dirt, an enclosure cannot be used unless it structurally complies with the guidelines and has passed the specified tests. This makes the enclosure itself expensive (including the test charges). The best way is to avoid installation in such places and install the inverter in a non-hazardous place.

High altitude

Use the inverter at an altitude of within 2500 m. For use at an altitude above 1000 m, consider a 3% reduction in the rated current per 500 m increase in altitude.

If it is used at a higher place, it is likely that thin air will reduce the cooling effect and low air pressure will deteriorate dielectric strength.

♦ Vibration, impact

The vibration resistance of the inverter is up to 5.9 m/s^2 (2.9 m/s^2 or less for the FR-F840-04320(185K) or higher) at 10 to 55 Hz frequency and 1 mm amplitude in X, Y, and Z directions. Subjecting the product to vibration and impacts over a long period of time may loosen the structures and cause poor contacts of connectors, even if those vibration and impacts are within the specified values.

Especially when impacts are applied repeatedly, caution must be taken because such impacts may break the installation feet.

■ Countermeasure

- · Provide the enclosure with rubber vibration isolators.
- Strengthen the structure to prevent the enclosure from resonance.
- Install the enclosure away from the sources of the vibration.

2.3.2 Amount of heat generated by the inverter

Installing the heat sink inside the enclosure

When the heat sink is installed inside the enclosure, the amount of heat generated by the inverter unit is shown in the following tables.

| | | Amount of | heat generated (W) |
|-------------|----------------------|-----------|--------------------|
| Voltage | Inverter model | SLD | LD |
| | FR-F820-00046(0.75K) | 60 | 55 |
| | FR-F820-00077(1.5K) | 95 | 85 |
| | FR-F820-00105(2.2K) | 140 | 130 |
| | FR-F820-00167(3.7K) | 200 | 185 |
| | FR-F820-00250(5.5K) | 310 | 285 |
| | FR-F820-00340(7.5K) | 355 | 320 |
| | FR-F820-00490(11K) | 525 | 480 |
| | FR-F820-00630(15K) | 570 | 515 |
| 200 V class | FR-F820-00770(18.5K) | 770 | 700 |
| | FR-F820-00930(22K) | 950 | 850 |
| | FR-F820-01250(30K) | 1000 | 950 |
| | FR-F820-01540(37K) | 1450 | 1300 |
| | FR-F820-01870(45K) | 1650 | 1480 |
| | FR-F820-02330(55K) | 2120 | 1900 |
| | FR-F820-03160(75K) | 2750 | 2450 |
| | FR-F820-03800(90K) | 3020 | 2710 |
| | FR-F820-04750(110K) | 3960 | 3530 |
| | FR-F840-00023(0.75K) | 55 | 50 |
| | FR-F840-00038(1.5K) | 75 | 70 |
| | FR-F840-00052(2.2K) | 85 | 80 |
| | FR-F840-00083(3.7K) | 130 | 120 |
| | FR-F840-00126(5.5K) | 175 | 160 |
| | FR-F840-00170(7.5K) | 245 | 230 |
| | FR-F840-00250(11K) | 345 | 315 |
| | FR-F840-00310(15K) | 370 | 345 |
| | FR-F840-00380(18.5K) | 450 | 415 |
| | FR-F840-00470(22K) | 565 | 520 |
| | FR-F840-00620(30K) | 740 | 675 |
| 100 \ / | FR-F840-00770(37K) | 930 | 825 |
| 400 V class | FR-F840-00930(45K) | 1110 | 1020 |
| | FR-F840-01160(55K) | 1340 | 1220 |
| | FR-F840-01800(75K) | 2000 | 1640 |
| | FR-F840-02160(90K) | 2520 | 2100 |
| | FR-F840-02600(110K) | 3150 | 2575 |
| | FR-F840-03250(132K) | 3600 | 2800 |
| | FR-F840-03610(160K) | 4050 | 3600 |
| | FR-F840-04320(185K) | 4650 | 3800 |
| | FR-F840-04810(220K) | 5300 | 4650 |
| | FR-F840-05470(250K) | 5850 | 5100 |
| | FR-F840-06100(280K) | 6650 | 5850 |
| | FR-F840-06830(315K) | 7550 | 6600 |

🦰 ΝΟΤΕ

The figures indicate the amount of heat generated when the output current is the rated current, power supply voltage is 220 V (200 V class) or 440 V (400 V class), and the carrier frequency is 2 kHz.

Installing the heat sink outside the enclosure

When the heat sink is installed outside the enclosure, the amount of heat generated by the inverter unit is shown in the following tables. (For the details on protruding the heat sink through a panel, refer to page 43.)

| | | | Amount of hea | it generated (W) | |
|-------------|----------------------|-------------------|------------------------|------------------|-------------------------|
| Voltage | Inverter model | Heat sink section | (outside of enclosure) | Control section | n (inside of enclosure) |
| | | SLD | LD | SLD | LD |
| | FR-F820-00105(2.2K) | 104 | 95 | 36 | 35 |
| | FR-F820-00167(3.7K) | 161 | 147 | 39 | 38 |
| | FR-F820-00250(5.5K) | 263 | 240 | 47 | 45 |
| | FR-F820-00340(7.5K) | 265 | 235 | 90 | 85 |
| | FR-F820-00490(11K) | 375 | 340 | 150 | 140 |
| | FR-F820-00630(15K) | 405 | 365 | 165 | 150 |
| | FR-F820-00770(18.5K) | 555 | 500 | 215 | 200 |
| 200 V class | FR-F820-00930(22K) | 690 | 615 | 260 | 235 |
| | FR-F820-01250(30K) | 700 | 665 | 300 | 285 |
| | FR-F820-01540(37K) | 1035 | 925 | 415 | 375 |
| | FR-F820-01870(45K) | 1170 | 1040 | 480 | 440 |
| | FR-F820-02330(55K) | 1520 | 1360 | 600 | 540 |
| | FR-F820-03160(75K) | 1960 | 1740 | 790 | 710 |
| | FR-F820-03800(90K) | 2165 | 1930 | 855 | 780 |
| | FR-F820-04750(110K) | 2860 | 2530 | 1100 | 1000 |
| | FR-F840-00023(0.75K) | 20 | 18 | 35 | 32 |
| | FR-F840-00038(1.5K) | 36 | 32 | 39 | 38 |
| | FR-F840-00052(2.2K) | 42 | 39 | 43 | 41 |
| | FR-F840-00083(3.7K) | 77 | 71 | 53 | 49 |
| | FR-F840-00126(5.5K) | 120 | 109 | 55 | 51 |
| | FR-F840-00170(7.5K) | 180 | 170 | 65 | 60 |
| | FR-F840-00250(11K) | 260 | 235 | 85 | 80 |
| | FR-F840-00310(15K) | 260 | 245 | 110 | 100 |
| | FR-F840-00380(18.5K) | 315 | 290 | 135 | 125 |
| | FR-F840-00470(22K) | 395 | 360 | 170 | 160 |
| | FR-F840-00620(30K) | 510 | 465 | 230 | 210 |
| | FR-F840-00770(37K) | 655 | 575 | 275 | 250 |
| 00 V class | FR-F840-00930(45K) | 780 | 720 | 330 | 300 |
| | FR-F840-01160(55K) | 970 | 880 | 370 | 340 |
| | FR-F840-01800(75K) | 1400 | 1140 | 600 | 500 |
| | FR-F840-02160(90K) | 1780 | 1470 | 740 | 630 |
| | FR-F840-02600(110K) | 2235 | 1820 | 915 | 755 |
| | FR-F840-03250(132K) | 2540 | 1960 | 1060 | 840 |
| | FR-F840-03610(160K) | 2830 | 2500 | 1220 | 1100 |
| | FR-F840-04320(185K) | 3250 | 2660 | 1400 | 1140 |
| | FR-F840-04810(220K) | 3700 | 3250 | 1600 | 1400 |
| | FR-F840-05470(250K) | 4090 | 3570 | 1760 | 1530 |
| | FR-F840-06100(280K) | 4650 | 4090 | 2000 | 1760 |
| | FR-F840-06830(315K) | 5280 | 4620 | 2270 | 1980 |

• The figures indicate the amount of heat generated when the output current is the rated current, power supply voltage is 220 V (200 V class) or 440 V (400 V class), and the carrier frequency is 2 kHz.

2.3.3 Cooling system types for inverter enclosure

From the enclosure that contains the inverter, the heat of the inverter and other equipment (transformers, lamps, resistors, etc.) and the incoming heat such as direct sunlight must be dissipated to keep the in-enclosure temperature lower than the permissible temperatures of the in-enclosure equipment including the inverter.

The cooling systems are classified as follows in terms of the cooling calculation method.

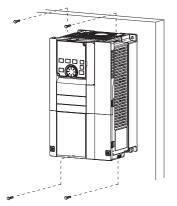
- · Cooling by natural heat dissipation from the enclosure surface (totally enclosed type)
- Cooling by heat sink (aluminum fin, etc.)

- · Cooling by ventilation (forced ventilation type, pipe ventilation type)
- · Cooling by heat exchanger or cooler (heat pipe, cooler, etc.)

| C | ooling system | Enclosure structure | Comment |
|------------|--|---|--|
| | Natural ventilation (enclosed type / open type) | | This system is low in cost and generally used, but the enclosure size increases as the inverter capacity increases. This system is for relatively small capacities. |
| Natural | Natural ventilation (totally enclosed type) | | Being a totally enclosed type, this system is the most appropriate for hostile environment having dust, dirt, oil mist, etc. The enclosure size increases depending on the inverter capacity. |
| | Heat sink cooling | Heat sink | This system has restrictions on the heat sink mounting position and area. This system is for relatively small capacities. |
| Forced air | Forced ventilation | | This system is for general indoor installation. This is appropriate for enclosure downsizing and cost reduction, and often used. |
| | Heat pipe | ۲ □ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ | This system is a totally enclosed type, and is appropriate for enclosure downsizing. |

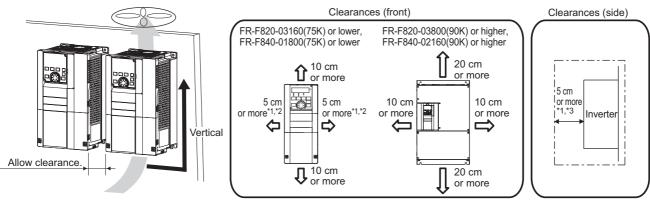
2.3.4 Inverter installation

♦ Inverter placement



Fix six positions for the FR-F840-04320(185K) or higher.

- · Install the inverter on a strong surface securely with screws.
- · Leave enough clearances and take cooling measures.
- · Avoid places where the inverter is subjected to direct sunlight, high temperature and high humidity.
- Install the inverter on a nonflammable wall surface.
- When encasing multiple inverters in an enclosure, install them in parallel as a cooling measure.
- For heat dissipation and maintenance, keep clearance between the inverter and the other devices or enclosure surface. The space below the inverter is required for wiring, and the space above the inverter is required for heat dissipation.
- When designing or building an enclosure for the inverter, carefully consider influencing factors such as heat generation of the contained devices and the operating environment.



- *1 For the FR-F820-00250(5.5K) or lower and FR-F840-00126(5.5K) or lower, allow 1 cm or more clearance.
- *2 When using the FR-F820-01250(30K) or lower and FR-F840-00620(30K) or lower at the surrounding air temperature of 40°C or less (30°C or less for the SLD rated inverter), inverters can be mounted side by side without leaving any clearance.
- *3 There needs to be a space of at least 30 cm in front of the inverter to replace the cooling fan of the FR-F840-04320(185K) or higher. Refer to page 627 for fan replacement.

Installation orientation of the inverter

Install the inverter on a wall as specified. Do not mount it horizontally or in any other way.

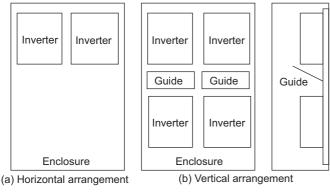
Above the inverter

Heat is blown up from inside the inverter by the small fan built in the unit. Any equipment placed above the inverter should be heat resistant.

◆ Arrangement of multiple inverters

When multiple inverters are placed in the same enclosure, generally arrange them horizontally as shown in the figure (a). When it is inevitable to arrange them vertically to minimize space, take such measures as to provide guides between the inverters since heat generated in the inverters in bottom row can increase the temperatures in the inverters in top row, causing inverter failures.

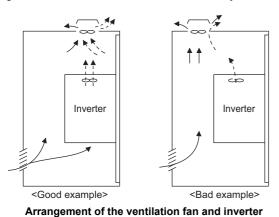
When installing multiple inverters, fully take measures to prevent the surrounding air temperature of the inverter from being higher than the permissible value by providing ventilation or increasing the enclosure size.



Arrangement of multiple inverters

Arrangement of the ventilation fan and inverter

Heat generated in the inverter is blown up from the bottom of the unit as warm air by the cooling fan. When installing a ventilation fan for that heat, determine the place of ventilation fan installation after fully considering an air flow. (Air passes through areas of low resistance. Make an airway and airflow plates to expose the inverter to cool air.)



2.3.5 Protruding the heat sink through a panel

When encasing the inverter to an enclosure, the heat generated in the enclosure can be greatly reduced by protruding the heat sink of the inverter.

When installing the inverter in a compact enclosure, etc., this installation method is recommended.

When using the panel through attachment (FR-A8CN)

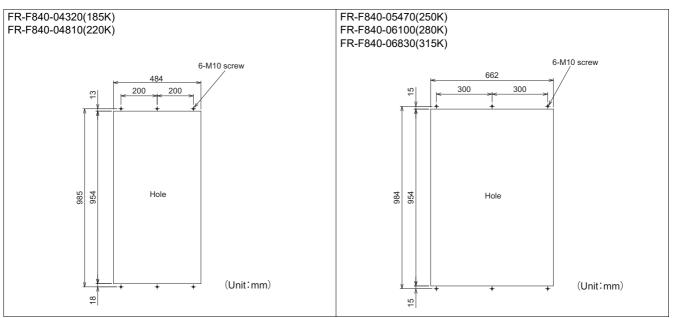
For the FR-F820-00105(2.2K) to 04750(110K) and the FR-F840-00023(0.75K) to 03610(160K), a heat sink can be protruded outside the enclosure using a panel through attachment (FR-A8CN). (For the FR-F840-04320(185K) or higher, the attachment is not necessary when the heat sink is to be protruded.)

For a panel cut dimension drawing and an installation procedure of the panel through attachment (FR-A8CN) to the inverter, refer to a manual of FR-A8CN.

Protrusion of heat sink for the FR-F840-04320(185K) or higher

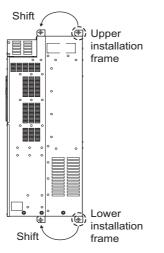
Panel cutting

Cut the panel of the enclosure according to the inverter capacity.



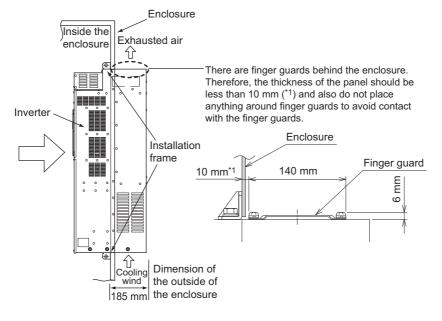
■ Mount point change of installation frame from the rear to the front

The upper and lower installation frames are attached on the inverter (one for each position). Change the mount point of the upper and lower installation frames from the rear to the front as shown in the figure. When reattaching the installation frames, make sure that the installation orientation is correct.



■ Installation of the inverter on the enclosure

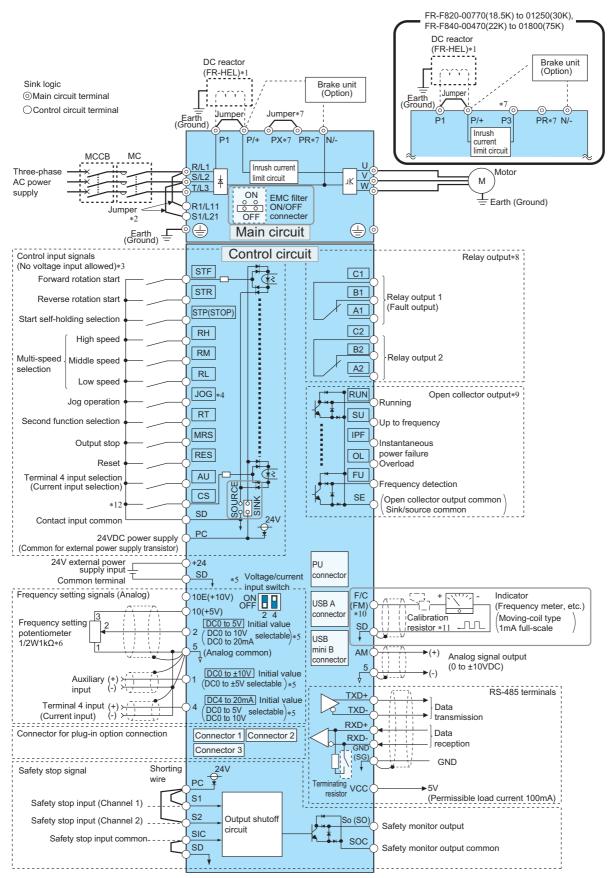
Push the inverter heat sink part outside the enclosure, and fix the inverter to the panel with upper and lower installation frames.



• NOTE

- As the heat sink part protruded through the panel includes a cooling fan, this type of installation is not suitable for the environment of water drops, oil, mist, dust, etc.
- Be careful not to drop screws, dust etc. into the inverter and cooling fan section.

Type FM

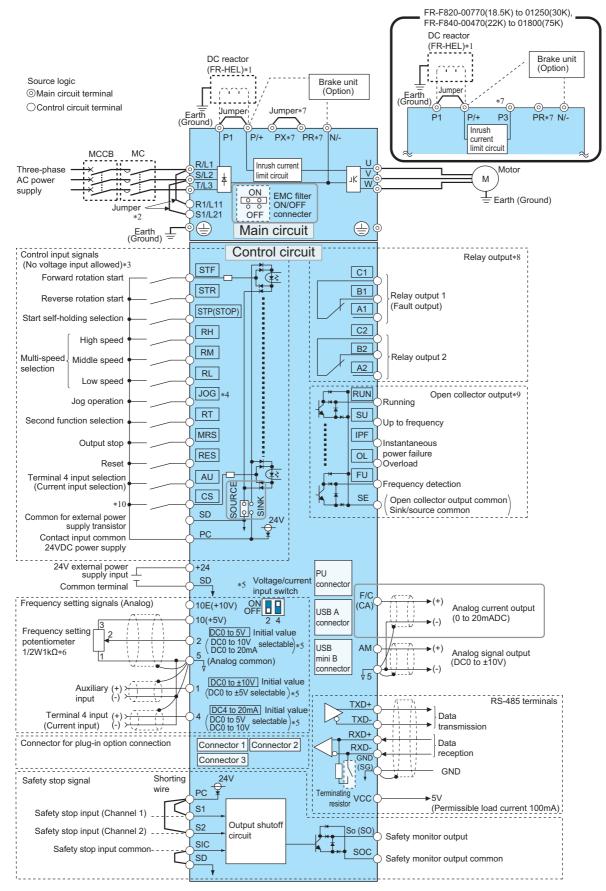


- *1 For the FR-F820-03160(75K) or higher and the FR-F840-01800(75K) or higher, always connect the DC reactor option FR-HEL. Refer to page 638 to select the right DC reactor according to the applicable motor capacity. To connect a DC reactor to the FR-F820-02330(55K) or lower or the FR-F840-01160(55K) or lower, remove a jumper installed across terminals P1 and P/+, before installing the DC reactor. (The jumper is not installed for the FR-F820-03160(75K) or higher and the FR-F840-01800(75K) or higher.)
- *2 When using separate power supply for the control circuit, remove the jumper between R1/L11 and S1/L21.
- *3 The function of these terminals can be changed using the Input terminal function selection (Pr.178 to Pr.189). (Refer to page 373.)
- *4 Terminal JOG is also used as a pulse train input terminal. Use Pr.291 to choose JOG or pulse.
- *5 Terminal input specifications can be changed by analog input specification switchover (**Pr.73**, **Pr.267**). To input a voltage, set the corresponding switch of the voltage/current input selection switch assembly to the OFF position. To input a current, set the switch to the ON position. Terminals 10 and 2 are also used as a PTC input terminal (**Pr.561**). (Refer to page 271.)
- *6 It is recommended to use 2 W 1 k Ω potentiometer when the frequency setting signal is changed frequently.
- *7 Do not use terminals PR, PX, and P3. Whether a jumper is provided across the terminals depends on the inverter model. (Refer to page 50.)
- *8 The function of these terminals can be changed using the Output terminal function selection (Pr.195 or Pr.196). (Refer to page 330.)
- *9 The function of these terminals can be changed using the Output terminal function selection (Pr.190 to Pr.194). (Refer to page 330.)
- *10 Terminal FM can be used to output pulse trains as open collector output by setting $\ensuremath{\text{Pr.291}}$.
- *11 Not required when calibrating the scale with the operation panel.
- *12 No function is assigned in the initial setting. Assign the function using Pr.186 CS terminal function selection. (Refer to page 373.)

• NOTE

- To prevent a malfunction due to noise, keep the signal cables 10 cm or more away from the power cables. Also, keep the cables of the main circuit for input and output separated.
- After wiring, wire offcuts must not be left in the inverter.
- Wire offcuts can cause a fault, failure or malfunction. Always keep the inverter clean.
- When drilling mounting holes in an enclosure etc., take caution not to allow chips and other foreign matter to enter the inverter. • Set the switches of the voltage/current input selection switch assembly correctly. Incorrect setting may cause a fault, failure or
- malfunction.





- *1 For the FR-F820-03160(75K) or higher and the FR-F840-01800(75K) or higher, always connect the DC reactor option FR-HEL. Refer to page 638 to select the right DC reactor according to the applicable motor capacity. To connect a DC reactor to the FR-F820-02330(55K) or lower or the FR-F840-01160(55K) or lower, remove a jumper installed across terminals P1 and P/+, before installing the DC reactor. (The jumper is not installed for the FR-F820-03160(75K) or higher and the FR-F840-01800(75K) or higher.)
- *2 When using separate power supply for the control circuit, remove the jumper between R1/L11 and S1/L21.
- *3 The function of these terminals can be changed using the Input terminal function selection (Pr.178 to Pr.189). (Refer to page 373.)
- *4 Terminal JOG is also used as a pulse train input terminal. Use **Pr.291** to choose JOG or pulse.
- *5 Terminal input specifications can be changed by analog input specification switchover (Pr.73, Pr.267). To input a voltage, set the corresponding switch of the voltage/current input selection switch assembly to the OFF position. To input a current, set the switch to the ON position. Terminals 10 and 2 are also used as a PTC input terminal (Pr.561). (Refer to page 271.)
- *6 It is recommended to use 2 W 1 k Ω potentiometer when the frequency setting signal is changed frequently.
- *7 Do not use terminals PR, PX, and P3. Whether a jumper is provided across the terminals depends on the inverter model. (Refer to page 50.)
- *8 The function of these terminals can be changed using the Output terminal function selection (Pr.195 or Pr.196). (Refer to page 330.)
- *9 The function of these terminals can be changed with the output terminal assignment (**Pr.190 to Pr.194**). (Refer to page 330.)
- *10 No function is assigned in the initial setting. Assign the function using Pr.186 CS terminal function selection. (Refer to page 373.)

- NOTE

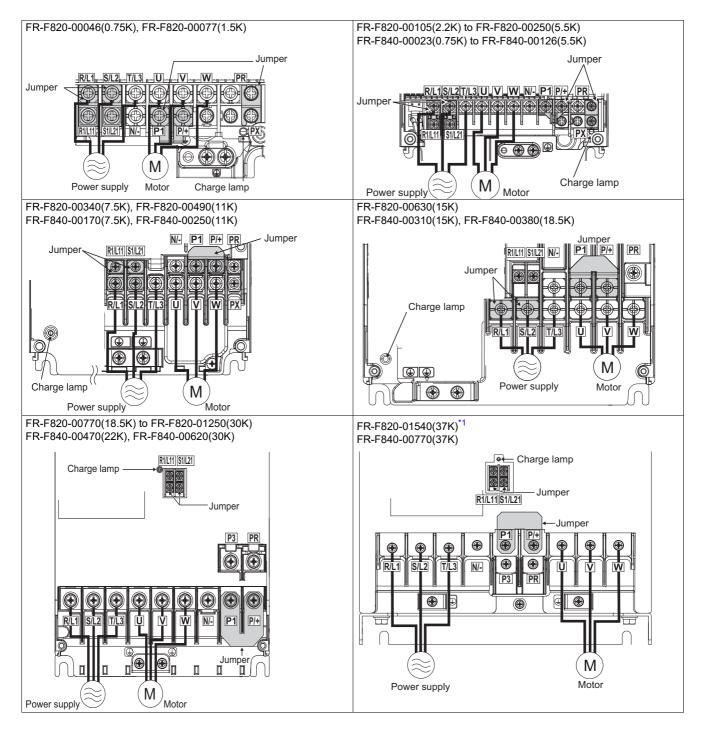
- To prevent a malfunction due to noise, keep the signal cables 10 cm or more away from the power cables. Also, keep the cables of the main circuit for input and output separated.
- After wiring, wire offcuts must not be left in the inverter.
 Wire offcuts can cause a fault, failure or malfunction. Always keep the inverter clean.
 When drilling mounting holes in an enclosure etc., take caution not to allow chips and other foreign matter to enter the inverter.
- Set the switches of the voltage/current input selection switch assembly correctly. Incorrect setting may cause a fault, failure or malfunction.

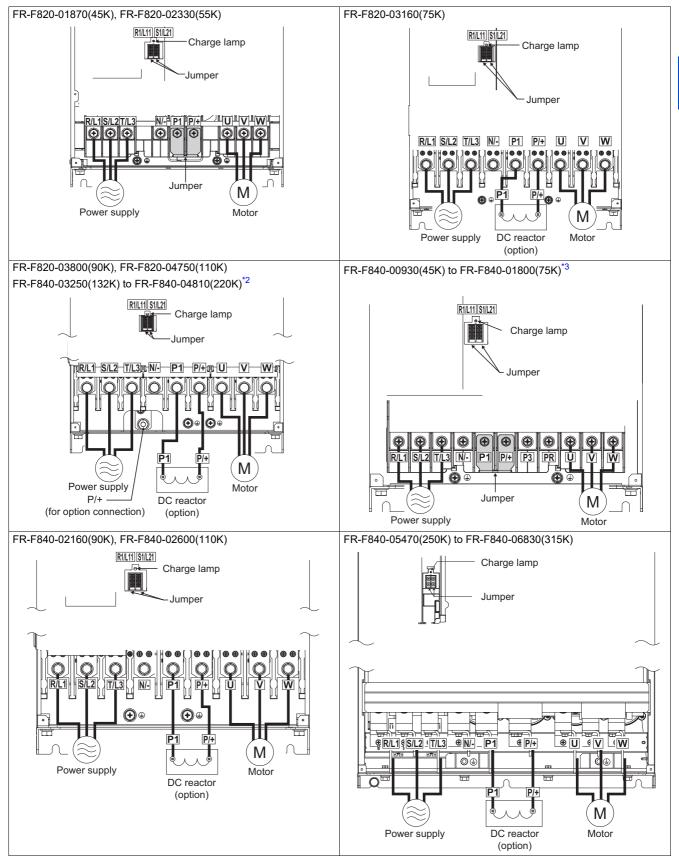
2.5.1 Details on the main circuit terminals

| Terminal symbol | Terminal name | Terminal function description | Refer to page |
|----------------------|---|---|---------------|
| R/L1, S/L2, T/ L3 | AC power input | Connect these terminals to the commercial power supply. Do not connect anything to these terminals when using the high power factor converter (FR-HC2), multifunction regeneration converter (FR-XC) ^{*1} , or power regeneration common converter (FR-CV). | _ |
| U, V, W | Inverter output | Connect these terminals to a three-phase squirrel cage motor or a PM motor. | — |
| R1/L11, S1/ L21 | Power supply for the control circuit | Connected to the AC power supply terminals R/L1 and S/L2. To retain the fault display and fault output, or to use the high power factor converter (FR-HC2), multifunction regeneration converter (FR-XC) ^{*1} , or power regeneration common converter (FR-CV), remove the jumpers across terminals R/L1 and R1/L11 and across S/L2 and S1/L21, and supply external power to these terminals. The power capacity necessary when separate power is supplied from R1/L11 and S1/L21 differs according to the inverter capacity. FR-F820-00630(15K) or lower or FR-F840-00380(18.5K) or lower: 60 VA, FR-F820-00770(18.5K) or higher or FR-F840-00470(22K) or higher: 80 VA | 69 |
| P/+, N/- | Brake unit connection | Connect the brake unit (FR-BU2, FR-BU, BU), power regeneration common converter (FR-CV), power regeneration converter (MT-RC), high power factor converter (FR-HC2), multifunction regeneration converter (FR-XC), or DC power supply (under DC feeding mode). | 80 |
| P/+, P1 | DC reactor connection for the FR- F820-02330(55K) or lower or the FR-F840-01160(55K) or lower | Remove the jumper across terminals P/+ and P1, and connect a DC reactor. When a DC reactor is not connected, the jumper across terminals P/+ and P1 should not be removed. | 88 |
| F/+, F I | DC reactor connection for the FR- F820-03160(75K) or higher or the FR-F840-01800(75K) or higher | Always connect a DC reactor, which is available as an option. | 00 |
| PX, PR, P3 | FR-F840-00250(11K) or lower. The | 3. The terminal PX is provided for the FR-F820-00490(11K) or lower and the terminal PR is provided for the FR-F820-01250(30K) or lower and the FR- ninal P3 is provided for the FR-F820-00770(18.5K) to 01540(37K) and the FR- | _ |
| | Earth (ground) | For earthing (grounding) the inverter chassis. Be sure to earth (ground) the inverter. | 59 |

*1 Available when used in the common bus regeneration mode

2.5.2 Main circuit terminal layout and wiring to power supply and motor





*1 Terminals P3 and PR on the FR-F820-01540(37K) are not provided with a screw. Do not connect anything to them.

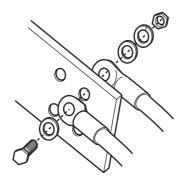
*2 When an option other than the DC reactor must be connected to terminal P/+, use terminal P/+ (for option connection).

*3 For the FR-F840-01800(75K), a jumper is not installed across terminals P1 and P/+. Always connect the DC reactor option FR-HEL across terminals P1 and P/+.

2



- Make sure the power cables are connected to the R/L1, S/L2, and T/L3. (Phase need not be matched.) Never connect the power cable to the U, V, and W of the inverter. Doing so will damage the inverter.
- Connect the motor to U, V, and W. (The phases must be matched.)
- When wiring the inverter main circuit conductor of the FR-F840-05470(250K) or higher, tighten a nut from the right side of the conductor. When wiring two cables, place cables on both sides of the conductor. For wiring, use bolts (nuts) provided with the inverter. (Refer to the following figure.)

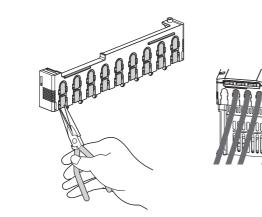


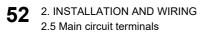
■ Handling of the wiring cover

(For the FR-F820-00630(15K) to 00930(22K) and FR-F840-00310(15K) to 00620(30K)) For the hook of the wiring cover, cut off the necessary parts using a pair of needle-nose pliers etc.



• Cut off the same number of lugs as wires. If parts where no wire is put through have been cut off (10 mm or more), protective structure (IEC 60529) becomes an open type (IP00).





2.5.3 Recommended cables and wiring length

Select a recommended size cable to ensure that the voltage drop ratio is within 2%.

If the wiring distance is long between the inverter and motor, the voltage drop in the main circuit will cause the motor torque to decrease especially at a low speed.

The following tables show the recommended cable gauges for 20 m power cables.

For LD rating (Pr.570 Multiple rating setting = "1")

• 200 V class (220 V input power supply, without a power factor improving AC or DC reactor)

| | | | Crimp t | orminal | Cable gauge | | | | | | | | | |
|--------------------------------|-----------------------------|-----------------|--------------------------|----------------|------------------------|------------|-----------|----------------------------------|------------------------|------------|---|------------|---------------------------------------|--|
| Applicable | Terminal | Tightening | Clumpt | Crimp terminal | | V cable | s, etc. (| mm ²) ^{*1} | AWG/MCM ^{*2} | | PVC cables, etc. (mm ²) ^{*3} | | etc. (mm ²) ^{*3} | |
| inverter model FR-F820-[] | screw size ^{*4} | torque (N·m) | R/L1, S/ L2, T/ L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | P/+, P1 | Earthing (grounding) cable | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | Earthing (grounding) cable | |
| 00046(0.75K) to 00105(2.2K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 | |
| 00167(3.7K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 3.5 | 3.5 | 3.5 | 3.5 | 12 | 12 | 4 | 4 | 4 | |
| 00250(5.5K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 5.5 | 5.5 | 5.5 | 5.5 | 10 | 10 | 6 | 6 | 6 | |
| 00340(7.5K) | M5 | 2.5 | 14-5 | 5.5-5 | 14 | 5.5 | 14 | 5.5 | 6 | 10 | 16 | 6 | 16 | |
| 00490(11K) | M5 | 2.5 | 14-5 | 14-5 | 14 | 14 | 14 | 8 | 6 | 6 | 16 | 16 | 16 | |
| 00630(15K) | M5 | 2.5 | 22-5 | 22-5 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 | |
| 00770(18.5K) | M6 | 4.4 | 38-6 | 22-6 | 38 | 22 | 38 | 14 | 2 | 4 | 35 | 25 | 25 | |
| 00930(22K) | M8(M6) | 7.8 | 38-8 | 38-8 | 38 | 38 | 38 | 22 | 2 | 2 | 35 | 35 | 25 | |
| 01250(30K) | M8(M6) | 7.8 | 60-8 | 60-8 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 | |
| 01540(37K) | M8(M6) | 7.8 | 80-8 | 60-8 | 80 | 60 | 80 | 22 | 3/0 | 1/0 | 70 | 70 | 35 | |
| 01870(45K) | M10(M8) | 26.5 | 100-10 | 100-10 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 | |
| 02330(55K) | M10(M8) | 26.5 | 100-10 | 100-10 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 | |

• 200 V class (220 V input power supply, with a power factor improving AC or DC reactor)

| | | | Crimp terminal | | Cable gauge | | | | | | | | | |
|--------------------------------|-----------------------------|-----------------|--------------------------|---------|------------------------|------------|-----------|----------------------------------|------------------------|-------------------|------------------------|------------|---------------------------------------|--|
| Applicable | Terminal | Tightening | Clumb | emmai | H | V cable | s, etc. (| mm ²) ^{*1} | AWG/ | MCM ^{*2} | PVC c | ables, e | etc. (mm ²) ^{*3} | |
| inverter model FR-F820-[] | screw size ^{*4} | torque (N·m) | R/L1, S/ L2, T/ L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | P/+, P1 | Earthing (grounding) cable | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | Earthing (grounding) cable | |
| 00046(0.75K) to 00105(2.2K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 | |
| 00167(3.7K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 3.5 | 3.5 | 3.5 | 3.5 | 12 | 12 | 4 | 4 | 4 | |
| 00250(5.5K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 5.5 | 5.5 | 5.5 | 5.5 | 10 | 10 | 6 | 6 | 6 | |
| 00340(7.5K) | M5 | 2.5 | 5.5-5 | 5.5-5 | 5.5 | 5.5 | 14 | 5.5 | 10 | 10 | 6 | 6 | 6 | |
| 00490(11K) | M5 | 2.5 | 14-5 | 14-5 | 14 | 14 | 14 | 8 | 6 | 6 | 16 | 16 | 16 | |
| 00630(15K) | M5 | 2.5 | 22-5 | 22-5 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 | |
| 00770(18.5K) | M6 | 4.4 | 22-6 | 22-6 | 22 | 22 | 38 | 14 | 4 | 4 | 25 | 25 | 16 | |
| 00930(22K) | M8(M6) | 7.8 | 38-8 | 38-8 | 38 | 38 | 38 | 22 | 2 | 2 | 35 | 35 | 25 | |
| 01250(30K) | M8(M6) | 7.8 | 60-8 | 60-8 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 | |
| 01540(37K) | M8(M6) | 7.8 | 60-8 | 60-8 | 60 | 60 | 80 | 22 | 1/0 | 1/0 | 70 | 70 | 35 | |
| 01870(45K) | M10(M8) | 26.5 | 100-10 | 100-10 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 | |
| 02330(55K) | M10(M8) | 26.5 | 100-10 | 100-10 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 | |
| 03160(75K) | M12(M8) | 46 | 150-12 | 150-12 | 125 | 125 | 125 | 38 | 250 | 250 | 120 | 120 | — | |
| 03800(90K) | M12(M8) | 46 | 150-12 | 150-12 | 150 | 150 | 150 | 38 | 2×4/0 | 2×4/0 | 150 | 150 | — | |
| 04750(110K) | M12(M8) | 46 | 150-12 | 150-12 | 150 | 150 | 2×100 | 60 | 2×4/0 | 2×4/0 | 2×95 | 2×95 | — | |

· 400 V class (440 V input power supply, without a power factor improving AC or DC reactor)

| | | | Crimp t | erminal | Cable gauge | | | | | | | | | |
|-----------------------------------|----------|------------|--------------------------|---------|------------------------|------------|-------------|----------------------------------|------------------------|-------------------|---|------------|---------------------------------------|--|
| Applicable | Terminal | Tightening | Crimp (| erninai | Н | IV cable | es, etc. (r | nm²) ^{*1} | AWG/ | MCM ^{*2} | PVC cables, etc. (mm ²) ^{*3} | | etc. (mm ²) ^{*3} | |
| inverter model FR-F840-[] | | | R/L1, S/ L2, T/ L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | P/+, P1 | Earthing (grounding) cable | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | Earthing (grounding) cable | |
| 00023(0.75K) to 00083(3.7K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 | |
| 00126(5.5K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 3.5 | 3.5 | 12 | 14 | 2.5 | 2.5 | 4 | |
| 00170(7.5K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 3.5 | 3.5 | 3.5 | 3.5 | 12 | 12 | 4 | 4 | 4 | |
| 00250(11K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 5.5 | 5.5 | 5.5 | 5.5 | 10 | 10 | 6 | 6 | 10 | |
| 00310(15K) | M5 | 2.5 | 8-5 | 5.5-5 | 8 | 5.5 | 8 | 5.5 | 8 | 10 | 10 | 6 | 10 | |
| 00380(18.5K) | M5 | 2.5 | 14-5 | 8-5 | 14 | 8 | 14 | 8 | 6 | 8 | 16 | 10 | 16 | |
| 00470(22K) | M6 | 4.4 | 14-6 | 14-6 | 14 | 14 | 22 | 14 | 6 | 6 | 16 | 16 | 16 | |
| 00620(30K) | M6 | 4.4 | 22-6 | 22-6 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 | |
| 00770(37K) | M6 | 4.4 | 22-6 | 22-6 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 | |
| 00930(45K) | M8 | 7.8 | 38-8 | 38-8 | 38 | 38 | 38 | 22 | 1 | 2 | 50 | 50 | 25 | |
| 01160(55K) | M8 | 7.8 | 60-8 | 60-8 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 | |

• 400 V class (440 V input power supply, with a power factor improving AC or DC reactor)

| | | | Crimp terminal | | | Cable gauge | | | | | | | | | |
|-----------------------------------|-----------------------------|-----------------|--------------------------|---------|------------------------|-------------|-------------|----------------------------------|------------------------|--------------------------|------------------------|---------------------------------|----------------------------------|--|--|
| Applicable | Terminal | Tightening | Crimpt | erminai | н | IV cable | es, etc. (r | nm²) ^{*1} | AWG/ | /MCM ^{*2} PVC o | | ables, etc. (mm²) ^{*3} | | | |
| inverter model FR-F840-[] | screw size ^{*4} | torque (N·m) | R/L1, S/ L2, T/ L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | P/+, P1 | Earthing (grounding) cable | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | Earthing (grounding) cable | | |
| 00023(0.75K) to 00083(3.7K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 | | |
| 00126(5.5K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 3.5 | 3.5 | 14 | 14 | 2.5 | 2.5 | 2.5 | | |
| 00170(7.5K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 3.5 | 3.5 | 3.5 | 3.5 | 12 | 12 | 4 | 4 | 4 | | |
| 00250(11K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 5.5 | 5.5 | 5.5 | 5.5 | 10 | 10 | 6 | 6 | 6 | | |
| 00310(15K) | M5 | 2.5 | 5.5-5 | 5.5-5 | 5.5 | 5.5 | 8 | 5.5 | 10 | 10 | 6 | 6 | 6 | | |
| 00380(18.5K) | M5 | 2.5 | 8-5 | 8-5 | 8 | 8 | 14 | 8 | 8 | 8 | 10 | 10 | 10 | | |
| 00470(22K) | M6 | 4.4 | 14-6 | 14-6 | 14 | 14 | 22 | 14 | 6 | 6 | 16 | 16 | 16 | | |
| 00620(30K) | M6 | 4.4 | 22-6 | 22-6 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 | | |
| 00770(37K) | M6 | 4.4 | 22-6 | 22-6 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 | | |
| 00930(45K) | M8 | 7.8 | 38-8 | 38-8 | 38 | 38 | 38 | 22 | 2 | 2 | 50 | 50 | 25 | | |
| 01160(55K) | M8 | 7.8 | 60-8 | 60-8 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 | | |
| 01800(75K) | M8 | 7.8 | 60-8 | 60-8 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 | | |
| 02160(90K) | M10 | 26.5 | 60-10 | 60-10 | 60 | 60 | 80 | 22 | 1/0 | 1/0 | 50 | 50 | 25 | | |
| 02600(110K) | M10 | 26.5 | 80-10 | 80-10 | 80 | 80 | 80 | 22 | 3/0 | 3/0 | 70 | 70 | 35 | | |
| 03250(132K) | M10 (M12) | 26.5 | 100-10 | 100-10 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 | | |
| 03610(160K) | M10 (M12) | 26.5 | 150-10 | 150-10 | 125 | 125 | 150 | 38 | 250 | 250 | 120 | 120 | 70 | | |
| 04320(185K) | M12 (M10) | 46 | 150-12 | 150-12 | 150 | 150 | 150 | 38 | 300 | 300 | 150 | 150 | 95 | | |
| 04810(220K) | M12 (M10) | 46 | 100-12 | 100-12 | 2×100 | 2×100 | 2×100 | 60 | 2×4/0 | 2×4/0 | 2×95 | 2×95 | 95 | | |
| 05470(250K) | M12 (M10) | 46 | 100-12 | 100-12 | 2×100 | 2×100 | 2 × 125 | 60 | 2×4/0 | 2×4/0 | 2×95 | 2×95 | 95 | | |
| 06100(280K) | M12 (M10) | 46 | 150-12 | 150-12 | 2×125 | 2×125 | 2×125 | 60 | 2×250 | 2×250 | 2×120 | 2×120 | 120 | | |
| 06830(315K) | M12 (M10) | 46 | 150-12 | 150-12 | 2×150 | 2×150 | 2×150 | 60 | 2×300 | 2×300 | 2×150 | 2×150 | 150 | | |

*1 For the FR-F820-02330(55K) or lower and FR-F840-01160(55K) or lower, it is the gauge of a cable with the continuous maximum permissible temperature of 75°C (HIV cable (600 V grade heat-resistant PVC insulated wire), etc.). It is assumed that the cables will be used in a surrounding air temperatures of 50°C or less and the wiring distance of 20 m or shorter.

For the FR-F820-03160(75K) or higher, FR-F840-01800(75K) or higher, it is the gauge of the cable with the continuous maximum permissible temperature of 90°C or higher. It is assumed that the cables will be used in a surrounding air temperatures of 50°C or less and housed in an enclosure.

*2 For all the 200 V class capacities and FR-F840-00930(45K) or lower, it is the gauge of a cable with the continuous maximum permissible temperature of 75°C (THHW cable). It is assumed that the cables will be used in a surrounding air temperatures of 40? or less and the wiring distance of 20 m or shorter.

For the FR-F840-01160(55K) or higher, it is the gauge of a cable with the continuous maximum permissible temperature of 90°C (THHN cable). It is assumed that the cables will be used in a surrounding air temperatures of 40°C or less and housed in an enclosure.

(For the use in the United States or Canada, refer to "Instructions for UL and cUL" in the Instruction Manual (Startup) or Instruction Manual (Hardware).)

*3 For the FR-F820-00770(18.5K) or lower and the FR-F840-00930(45K) or lower, it is the gauge of a cable with the continuous maximum permissible temperature of 70°C (PVC cable). It is assumed that the cables will be used in a surrounding air temperatures of 40°C or less and the wiring distance of 20 m or shorter.

For the FR-F820-00930(22K) or higher and the FR-F840-01160(55K) or higher, it is the gauge of a cable with the continuous maximum permissible temperature of 90°C (XLPE cable). It is assumed that the cables will be used in a surrounding air temperatures of 40°C or less and housed in an enclosure.

(Selection example mainly for use in Europe.)

*4 The screw size for terminals R/L1, S/L2, T/L3, U, V, W, P/+, N/-, and P1, and the earthing (grounding) terminal are shown. The screw size for earthing (grounding) terminal on FR-F820-00930(22K) or higher is shown in parentheses. The screw size for terminal P/+ for option connection on the FR-F840-03250(132K) and FR-F840-03610(160K) is shown in parentheses. The screw size for earthing (grounding) terminal on FR-F840-04320(185K) or higher is shown in parentheses.

For SLD rating (Pr.570 Multiple rating setting = "0")

• 200 V class (220 V input power supply, without a power factor improving AC or DC reactor)

| | | | Crimp t | orminal | Cable gauge | | | | | | | | | |
|--------------------------------|-----------------------------|-----------------|--------------------------|---------|------------------------|------------|-----------|----------------------------------|------------------------|------------|---|------------|----------------------------------|--|
| Applicable | Terminal | Tightening | Crimp (| erminal | HI | V cable | s, etc. (| mm ²) ^{*1} | AWG/MCM ^{*2} | | PVC cables, etc. (mm ²) ^{*3} | | | |
| inverter model FR-F820-[] | screw size ^{*4} | torque (N·m) | R/L1, S/ L2, T/ L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | P/+, P1 | Earthing (grounding) cable | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | Earthing (grounding) cable | |
| 00046(0.75K) to 00105(2.2K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 | |
| 00167(3.7K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 3.5 | 3.5 | 3.5 | 3.5 | 12 | 12 | 4 | 4 | 4 | |
| 00250(5.5K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 5.5 | 5.5 | 5.5 | 5.5 | 10 | 10 | 6 | 6 | 6 | |
| 00340(7.5K) | M5 | 2.5 | 14-5 | 8-5 | 14 | 8 | 14 | 5.5 | 6 | 8 | 16 | 10 | 16 | |
| 00490(11K) | M5 | 2.5 | 14-5 | 14-5 | 14 | 14 | 14 | 8 | 6 | 6 | 16 | 16 | 16 | |
| 00630(15K) | M5 | 2.5 | 22-5 | 22-5 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 | |
| 00770(18.5K) | M6 | 4.4 | 38-6 | 22-6 | 38 | 22 | 38 | 14 | 2 | 4 | 50 | 25 | 25 | |
| 00930(22K) | M8(M6) | 7.8 | 38-8 | 38-8 | 38 | 38 | 38 | 22 | 2 | 2 | 50 | 50 | 25 | |
| 01250(30K) | M8(M6) | 7.8 | 60-8 | 60-8 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 | |
| 01540(37K) | M8(M6) | 7.8 | 80-8 | 80-8 | 80 | 80 | 80 | 22 | 3/0 | 3/0 | 70 | 70 | 35 | |
| 01870(45K) | M10(M8) | 26.5 | 100-10 | 100-10 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 | |
| 02330(55K) | M10(M8) | 26.5 | 100-10 | 100-10 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 | |

· 200 V class (220 V input power supply, with a power factor improving AC or DC reactor)

| | | | Crimp terminal | | Cable gauge | | | | | | | | |
|--------------------------------|-----------------------------|-----------------|--------------------------|---------|------------------------|------------|-----------|----------------------------------|------------------------|-------------------|------------------------|------------|---------------------------------------|
| Applicable | Terminal | Tightening | Crimp (| emmai | HI | V cable | s, etc. (| mm ²) ^{*1} | AWG/ | MCM ^{*2} | PVC c | ables, e | etc. (mm ²) ^{*3} |
| inverter model FR-F820-[] | screw size ^{*4} | torque (N·m) | R/L1, S/ L2, T/ L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | P/+, P1 | Earthing (grounding) cable | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | Earthing (grounding) cable |
| 00046(0.75K) to 00105(2.2K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00167(3.7K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 3.5 | 3.5 | 3.5 | 3.5 | 12 | 12 | 4 | 4 | 4 |
| 00250(5.5K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 5.5 | 5.5 | 5.5 | 5.5 | 10 | 10 | 6 | 6 | 6 |
| 00340(7.5K) | M5 | 2.5 | 8-5 | 8-5 | 8 | 8 | 14 | 5.5 | 8 | 8 | 10 | 10 | 10 |
| 00490(11K) | M5 | 2.5 | 14-5 | 14-5 | 14 | 14 | 14 | 8 | 6 | 6 | 16 | 16 | 16 |
| 00630(15K) | M5 | 2.5 | 22-5 | 22-5 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 |
| 00770(18.5K) | M6 | 4.4 | 22-6 | 22-6 | 22 | 22 | 38 | 14 | 4 | 4 | 25 | 25 | 25 |
| 00930(22K) | M8(M6) | 7.8 | 38-8 | 38-8 | 38 | 38 | 38 | 22 | 2 | 2 | 50 | 50 | 25 |
| 01250(30K) | M8(M6) | 7.8 | 60-8 | 60-8 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 |
| 01540(37K) | M8(M6) | 7.8 | 80-8 | 80-8 | 80 | 80 | 80 | 22 | 3/0 | 3/0 | 70 | 70 | 35 |
| 01870(45K) | M10(M8) | 26.5 | 100-10 | 100-10 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 |
| 02330(55K) | M10(M8) | 26.5 | 100-10 | 100-10 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 |
| 03160(75K) | M12(M8) | 46 | 150-12 | 150-12 | 125 | 125 | 125 | 38 | 250 | 250 | 120 | 120 | — |
| 03800(90K) | M12(M8) | 46 | 150-12 | 150-12 | 150 | 150 | 150 | 38 | 2×4/0 | 2×4/0 | 2×95 | 2×95 | — |
| 04750(110K) | M12(M8) | 46 | 100-12 | 100-12 | 2×100 | 2×100 | 2×100 | 60 | 2×4/0 | 2×4/0 | 2×95 | 2×95 | — |

· 400 V class (440 V input power supply, without a power factor improving AC or DC reactor)

| | | c | Crimp t | erminal | Cable gauge | | | | | | | | | |
|-----------------------------------|-----------------------------|-----------------|--------------------------|---------|------------------------|---|---------|----------------------------------|------------------------|-------------------|---|------------|----------------------------------|--|
| Applicable | Terminal | Tightening | Crimpt | erninai | Н | HIV cables, etc. (mm ²) ^{*1} | | | | MCM ^{*2} | PVC cables, etc. (mm ²) ^{*3} | | | |
| inverter model FR-F840-[] | screw size ^{*4} | torque (N·m) | R/L1, S/ L2, T/ L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | P/+, P1 | Earthing (grounding) cable | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | Earthing (grounding) cable | |
| 00023(0.75K) to 00083(3.7K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 | |
| 00126(5.5K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 3.5 | 3.5 | 12 | 14 | 2.5 | 2.5 | 4 | |
| 00170(7.5K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 3.5 | 3.5 | 3.5 | 3.5 | 12 | 12 | 4 | 4 | 4 | |
| 00250(11K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 5.5 | 5.5 | 5.5 | 5.5 | 10 | 10 | 6 | 6 | 10 | |
| 00310(15K) | M5 | 2.5 | 8-5 | 5.5-5 | 8 | 5.5 | 8 | 5.5 | 8 | 10 | 10 | 6 | 10 | |
| 00380(18.5K) | M5 | 2.5 | 14-5 | 8-5 | 14 | 8 | 14 | 8 | 6 | 8 | 16 | 10 | 16 | |
| 00470(22K) | M6 | 4.4 | 14-6 | 14-6 | 14 | 14 | 22 | 14 | 6 | 6 | 16 | 16 | 16 | |
| 00620(30K) | M6 | 4.4 | 22-6 | 22-6 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 | |
| 00770(37K) | M6 | 4.4 | 22-6 | 22-6 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 | |
| 00930(45K) | M8 | 7.8 | 38-8 | 38-8 | 38 | 38 | 38 | 22 | 1 | 2 | 50 | 50 | 25 | |
| 01160(55K) | M8 | 7.8 | 60-8 | 60-8 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 | |

• 400 V class (440 V input power supply, with a power factor improving AC or DC reactor)

| | | | Onimum A | | Cable gauge | | | | | | | | |
|--|--------------|------------|--------------------------|---------|------------------------|------------|-------------|----------------------------------|------------------------|-------------------|------------------------|------------|--------------------------------------|
| Applicable | Terminal | Tightening | Crimpt | erminal | н | IV cable | es, etc. (r | nm²) ^{*1} | AWG/ | MCM ^{*2} | PVC c | ables, e | tc. (mm ²) ^{*3} |
| inverter model screw torque FR-F840-[] size ^{*4} (N·m) | | | R/L1, S/ L2, T/ L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | P/+, P1 | Earthing (grounding) cable | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | Earthing (grounding) cable |
| 00023(0.75K) to 00083(3.7K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00126(5.5K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 3.5 | 3.5 | 14 | 14 | 2.5 | 2.5 | 4 |
| 00170(7.5K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 3.5 | 3.5 | 3.5 | 3.5 | 12 | 12 | 4 | 4 | 4 |
| 00250(11K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 5.5 | 5.5 | 5.5 | 5.5 | 10 | 10 | 6 | 6 | 10 |
| 00310(15K) | M5 | 2.5 | 5.5-5 | 5.5-5 | 5.5 | 5.5 | 8 | 5.5 | 10 | 10 | 6 | 6 | 10 |
| 00380(18.5K) | M5 | 2.5 | 8-5 | 8-5 | 8 | 8 | 14 | 8 | 8 | 8 | 10 | 10 | 16 |
| 00470(22K) | M6 | 4.4 | 14-6 | 14-6 | 14 | 14 | 22 | 14 | 6 | 6 | 16 | 16 | 16 |
| 00620(30K) | M6 | 4.4 | 22-6 | 22-6 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 |
| 00770(37K) | M6 | 4.4 | 22-6 | 22-6 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 |
| 00930(45K) | M8 | 7.8 | 38-8 | 38-8 | 38 | 38 | 38 | 22 | 2 | 2 | 50 | 50 | 25 |
| 01160(55K) | M8 | 7.8 | 60-8 | 60-8 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 |
| 01800(75K) | M8 | 7.8 | 60-8 | 60-8 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 |
| 02160(90K) | M10 | 26.5 | 80-10 | 80-10 | 80 | 80 | 80 | 22 | 3/0 | 3/0 | 70 | 70 | 35 |
| 02600(110K) | M10 | 26.5 | 100-10 | 100-10 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 |
| 03250(132K) | M10 (M12) | 26.5 | 150-10 | 150-10 | 125 | 125 | 150 | 38 | 250 | 250 | 120 | 120 | 70 |
| 03610(160K) | M10 (M12) | 26.5 | 150-10 | 150-10 | 150 | 150 | 150 | 38 | 300 | 300 | 150 | 150 | 95 |
| 04320(185K) | M12 (M10) | 46 | 100-12 | 100-12 | 2×100 | 2×100 | 2×100 | 60 | 2×4/0 | 2×4/0 | 2×95 | 2×95 | 95 |
| 04810(220K) | M12 (M10) | 46 | 100-12 | 100-12 | 2×100 | 2×100 | 2 × 125 | 60 | 2×4/0 | 2×4/0 | 2×95 | 2×95 | 95 |
| 05470(250K) | M12 (M10) | 46 | 150-12 | 150-12 | 2×125 | 2×125 | 2×125 | 60 | 2×250 | 2×250 | 2×120 | 2×120 | 120 |
| 06100(280K) | M12 (M10) | 46 | 150-12 | 150-12 | 2×150 | 2×150 | 2×150 | 60 | 2×300 | 2×300 | 2×150 | 2×150 | 150 |
| 06830(315K) | M12 (M10) | 46 | 150-12 | 150-12 | 2×200 | 2×200 | 2×200 | 100 | 2×350 | 2×350 | 2×185 | 2×185 | 2×95 |

*1 For all the 200 V class capacities and FR-F840-01160(55K) or lower, it is the gauge of a cable with the continuous maximum permissible temperature of 75°C (HIV cable (600 V grade heat-resistant PVC insulated wire), etc.). It is assumed that the cables will be used in a surrounding air temperatures of 50°C or less and the wiring distance of 20 m or shorter.

For the FR-F840-01800(75K) or higher, it is the gauge of the cable with the continuous maximum permissible temperature of 90°C or higher. It is assumed that the cables will be used in a surrounding air temperatures of 50°C or less and housed in an enclosure.

*2 For all the 200 V class capacities and FR-F840-00930(45K) or lower, it is the gauge of a cable with the continuous maximum permissible temperature of 75°C (THHW cable). It is assumed that the cables will be used in a surrounding air temperatures of 40°C or less and the wiring distance of 20 m or shorter.

For the FR-F840-01160(55K) or higher, it is the gauge of a cable with the continuous maximum permissible temperature of 90°C (THHN cable). It is assumed that the cables will be used in a surrounding air temperatures of 40°C or less and housed in an enclosure.

(For the use in the United States or Canada, refer to "Instructions for UL and cUL" in the Instruction Manual (Startup) or Instruction Manual (Hardware).)

*3 For the FR-F820-00930(22K) or lower and the FR-F840-00930(45K) or lower, it is the gauge of a cable with the continuous maximum permissible temperature of 70°C (PVC cable). It is assumed that the cables will be used in a surrounding air temperatures of 40°C or less and the wiring distance of 20 m or shorter.

For the FR-F820-01250(30K) or higher and the FR-F840-01160(55K) or higher, it is the gauge of a cable with the continuous maximum permissible temperature of 90°C (XLPE cable). It is assumed that the cables will be used in a surrounding air temperatures of 40°C or less and housed in an enclosure.

- (Selection example mainly for use in Europe.)
- *4 The screw size for terminals R/L1, S/L2, T/L3, U, V, W, P/+, N/-, and P1, and the earthing (grounding) terminal are shown. The screw size for earthing (grounding) terminal on FR-F820-00930(22K) or higher is shown in parentheses. The screw size for terminal P/+ for option connection on the FR-F840-03250(132K) and FR-F840-03610(160K) is shown in parentheses. The screw size for earthing (grounding) terminal on FR-F840-04320(185K) or higher is shown in parentheses.

The line voltage drop can be calculated by the following formula:

Line voltage drop [V] = $\frac{\sqrt{3} \times \text{wire resistance } [m\Omega/m] \times \text{wiring distance } [m] \times \text{current } [A]}{1000}$

Use a larger diameter cable when the wiring distance is long or when the voltage drop (torque reduction) in the low speed range needs to be reduced.

• NOTE

- Tighten the terminal screw to the specified torque.
 - A screw that has been tightened too loosely can cause a short circuit or malfunction.
 - A screw that has been tightened too tightly can cause a short circuit or malfunction due to the unit breakage.
- · Use crimp terminals with insulation sleeves to wire the power supply and motor.

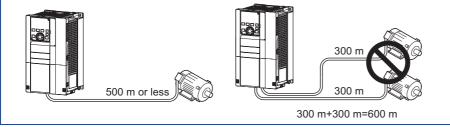
Total wiring length

■ With induction motor

Connect one or more general-purpose motors within the total wiring length shown in the following table.

| Pr.72 setting (carrier frequency) | FR-F820-00046(0.75K), FR-F840-00023(0.75K) | FR-F820-00077(1.5K), FR-F840-00038(1.5K) | FR-F820-00105(2.2K) or higher, FR- F840-00052(2.2K) or higher | |
|--------------------------------------|---|---|--|--|
| 2 (2 kHz) or lower | 300 m | 500 m | 500 m | |
| 3 (3 kHz) or higher | 200 m | 300 m | 500 m | |

Total wiring length (FR-F820-00105(2.2K) or higher, FR-F840-00052(2.2K) or higher)



When driving a 400 V class motor by the inverter, surge voltages attributable to the wiring constants may occur at the motor terminals, deteriorating the insulation of the motor. In this case, take one of the following measure.

 Use a "400 V class inverter-driven insulation-enhanced motor" and set Pr.72 PWM frequency selection according to the wiring length.

| Wiring length 50 m or shorter | Wiring length 50 to 100 m | Wiring length longer than 100 m | |
|-------------------------------|---------------------------|---------------------------------|--|
| 15 (14.5 kHz) or lower | 9 (9 kHz) or lower | 4 (4 kHz) or lower | |

 For the FR-F840-01160(55K) or lower, connect a surge voltage suppression filter (FR-ASF-H/FR-BMF-H) at the output side of the inverter. For the FR-F840-01800(75K) or higher, connect a sine wave filter (MT-BSL/BSC) at the output side of the inverter.

■ With PM motor

Use the following length of wiring or shorter when connecting a PM motor.

| Voltage class | Pr.72 setting (carrier frequency) | FR-F820-00077(1.5K) or lower, FR-F840-00038(1.5K) or lower | FR-F820-00105(2.2K) or higher, FR-F840-00052(2.2K) or higher |
|---------------|-----------------------------------|---|---|
| 200 V | 0 (2 kHz) to 15 (14 kHz) | 100 m | 100 m |
| | 5 or lower (2 kHz) | 100 m | 100 m |
| 400 V | 6 to 9 (6 kHz) | 50 m | 100 m |
| | 10 (10 kHz) or higher | 50 m | 50 m |

Use one PM motor for one inverter. Multiple PM motors cannot be connected to an inverter.

- NOTE

- Especially for long-distance wiring, the inverter may be affected by a charging current caused by stray capacitance of the wiring, leading to an activation of the overcurrent protection, malfunction of the fast-response current limit operation, or even to an inverter failure. It may also cause a malfunction or fault of the equipment connected ON the inverter output side. If the fast-response current limit function malfunctions, disable the function. (Refer to **Pr.156 Stall prevention operation selection** on page 290.)
- A surge voltage suppression filter (FR-ASF-H/FR-BMF-H) can be used under V/F control and Advanced magnetic flux vector control.

A sine wave filter (MT-BSL/BSC) can be used under V/F control. Do not use the filters under different control methods.

- For details on **Pr.72 PWM frequency selection**, refer to page 218.
- For details on the surge voltage suppression filter (FR-ASF-H/FR-BMF-H) and the sine wave filter (MT-BSL/BSC), refer to the Instruction Manual of each option.
- Refer to page 104 to drive a 400 V class motor by an inverter.

2.5.4 Earthing (grounding) precautions

Always earth (ground) the motor and inverter.

Purpose of earthing (grounding)

Generally, an electrical apparatus has an earth (ground) terminal, which must be connected to the ground before use.

An electrical circuit is usually insulated by an insulating material and encased. However, it is impossible to manufacture an insulating material that can shut off a leakage current completely, and actually, a slight current flows into the case. The purpose of earthing (grounding) the case of an electrical apparatus is to prevent operators from getting an electric shock from this leakage current when touching it.

To avoid the influence of external noises, the earthing (grounding) is important to EMI-sensitive equipment that handle lowlevel signals or operate very fast such as audio equipment, sensors, computers.

Earthing (grounding) system to be established

As described previously, the purpose of earthing (grounding) is roughly classified into the electrical shock prevention and the prevention of malfunction due to the influence of electromagnetic noise. These two purposes should be clearly distinguished, and the appropriate earth (ground) system must be established to prevent the leakage current having the inverter's high frequency components from reversing through another earth (ground) point for malfunction prevention by following these instructions:

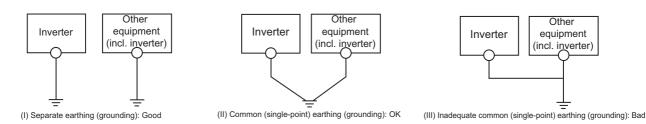
 Make the separate earth (ground) connection (I) for high frequency products such as the inverter from any other devices (EMI-sensitive devices described above) wherever possible.

Establishing adequate common (single-point) earth (ground) system (II) shown in the following figure is allowed only in cases where the separate earth (ground) system (I) is not feasible. Do not make inadequate common (single-point) earth (ground) connection (III).

As leakage currents containing many high frequency components flows into the earthing (grounding) cables of the inverter and peripheral devices (including a motor), the inverter must also be earthed (grounded) separately from EMI-sensitive devices described above.

In a high building, it may be effective to use its iron structure frames as earthing (grounding) electrode for EMI prevention in order to separate from the earth (ground) system for electric shock prevention.

- Earthing (Grounding) must conform to the requirements of national and local safety regulations and electrical codes (NEC section 250, IEC 61140 class 1 and other applicable standards). A neutral-point earthed (grounded) power supply for 400 V class inverter in compliance with EN standard must be used.
- Use the thickest possible earthing (grounding) cable. The size of the earthing (grounding) cable should be the same or larger than the one indicated in the table on page 53.
- The earthing (grounding) point should be as close as possible to the inverter, and the earth (ground) wire length should be as short as possible.
- Run the earthing (grounding) cable as far away as possible from the I/O wiring of the EMI-sensitive devices and run them in parallel in the minimum distance.





• To be compliant with the EU Directive (Low Voltage Directive), refer to the Instruction Manual (Startup).

2.6.1 Details on the control circuit terminals

♦ Input signal

| Туре | Terminal symbol | Common | Terminal name | Terminal function desc | ription | Rated specification | Refer to page | | | | | |
|---------------|-----------------------------|---|--|--|--|--|---|---|---|---|---|-----|
| | STF ^{*1} | | Forward rotation start | Turn ON the STF signal to start forward rotation and turn it OFF to stop. | When the STF and STR signals are turned ON | | | | | | | |
| | STR ^{*1} | | | | | | Reverse rotation start | Turn ON the STR signal to start reverse rotation and turn it OFF to stop. | simultaneously, the stop command is given. | Input resistance: 4.7 kΩ, voltage when contacts are open: 21 | 563 | |
| | STP (STOP) ^{*1} | | Start self-holding selection | Turn ON the STP (STOP) signal to s signal. | self-hold the start | to 27 VDC, current when contacts are | 563 | | | | | |
| | RH, RM, RL ^{*1} | | Multi-speed selection | Multi-speed can be selected according to the combination of RH, RM and RL signals. | | short-circuited: 4 to 6 mADC | 263 | | | | | |
| | | | Jog mode selection | Turn ON the JOG signal to enable J (initial setting) and turn ON the start signal to start JOG operation. | | | 261 | | | | | |
| Ŧ | JOG ^{*1} | SD (sink (negative common)) PC (source (positive common)) | Pulse train input | Terminal JOG is also used as a pulse train input terminal. To use as a pulse train input terminal, change the Pr.291 setting. (Maximum input pulse: 100k pulses/s) | | Input resistance: $2 k\Omega$, current when contacts are short-circuited: 8 to 13 mADC | 258 | | | | | |
| Contact input | RT ^{*1} | | common)) PC (source (positive | common)) PC (source (positive | common)) PC (source (positive common)) | Second function selection | Turn ON the RT signal to enable the When the second function such as " boost" and "Second V/F (base frequ turning ON the RT signal enables th function. | Second torque ency)" is set, | | 377 | | |
| | MRS ^{*1} | | | | | , | | Output stop | Turn ON the MRS signal (2 ms or m inverter output. Use this signal to shut off the inverte stopping the motor with an electrom | er output when agnetic brake. | Input resistance: 4.7 kΩ, voltage when | 375 |
| | RES ^{*1} | | | | | | Reset | Use this signal to reset a fault output protective function is activated. Turn ON the RES signal for 0.1 seco turn it OFF. In the initial setting, reset is always e Pr.75 , reset can be enabled only at occurrence. The inverter recovers ab the reset is released. | nd or longer, then nabled. By setting an inverter fault | contacts are open: 21 to 27 VDC, current when contacts are short-circuited: 4 to 6 mADC | 196 | |
| | AU ^{*1} | | Terminal 4 input selection | The terminal 4 function is available of signal is ON. Turning the AU signal ON makes ter | - | | 349 | | | | | |
| | CS ^{*1} | | (No function) | Use Pr.186 CS terminal function s function assignment. | election for | | — | | | | | |

| Туре | Terminal symbol | Common | Terminal name | Terminal function description | Rated specification | Refer to page |
|--------------------|--------------------|--------|----------------------------------|---|--|---------------------|
| | 10E | 5 | Frequency setting | | | 349 |
| | 10 | 5 | power supply | Change the input specifications of terminal 2 using Pr.73 when connecting it to terminal 10E. | 5 ±0.5 VDC, permissible load current: 10 mA | 349 |
| setting | 2 | 5 | Frequency setting (voltage) | Inputting 0 to 5 VDC (or 0 to 10 V, 0 to 20 mA) provides the maximum output frequency at 5 V (10 V, 20 mA) and makes input and output proportional. Use Pr.73 to switch among input 0 to 5 VDC (initial setting), 0 to 10 VDC, and 0 to 20 mA. Set the voltage/current input switch 1 for terminal 2 in the ON position to select current input (0 to 20 mA). ^{*2} | For voltage input, input resistance: 10 to 11 $k\Omega$, maximum permissible voltage: 20 VDC. For current input, input resistance: 245 $\pm 5 \Omega$, maximum permissible current: 30 mA. Voltage/current input switch switch2 switch1 | 349 |
| Frequency setting | 4 | 5 | Frequency setting (current) | Inputting 4 to 20 mADC (or 0 to 5 V, 0 to 10 V) provides the maximum output frequency at 20 mA and makes input and output proportional. This input signal is valid only when the AU signal is ON (terminal 2 input is invalid). Use Pr.267 to switch among input 4 to 20 mA (initial setting), 0 to 5 VDC, and 0 to 10 VDC. Set the corresponding switch of the voltage/current input selection switch assembly to the OFF position to select voltage input (0 to 5 V / 0 to 10 V). ^{*2} Use Pr.858 to switch terminal functions. | | 349 |
| | 1 | 5 | Frequency setting auxiliary | Input 0 to ± 5 VDC or 0 to ± 10 VDC to add this signal to the frequency setting signal input via terminal 2 or 4. Use Pr.73 to switch between input 0 to ± 5 VDC and 0 to ± 10 VDC (initial setting). Use Pr.868 to switch terminal functions. | Input resistance: 10 to 11 kΩ, maximum permissible voltage: ±20 VDC. | 349 |
| Thermistor | 10 2 | _ | PTC thermistor input | For receiving PTC thermistor outputs. When PTC thermistor is valid (Pr.561 ≠ "9999"), terminal 2 is not available for frequency setting. | [Applicable PTC thermistor specification] Overheat detection resistance: 0.5 to 30 kΩ (Set in Pr.561) | 266 |
| Power supply input | +24 | SD | 24 V external power supply input | For connecting a 24 V external power supply. If a 24 V external power supply is connected, power is supplied to the control circuit while the main power circuit is OFF. | Input voltage: 23 to 25.5 VDC, input current: 1.4 A or less | 73 |

*1 The terminal function can be selected by Pr.178 to Pr.196 (Input terminal function selection). (Refer to page 373.)

*2 Correctly set **Pr.73**, **Pr.267**, and the corresponding switch of the voltage/current input selection switch assembly to input an analog signal in accordance with the setting.

Applying a voltage with the switch ON (current input is selected) or applying a current with the switch OFF (voltage input is selected) could cause component damage of the inverter or analog circuits of output devices. (For the details, refer to page 349.)

*3 Sink logic is initially set for the FM-type inverter.

*4 Source logic is initially set for the CA-type inverter.

Output signal

| Туре | Terminal symbol | Common | Terminal name | Terminal function descr | iption | Rated specification | Refer to page | | | | |
|----------------|---|------------------------------|---|--|--|--|---------------------|--|--|---|-----|
| Relay | A1, B1, C1 ^{*1} — Relay output 1 (fault t output) F | | | 1 changeover contact output that ind inverter's protective function has bee the outputs are stopped. Fault: discontinuity across B and C (co and C), Normal: continuity across B a (discontinuity across A and C) | Contact capacity: 230 VAC 0.3 A (power factor = 0.4), 30 VDC 0.3 A | 330 | | | | | |
| | A2, B2, C2 ^{*1} | — | Relay output 2 | 1 changeover contact output | | 330 | | | | | |
| | RUN ^{*1} | SE | Inverter running | frequency is equal to or higher than t frequency (initial value: 0.5 Hz). The | The output is in LOW state when the inverter output requency is equal to or higher than the starting requency (initial value: 0.5 Hz). The output is in HIGH state during stop or DC injection brake operation. | | 330 | | | | |
| | SU ^{*1} | SE | Up to frequency | The output is in LOW state when the output frequency is within the set frequency range $\pm 10\%$ (initial value). The output is in HIGH state during acceleration/deceleration and at a stop. | | Permissible load: 24 VDC (27 VDC at maximum) 0.1 A (The voltage drop is | 337 | | | | |
| Open collector | OL*1 SE Overload warning IPF*1 SE Instantaneous power failure | | Overload warning | The output is in LOW state when stall prevention is activated by the stall prevention function. The output is in HIGH state when stall prevention is canceled. | Fault code (4 bits) output. (Refer to page | 2.8 V at maximum while the signal is ON.) The open collector transistor is ON (conductive) in LOW state. The transistor is OFF (not conductive) in HIGH state. | 290 | | | | |
| | | | | The output is in LOW state when an instantaneous power failure occurs or when the undervoltage protection is activated. | 345.) | | 466, 472 | | | | |
| | FU ^{*1} | SE | Frequency detection | The output is in LOW state when the inverter output frequency is equal to or higher than the preset detection frequency, and is in HIGH state when it is less than the preset detection frequency. | put is in LOW state when the routput frequency is equal to er than the preset detection icy, and is in HIGH state is less than the preset | | 337 | | | | |
| | | NPN open collector output | | | | | For meter | | Output item: output frequency (initial setting) | Permissible load current: 2 mA, pulse for full scale: 1440 pulses/ s | 314 |
| Pulse | FM ^{*2} | | Among several monitor items such as output frequency, select one to output it via these terminals. The signal is not output during an inverter reset. The size of output signal is proportional to the magnitude of the | This terminal can be used for open collector outputs depending on the Pr.291 setting. | Maximum output pulse: 50k pulses/s, permissible load current: 80 mA | 258 | | | | | |
| Analog | АМ | | corresponding monitor item. Use Pr.55 , Pr.56 , and Pr.866 to set full scales for the monitoring output frequency, output current, and torque. (Refer to page 314.) | Output item: output frequency (initial setting) | Output signal: 0 ± 10 VDC, permissible load current: 1 mA (load impedance $10 \text{ k}\Omega$ or more), resolution: 13 bits | 314 | | | | | |
| | CA ^{*3} | 5 | Analog current output | | | Load impedance: 200 to 450 Ω, output signal: 0 to 20 mADC | 314 | | | | |

*1 The terminal function can be selected by Pr.190 to Pr.196 (Output terminal function selection). (Refer to page 330.)

*2 Terminal FM is provided in the FM-type inverter.*3 Terminal CA is provided in the CA-type inverter.

Safety stop signal

| Terminal symbol | Terminal name | Common | Terminal function description | Rated specification | Refer to page |
|--------------------|--|--------|---|---|---------------------|
| S1 | Safety stop input (Channel 1) | | Use terminals S1 and S2 to receive the safety stop signal input from the safety relay module. Terminals S1 and S2 can be used at a time (dual channel). The Inverter judges the condition of the internal safety circuit | Input resistance: 4.7 | |
| S2 | Safety stop input (Channel 2) | SIC | from the status (shorted/opened) between terminals S1 and SIC, or between S2 and SIC. When the status is opened, the inverter output is shut off. In the initial status, terminal S1 and S2 are shorted with terminal PC by shorting wires. Terminal SIC is shorted with terminal SD. Remove the shorting wires and connect the safety relay module when using the safety stop function. | $k\dot{\Omega}$, input current: 4 to 6 mADC (with 24 VDC input) | 74 |
| So (SO) | Safety monitor output (open collector output) | SOC | The output status varies depending on the input status of the safety stop signals. The output is in HIGH state during occurrence of the internal safety circuit failure. The output is in LOW state otherwise. (The open collector transistor is ON (conductive) in LOW state. The transistor is OFF (not conductive) in HIGH state.) Refer to the Safety Stop Function Instruction Manual if the output becomes in HIGH state even though both terminals S1 and S2 are open. (Contact your sales representative for this manual.) | Permissible load: 24 VDC (27 VDC at maximum), 0.1 A (The voltage drop is 3.4 V at maximum while the signal is ON.) | |

Common terminal

| Terminal symbol | Common | Terminal name | Terminal function description | Rated specification | Refer to page |
|--------------------|-------------------|---|---|---|---------------------|
| | | Contact input common (sink) ^{*1} | Common terminal for the contact input terminal (sink logic), terminal FM. | | |
| SD | _ | External transistor common (source) ^{*2} | Connect this terminal to the power supply common terminal of a transistor output (open collector output) device, such as a programmable controller, in the source logic to avoid malfunction by undesirable current. | _ | _ |
| | | 24 VDC power supply common | Common terminal for the 24 VDC power supply (terminal PC, terminal +24). Isolated from terminals 5 and SE. | | |
| PC | _ | External transistor common (sink) ^{*1} | Connect this terminal to the power supply common terminal of a transistor output (open collector output) device, such as a programmable controller, in the sink logic to avoid malfunction by undesirable current. | Power supply voltage range: 19.2 to 28.8 | 65 |
| | | Contact input common (source) ^{*2} | Common terminal for contact input terminal (source logic). | VDC, permissible load current: 100 mA | |
| | SD | 24 VDC power supply | Can be used as a 24 VDC 0.1 A power supply. | | |
| 5 | Frequency setting | | Common terminal for the frequency setting signal (via terminal 2, 1, or 4) and for the analog output terminals AM and CA. Do not earth (ground). | _ | 349 |
| SE | _ | Open collector output common | Common terminal for terminals RUN, SU, OL, IPF, FU | _ | — |
| SIC | _ | Safety stop input terminal common | Common terminal for terminals S1 and S2. | _ | 74 |
| SOC | _ | Safety monitor output terminal common | Common terminal for terminal So (SO). | _ | 74 |

*1 Sink logic is initially set for the FM-type inverter.

*2 Source logic is initially set for the CA-type inverter.

2

Communication

| Туре | | erminal symbol | Terminal name | Terminal function desc | ription | Refer to page | | |
|--------|-----------|-------------------|-----------------------|--|---|------------------|--|--|
| 85 | _ | — PU connector | | RS-485 communication can be made through the PU connector (for connection on a 1:1 basis only). Conforming standard: EIA-485 (RS-485) Transmission format: Multidrop link Transmission speed: 4800 to 115200 bps Wiring length: 500 m | | | | |
| RS-485 | terminals | TXD+ | Inverter transmission | RS-485 communication can be made through th | o PS 185 torminals | | | |
| | ці. | TXD- | Co | Conforming standard: EIA-485 (RS-485) | | | | |
| | terr | RXD+ | Inverter reception Tr | Transmission format: Multidrop link | | | | |
| | | RXD- | terminal | Transmission format: Multidrop link Transmission speed: 300 to 115200 bps | | | | |
| | RS-485 | GND (SG) | Earthing (grounding) | Overall length: 500 m | | | | |
| | | USB A connec | | A connector (receptacle). Plug a USB memory device into this connector to copy parameter settings or use the trace function. | Interface: conforms to USB 1.1 (USB 2.0 full-speed | 78 | | |
| USB | _ | | USB B connector | Mini B connector (receptacle). By connecting the inverter to a personal computer via this connector, FR Configurator2 installed on the computer can be used for setting the inverter, or monitoring or testing the inverter operation. | compatible) Transmission speed: 12 Mbps | 78 | | |

2.6.2 Control logic (sink/source) change

Switch the control logic of input signals as necessary.

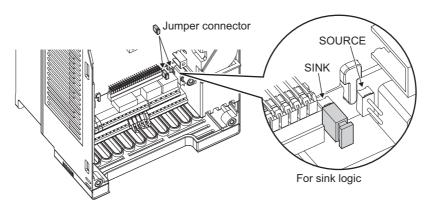
To change the control logic, change the jumper connector position on the control circuit board.

Connect the jumper connector to the connector pin of the desired control logic.

The control logic of input signals is initially set to the sink logic (SINK) for the type FM inverter.

The control logic of input signals is initially set to the source logic (SOURCE) for the type CA inverter.

(The output signals may be used in either the sink or source logic independently of the jumper connector position.)



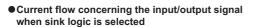


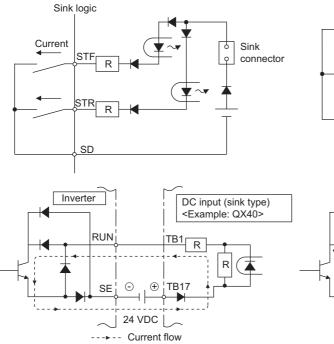
• Make sure that the jumper connector is installed correctly.

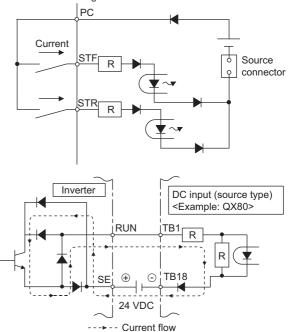
• Never change the control logic while power is ON.

Sink logic and source logic

- In the sink logic, a signal turns ON when a current exits from the corresponding signal input terminal.
 Terminal SD is common to the contact input signals. Terminal SE is common to the open collector output signals.
- In the source logic, a signal turns ON when a current enters into the corresponding signal input terminal.
 Terminal PC is common to the contact input signals. Terminal SE is common to the open collector output signals.







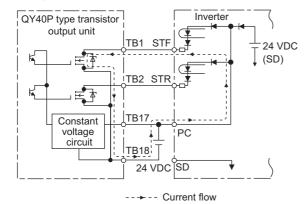
• Current flow concerning the input/output signal

when source logic is selected Source logic

· When using an external power supply for transistor output

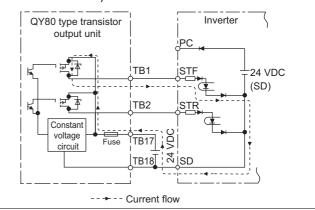
Sink logic

Use terminal PC as a common terminal, and perform wiring as shown below. (Do not connect terminal SD on the inverter with the terminal of 0 V for the external power supply. When using terminals PC-SD as a 24 VDC power supply, do not install an external power supply in parallel with the inverter. Doing so may cause a malfunction in the inverter due to undesirable currents.)



Source logic

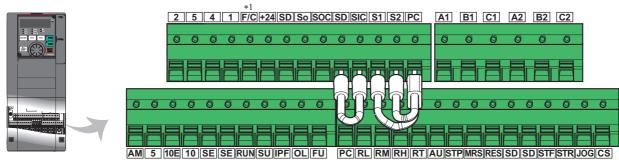
Use terminal SD as a common terminal, and perform wiring as shown below. (Do not connect terminal PC on the inverter with the terminal of +24 V for the external power supply. When using terminals PC-SD as a 24 VDC power supply, do not install an external power supply in parallel with the inverter. Doing so may cause a malfunction in the inverter due to undesirable currents.)



2.6.3 Wiring of control circuit

Control circuit terminal layout

- Recommended cable gauge: 0.3 to 0.75 mm^2



*1 This terminal operates as terminal FM for the type FM inverter. For the type CA inverter, the terminal operates as terminal CA.

Wiring method

■ Power supply connection

Use crimp terminals and stripped wire for the control circuit wiring. For single wire, the stripped wire can be used without crimp terminal.

Connect the end of wires (crimp terminal or stranded wire) to the terminal block.

1. Strip the signal wires as follows. If too much of the wire is stripped, a short circuit may occur with neighboring wires. If not enough of the wire is stripped, wires may become loose and fall out.

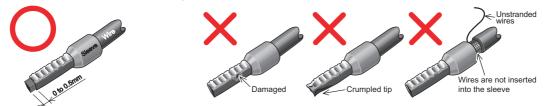
Twist the stripped end of wires to prevent them from fraying. Do not solder them.

Cable sheath stripping length



2. Crimp the terminals on the wire.

Insert the wire into a crimp terminal, making sure that 0 to 0.5 mm of the wire protrudes from the end of the sleeve. Check the condition of the crimp terminals after crimping. Do not use the crimp terminals of which the crimping is inappropriate, or the face is damaged.



Crimp terminals commercially available (as of October 2020)

• Phoenix Contact Co., Ltd.

| Cable gauge (mm ²) | | Crimping tool | | |
|--------------------------------|------------------------|---------------------------|----------------------------------|------------|
| Cable gauge (mm) | With insulation sleeve | Without insulation sleeve | For UL wire ^{*1} | name |
| 0.3 | AI 0,34-10TQ | — | — | |
| 0.5 | AI 0,5-10WH | — | AI 0,5-10WH-GB | |
| 0.75 | AI 0,75-10GY | A 0,75-10 | AI 0,75-10GY-GB | |
| 1 | AI 1-10RD | A 1-10 | AI 1-10RD/1000GB | CRIMPFOX 6 |
| 1.25, 1.5 | AI 1, 5-10BK | A 1, 5-10 | AI 1,5-10BK/1000GB ^{*2} | |
| 0.75 (two-wire product) | AI-TWIN 2×0,75-10GY | — | — | |

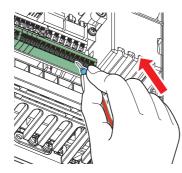
*1 A ferrule terminal with an insulation sleeve compatible with the MTW wire which has a thick wire insulation.

^{*2} Applicable for terminals A1, B1, C1, A2, B2, C2.

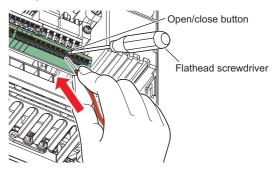
• NICHIFU Co., Ltd.

| Cable gauge (mm ²) | Blade terminal product number | Insulation cap product number | Crimping tool product number |
|--------------------------------|----------------------------------|-------------------------------|---------------------------------|
| 0.3 to 0.75 | BT 0.75-11 | VC 0.75 | NH 69 |

3. Insert the wire into the terminal block.



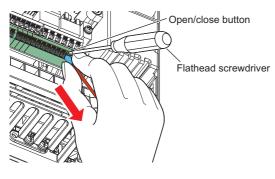
When using single wire or stranded wire without crimp terminal, push an open/close button all the way down with a flathead screwdriver, and insert the wire.



- When using stranded wires without a crimp terminal, twist enough to avoid short circuit with a nearby terminals or wires.
- Place the flathead screwdriver vertical to the open/close button. In case the blade tip slips, it may cause an inverter damage or injury.

■ Wire removal

Pull the wire while pushing the open/close button all the way down firmly with a flathead screwdriver.



- NOTE

- Pulling out the wire forcefully without pushing the open/close button all the way down may damage the terminal block.
- Use a small flathead screwdriver (tip thickness: 0.4 mm, tip width: 2.5 mm).
 If a flathead screwdriver with a narrow tip is used, terminal block may be damaged.
 Commercially available products (as of October 2020)

| Product name | Model | Manufacturer |
|-----------------|------------------|---------------------------|
| Screwdriver | SZF 0- 0,4 × 2,5 | Phoenix Contact Co., Ltd. |

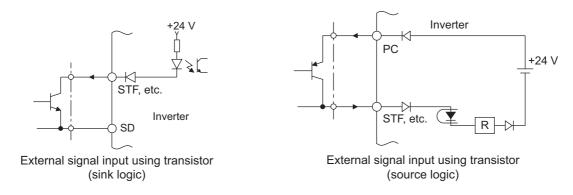
• Place the flathead screwdriver vertical to the open/close button. In case the blade tip slips, it may cause an inverter damage or injury.

Common terminals of the control circuit (SD, PC, 5, SE)

- Terminals SD (sink logic), PC (source logic), 5, and SE are common terminals (0 V) for I/O signals. (All common terminals are isolated from each other.) Do not earth (ground) these terminals. Avoid connecting terminal SD (sink logic) with terminal 5, terminal PC (source logic) with terminal 5, and terminal SE with terminal 5.
- In the sink logic, terminal SD is a common terminal for the contact input terminals (STF, STR, STP (STOP), RH, RM, RL, JOG, RT, MRS, RES, AU, and CS) and the pulse train output terminal (FM^{*1}). The open collector circuit is isolated from the internal control circuit by photocoupler.
- In the source logic, terminal PC is a common terminal for the contact input terminals (STF, STR, STP (STOP), RH, RM, RL, JOG, RT, MRS, RES, AU, CS). The open collector circuit is isolated from the internal control circuit by photocoupler.
- Terminal 5 is a common terminal for the frequency setting terminals (1, 2, and 4) and the analog output terminals (AM and CA^{*2}). It should be protected from external noise using a shielded or twisted cable.
- Terminal SE is a common terminal for the open collector output terminals (RUN, SU, OL, IPF, and FU). The contact input circuit is isolated from the internal control circuit by photocoupler.
 - *1 Terminal FM is provided in the FM-type inverter.
 - *2 Terminal CA is provided in the CA-type inverter.

Signal inputs by contactless switches

The contact input terminals of the inverter (STF, STR, STP (STOP), RH, RM, RL, JOG, RT, MRS, RES, AU, and CS) can be controlled using a transistor instead of a contact switch as follows.



2.6.4 Wiring precautions

- It is recommended to use a cable of 0.3 to 0.75 mm² for the connection to the control circuit terminals.
- The wiring length should be 30 m (200 m for terminal FM) at the maximum.
- Use two or more parallel micro-signal contacts or twin contacts to prevent contact faults when using contact inputs since the control circuit input signals are micro-currents.

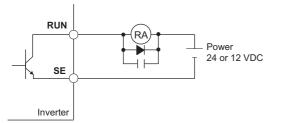




Micro signal contacts

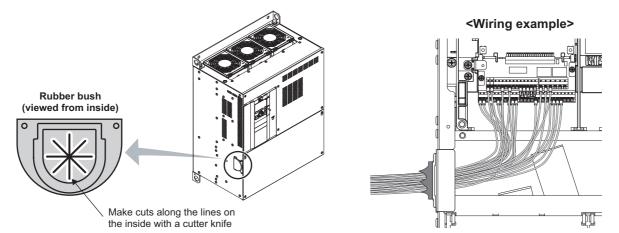
- Twin contacts
- To suppress EMI, use shielded or twisted cables for the control circuit terminals and run them away from the main and
 power circuits (including the 200 V relay sequence circuit). For the cables connected to the control circuit terminals,
 connect their shields to the common terminal of the connected control circuit terminal. When connecting an external power
 supply to terminal PC, however, connect the shield of the power supply cable to the negative side of the external power
 supply. Do not directly earth (ground) the shield to the enclosure, etc.
- Always apply a voltage to the fault output terminals (A1, B1, C1, A2, B2, and C2) via a relay coil, lamp, etc.

• When a relay coil is connected to the output terminals, use one with a surge absorbing function (reflux diode). When the voltage application direction is incorrect, the inverter will be damaged. Pay attention to the diode direction or other precautions to avoid incorrect wiring.



• For the FR-F820-03160(75K) or higher and FR-F840-02160(90K) or higher, separate the wiring of the control circuit away from the wiring of the main circuit.

Make cuts in rubber bush of the inverter side and lead the wires through.



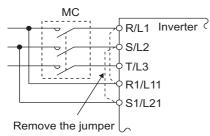
2.6.5 When using separate power supplies for the control circuit and the main circuit

Cable size for the control circuit power supply (terminals R1/L11 and S1/ L21)

- Terminal screw size: M4
- Cable gauge: 0.75 to 2 mm²
- Tightening torque: 1.5 N·m

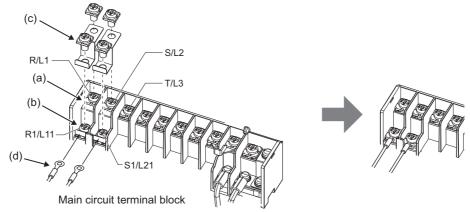
Connection method

Connection diagram

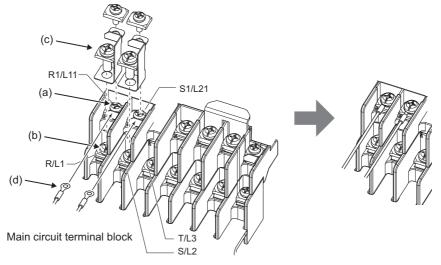


If a fault occurs and the electromagnetic contactor (MC) installed at the inverter's input line is opened, power supply to the control circuit is also stopped and the fault signals cannot be output anymore. Terminals R1/L11 and S1/L21 of the control circuit are provided to keep outputting the fault signals in such a case. Follow the following steps to wire terminals R1/L11 and S1/L21 on the inverter to the power input lines of the MC. Do not connect the power cable to incorrect terminals. Doing so may damage the inverter.

• FR-F820-00250(5.5K) or lower, FR-F840-00126(5.5K) or lower

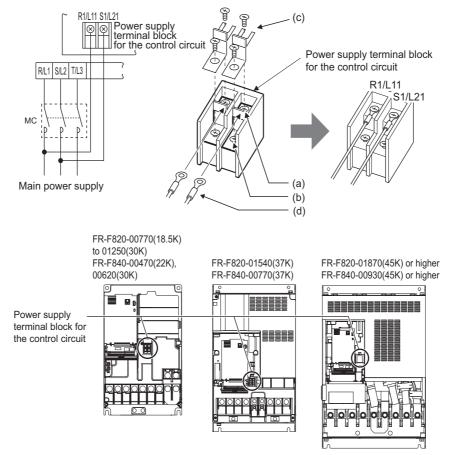


- (a) Remove the upper screws.
- (b) Remove the lower screws.
- (c) Remove the jumper.
- (d) Connect the separate power cable for the control circuit to the lower terminals (R1/L11, S1/L21).
- FR-F820-00340(7.5K) to FR-F820-00630(15K), FR-F840-00170(7.5K) to FR-F840-00380(18.5K)



- (a) Remove the upper screws.
- (b) Remove the lower screws.
- (c) Remove the jumper.
- (d) Connect the separate power cable for the control circuit to the upper terminals (R1/L11, S1/L21).

• FR-F820-00770(18.5K) or higher, FR-F840-00470(22K) or higher



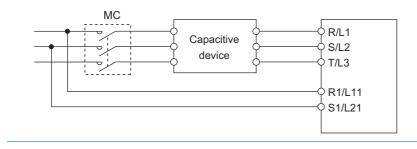
- (a) Remove the upper screws.
- (b) Remove the lower screws.
- (c) Pull the jumper toward you to remove.
- (d) Connect the separate power cable for the control circuit to the upper terminals (R1/L11, S1/L21).



- When using separate power supplies, always remove the jumpers across terminals R/L1 and R1/L11 and across S/L2 and S1/L21. The inverter may be damaged if the jumpers are not removed.
- When the control circuit power is supplied from other than the input line of the MC, the voltage of the separate power supply must be the same as that of the main control circuit .
- The power capacity necessary when separate power is supplied from R1/L11 and S1/L21 differs according to the inverter capacity.

| Inverter | Power supply capacity |
|--|-----------------------|
| FR-F820-00630(15K) or lower FR-F840-00380(18.5K) or lower | 60 VA |
| FR-F820-00770(18.5K) or higher FR-F840-00470(22K) or higher | 80 VA |

- If the main circuit power is switched OFF (for 0.1 second or more) then ON again, the inverter is reset and a fault output will not be held.
- When a power supply is provided for the control circuit separately from the main circuit and a capacitive device (such as an EMC filter or a radio noise filter) is connected, refer to the following diagram. (For the wiring example to comply with ship classification standards, refer to page 662.)



2.6.6 When supplying 24 V external power to the control circuit

Connect the 24 V external power supply across terminals +24 and SD to turn the I/O terminal ON/OFF operation, keep the operation panel ON, and carry out communication during communication operation even at power-OFF state of inverter's main circuit power supply. When the main circuit power supply is turned ON, the power supply is switched from the 24 V external power supply to the main circuit power supply.

Specification of the applied 24 V external power supply

| Item | Rated specification |
|---------------|---------------------|
| Input voltage | 23 to 25.5 VDC |
| Input current | 1.4 A or less |

Commercially available products (as of October 2020)

| Model | Product overview | Manufacturer | |
|---|--|-------------------|--|
| S8FS-G05024C ^{*1} | Specifications: Capacity 50 W, output voltage 24 VDC, output current 2.2 A Installation method: Direct installation, screw type terminal block with cover Input: Single-phase 100 to 240 VAC | | |
| S8VK-S06024 ^{*1} Specifications: Capacity 60 W, output voltage 24 VDC, output current 2.5 A Installation method: DIN rail, push-in (spring) type terminal block Input: Single-phase 100 to 240 VAC | | OMRON Corporation | |
| S8VK-WA24024 ^{*1} | Specifications: Capacity 240 W, output voltage 24 VDC, output current 10 A Installation method: DIN rail, push-in (spring) type terminal block Input: Three-phase 200 to 240 VAC | | |

*1 For the latest information about OMRON power supply, contact OMRON corporation.

Starting and stopping the 24 V external power supply operation

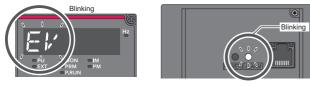
- Supplying 24 V external power while the main circuit power is OFF starts the 24 V external power supply operation. Likewise, turning OFF the main circuit power while supplying 24 V external power starts the 24 V external power supply operation.
- Turning ON the main circuit power stops the 24 V external power supply operation and enables the normal operation.

- NOTE

- When the 24 V external power is supplied while the main circuit power supply is OFF, the inverter operation is disabled.
- In the initial setting, when the main circuit power supply is turned ON during the 24 V external power supply operation, a reset is performed in the inverter, then the power supply changes to the main circuit power supply. (The reset can be disabled using Pr.30. (Refer to page 566.))

Confirming the 24 V external power supply input

• During the 24 V external power supply operation, "EV" blinks on the operation panel. The alarm lamp also blinks. Thus, the 24 V external power supply operation can be confirmed even when the operation panel is removed.



• During 24 V external power supply operation, the 24 V external power supply operation (EV) signal is output. To use the EV signal, set "68 (positive logic) or 168 (negative logic)" in one of **Pr.190 to Pr.196 (Output terminal function selection)** to assign function to an output terminal.

Operation while the 24 V external power is supplied

- Fault history and parameters can be read and parameters can be written (when the parameter write from the operation panel is enabled) using the operation panel keys.
- The safety stop function is invalid during the 24 V external power supply operation.

- During the 24 V external power supply operation, the monitor items and signals related to inputs to main circuit power supply, such as the output current, converter output voltage, and IPF signal, are invalid.
- The alarms, which have occurred when the main circuit power supply is ON, continue to be output after the power supply is changed to the 24 V external power supply. Perform the inverter reset or turn OFF then ON the power to reset the faults.
- If the power supply changes from the main circuit power supply to the 24 V external power supply while measuring the main circuit capacitor's life, the measurement completes after the power supply changes back to the main circuit power supply (Pr.259 = "3").
- The output data is retained when "1 or 11" is set in Pr.495 Remote output selection.

NOTE

- Inrush current equal to or higher than the 24 V external power supply specification may flow at power-ON. Confirm that the
 power supply and other devices are not affected by the inrush current and the voltage drop caused by it. Depending on the
 power supply, the overcurrent protection may be activated to disable the power supply. Select the power supply and capacity
 carefully.
- When the wiring length between the external power supply and the inverter is long, the voltage often drops. Select the appropriate wiring size and length to keep the voltage in the rated input voltage range.
- In a serial connection of several inverters, the current increases when it flows through the inverter wiring near the power supply. The increase of the current causes voltage to drop further. When connecting different inverters to different power supplies, use the inverters after confirming that the input voltage of each inverter is within the rated input voltage range. Depending on the power supply, the overcurrent protection may be activated to disable the power supply. Select the power supply and capacity carefully.
- "E.SAF" or "E.P24" may appear when the start-up time of the 24 V power supply is too long (less than 1.5 V/s) in the 24 V external power supply operation.
- "E.P24" may appear when the 24 V external power supply input voltage is low. Check the external power supply input.
- Do not touch the control circuit terminal block (circuit board) during the 24 V power supply operation (when conducted). Otherwise you may get an electric shock or burn.

2.6.7 Safety stop function

Function description

The terminals related to the safety stop function are as follows.

| Terminal symbol | Terminal function description | | |
|--------------------|---|--|--|
| S1 ^{*1} | Input terminal as the safety stop channel 1. | Status of both the circuit between terminals S1 and SIC and | |
| S2 ^{*1} | the circuit between terminals S2 and SIC open: Safety stop is activated. Shorted: Safety stop is not activated | | |
| SIC ^{*1} | Common terminal for S1 and S2. | | |
| So (SO) | Output terminal used for fault detection and fault indication display. The terminal is ON (conducted) while no internal safety circuit failure ^{*2} exists. | OFF: Internal safety circuit failure ^{*2} ON: No internal safety circuit failure ^{*2} | |
| SOC | Open collector output (terminal So (SO)) common | | |

*1 In the initial status, terminals S1 and PC, S2 and PC, and SIC and SD are respectively shorted with shorting wires. To enable the safety stop function, remove all the shorting wires, and then connect a safety relay module as shown in the connection diagram.

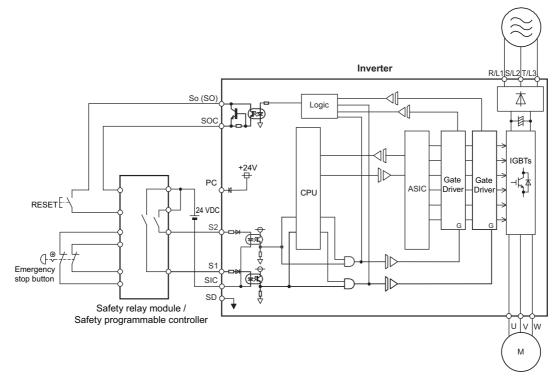
*2 When any fault listed on the next page occurs in the internal safety circuit, the corresponding indication is shown on the operation panel.

NOTE

Terminal So (SO) can be used to display a fault indication and to prevent restarting of the inverter. The signal output from terminal So (SO) cannot be used to input a safety stop signal to other devices.

Connection diagram

To prevent restart at failure occurrence, connect terminals So (SO) and SOC to the reset button, which are the feedback input terminals of the safety relay module.



Safety stop function operation

| Input | Internal safety circuit | Input ter | minal ^{*1*2} | Output terminal | Output signal ^{*8*9*10} | tput I ^{*8*9*10} Inverter operating status Operation panel indi | | nel indication |
|-------|----------------------------|-----------|-----------------------|--------------------|-------------------------------------|---|---------------------|-----------------------------|
| power | status | S1 | S2 | So (SO) | SAFE | | E.SAF ^{*6} | SA ^{*7} |
| OFF | — | — | — | OFF | OFF | Output shutoff (Safe state) | Not displayed | Not displayed |
| | Normal | ON | ON | ON ^{*3} | OFF | Operation enabled | Not displayed | Not displayed |
| | Normal | ON | OFF | OFF ^{*4} | OFF ^{*4} | Output shutoff (Safe state) | Displayed | Displayed |
| | Normal | OFF | ON | OFF ^{*4} | OFF ^{*4} | Output shutoff (Safe state) | Displayed | Displayed |
| ON | Normal | OFF | OFF | ON ^{*3} | ON ^{*3} | Output shutoff (Safe state) | Not displayed | Displayed |
| - | Fault | ON | ON | OFF | OFF | Output shutoff (Safe state) | Displayed | Not displayed ^{*5} |
| | Fault | ON | OFF | OFF | OFF | Output shutoff (Safe state) | Displayed | Displayed |
| | Fault | OFF | ON | OFF | OFF | Output shutoff (Safe state) | Displayed | Displayed |
| | Fault | OFF | OFF | OFF | OFF | Output shutoff (Safe state) | Displayed | Displayed |

*1 The terminal ON state shows that the terminal is conducted (the line is closed), and the OFF state shows that the terminal is not conducted (the line is open).

*2 When not using the safety stop function, short across terminals S1 and PC, S2 and PC, and SIC and SD to use the inverter. (In the initial status, terminals S1 and PC, S2 and PC, and SIC and SD are respectively shorted with shorting wires.)

*3 If any of the faults shown in the following table occurs, terminal So (SO) and the SAFE signal turns OFF.

| Fault type | Operation panel indication |
|--|----------------------------|
| Option fault | E.OPT |
| Communication option fault | E.OP1 |
| Parameter storage device fault (control circuit board) | E.PE |
| Retry count excess | E.RET |
| Parameter storage device fault (main circuit board) | E.PE2 |
| Internal storage device fault | E.PE6 |
| Operation panel power supply short circuit/RS-485 terminals power supply short circuit | E.CTE |

| Fault type | Operation panel indication |
|------------------------|----------------------------|
| 24 VDC power fault | E.P24 |
| Safety circuit fault | E.SAF |
| Overspeed occurrence | E.OS |
| | E.CPU |
| CPU fault | E.5 to E.7 |
| Internal circuit fault | E.13 |

- *4 When the internal safety circuit is operated normally (no faults occurs), terminal So (SO) and the SAFE signal remain ON until "E.SAF" is displayed. Terminal So (SO) and the SAFE signal turn OFF when "E.SAF" is displayed.
- *5 "SA" is displayed when terminals S1 and S2 are identified as OFF due to a fault occurred in the internal safety circuit.
- *6 $\,$ If another fault occurs when the fault E.SAF occurs, the other fault indication may be displayed.
- *7 If another warning occurs when the warning SA occurs, the other warning indication may be displayed.
- *8 The ON/OFF state of the output signal is the one for the positive logic. The ON and OFF are reversed for the negative logic.
- *9 To assign the function of the SAFE signal to an output terminal, set either value shown in the following table in any parameter from **Pr.190 to Pr.196 (Output terminal function selection)**.

| Output signal | Pr.190 to Pr.196 settings | | |
|---------------|---------------------------|----------------|--|
| Output signal | Positive logic | Negative logic | |
| SAFE | 80 | 180 | |

*10 The use of SAFE signal has not been certified for compliance with safety standards.

For more details, refer to the Safety Stop Function Instruction Manual.

Find a PDF file of the manual in the CD-ROM enclosed with the product.

The manual can also be downloaded in PDF form from the Mitsubishi Electric FA Global Website.

www.MitsubishiElectric.co.jp/fa

2.7 Communication connectors and terminals

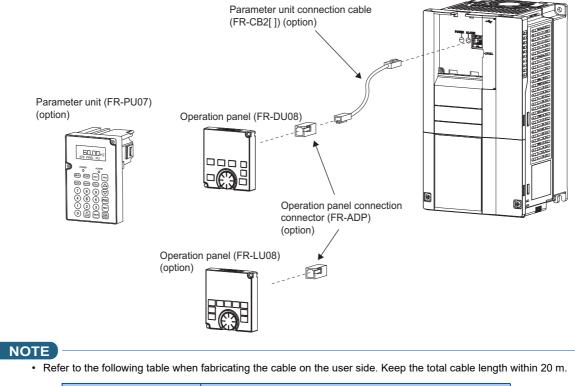
2.7.1 PU connector

Mounting the operation panel or the parameter unit on the enclosure surface

• Having an operation panel or a parameter unit on the enclosure surface is convenient. With a connection cable, the operation panel or the parameter unit can be mounted to the enclosure surface and connected to the inverter. Use the cable option FR-CB2[] or the following connector and cable available on the market. (To install the operation

panel, the optional connector (FR-ADP) is also required.)

Securely insert one end of the cable into the PU connector and the other end into the connection connector on the parameter unit or the FR-ADP attached on the operation panel until the stoppers are fixed.



| Name | Remarks |
|---------------------|---|
| Communication cable | Cable compliant with EIA-568 (such as 10BASE-T cable) |

Communication operation

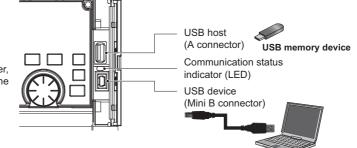
• Using the PU connector as a computer network port enables communication operation from a personal computer, etc. When the PU connector is connected with a personal, FA or other computer by a communication cable, a user program can run to monitor the inverter or read and write parameters.

Communication can be performed with the Mitsubishi inverter protocol (computer link operation). For the details, refer to page 495.

2.7.2 USB connector



Place a flathead screwdriver, etc. in a slot and push up the cover to open.



Personal computer (FR Configurator2)

♦ USB host communication

| Interface | | Conforms to USB 1.1 |
|--------------------------|---------------------|--|
| Transmission speed | | 12 Mbps |
| Wiring length | | Maximum 5 m |
| C | onnector | USB A connector (receptacle) |
| Commetible | Format | FAT32 |
| Compatible USB memory | Capacity | 1 GB or more (used in the recorder mode of the trace function) |
| COD memory | Encryption function | Not available |

Different inverter data can be saved in a USB memory device.
 The USB host communication enables the following functions.

| Function | Description | Refer to page |
|---------------------------|--|---------------------|
| Parameter copy | Copies the parameter settings from the inverter to the USB memory device. A maximum of 99 parameter setting files can be saved in a USB memory device. The parameter setting data copied in the USB memory device can be copied to other inverters. This function is useful in backing up the parameter setting or for sharing the parameter setting among multiple inverters. The parameter setting file can be copied onto a personal computer from the USB memory device and edited using FR Configurator2. | 582 |
| Trace | The monitoring data and output status of the signals can be saved in a USB memory device. The saved data can be imported to FR Configurator2 to diagnose the operating status of the inverter. | 486 |
| PLC function data copy | This function copies the PLC function project data to a USB memory device when the PLC function is used. The PLC function project data copied in the USB memory device can be copied to other inverters. This function is useful in backing up the parameter setting and for allowing multiple inverters to operate by the same sequence programs. | 483 |

- When the inverter recognizes the USB memory device without any problem, "
- When the USB memory device is removed, "
- The operating status of the USB host can be checked on the LED display of the inverter.

| LED display status | Operating status |
|--------------------|---|
| OFF | No USB connection. |
| ON | The communication is established between the inverter and the USB device. |
| Fast blinking | The USB memory device is being accessed. (Do not remove the USB memory device.) |
| Slow blinking | Error in the USB connection. |

- When a device such as a USB charger is connected to the USB connector and an excessive current (500 mA or higher) flows, USB host error "
- When the UF warning appears, the USB error can be canceled by removing the USB device and setting **Pr.1049** = "1". (The UF warning can also be canceled by resetting the inverter power or resetting with the RES signal.)



- Do not connect devices other than a USB memory device to the inverter.
- If a USB device is connected to the inverter via a USB hub, the inverter cannot recognize the USB memory device properly.

♦ USB device communication

The inverter can be connected to a personal computer with a USB (ver. 1.1) cable.

Parameter setting and monitoring can be performed by using FR Configurator2.

| Interface | Conforms to USB 1.1 |
|----------------------------|-----------------------------------|
| Transmission speed 12 Mbps | |
| Wiring length | Maximum 5 m |
| Connector | USB mini B connector (receptacle) |
| Power supply | Self-powered |

NOTE

• For details on FR Configurator2, refer to the Instruction Manual of FR Configurator2.

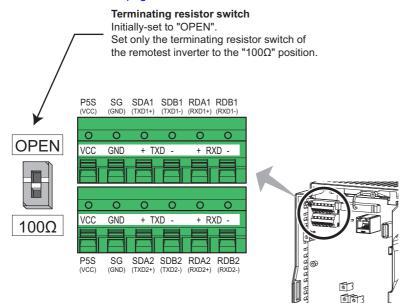
2.7.3 RS-485 terminal block

Communication operation

| Conforming standard | EIA-485 (RS-485) |
|---------------------|------------------------------|
| Transmission format | Multidrop link |
| Communication speed | maximum 115200 bps |
| Overall length | 500 m |
| Connection cable | Twisted pair cable (4 pairs) |

The RS-485 terminals enable communication operation from a personal computer, etc. When the PU connector is connected with a personal, FA or other computer by a communication cable, a user program can run to monitor the inverter or read and write parameters.

Communication can be performed with the Mitsubishi inverter protocol (computer link operation) and MODBUS RTU protocol. For the details, refer to page 497.



2.8 Connection of stand-alone option units

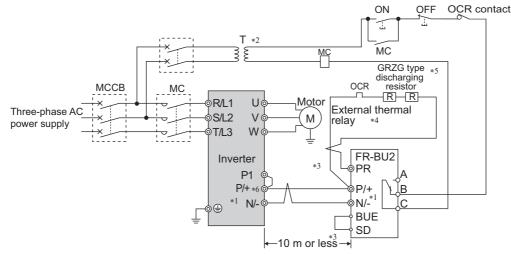
The inverter accepts a variety of stand-alone option units as required.

Incorrect connection will cause inverter damage or accident. Connect and operate the option unit carefully in accordance with the Instruction Manual of the corresponding option unit.

2.8.1 Connection of the brake unit (FR-BU2)

Connect the brake unit (FR-BU2(-H)) as follows to improve the braking capability during deceleration.

Connection example with the GRZG type discharging resistor



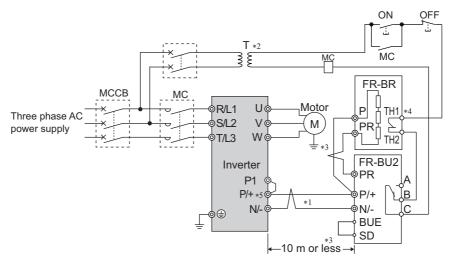
- *1 When wiring, make sure to match the terminal symbols (P/+, N/-) on the inverter and on the brake unit (FR-BU2). (Incorrect connection will damage the inverter and brake unit.)
- *2 When the power supply is 400 V class, install a stepdown transformer.
- *3 The wiring distance between the inverter, brake unit (FR-BU2) and discharging resistor must be within 5 m. Even when the cable is twisted, the wiring length must be within 10 m.
- *4 It is recommended to install an external thermal relay to prevent overheat of the discharging resistor.
- *5 For the connection method of the discharging resistor, refer to the Instruction Manual of the FR-BU2.
- *6 A jumper is installed across terminals P/+ and P1. Do not remove the jumper except when connecting a DC reactor (FR-HEL).
- · Recommended external thermal relay

| Brake unit | Discharging resistor | Recommended external thermal relay | |
|--------------|--|---------------------------------------|---------------------------|
| FR-BU2-1.5K | GZG 300W-50Ω (one) | TH-T25-1.3A | 4.0 E.0 |
| FR-BU2-3.7K | GRZG 200-10 Ω (three in series) | TH-T25-3.6A | |
| FR-BU2-7.5K | GRZG 300-5 Ω (four in series) | TH-T25-6.6A | |
| FR-BU2-15K | GRZG 400-2Ω (six in series) | TH-T25-11A | |
| FR-BU2-H7.5K | GRZG 200-10 Ω (six in series) | TH-T25-3.6A | 2/T1 |
| FR-BU2-H15K | GRZG 300-5Ω (eight in series) | TH-T25-6.6A | To the brake To a resisto |
| FR-BU2-H30K | GRZG 400-2 Ω (twelve in series) | TH-T25-11A | unit terminal P/+ |

- NOTE

• Set "1" in Pr.0 Brake mode selection in the FR-BU2 to use a GRZG type discharging resistor.

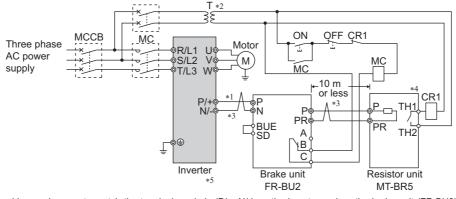
Connection example with the FR-BR(-H) resistor unit



- *1 When wiring, make sure to match the terminal symbols (P/+, N/-) on the inverter and on the brake unit (FR-BU2). (Incorrect connection will damage the inverter and brake unit.)
- *2 When the power supply is 400 V class, install a stepdown transformer.
- *3 The wiring distance between the inverter, brake unit (FR-BU2) and resistor unit (FR-BR) must be within 5 m. Even when the cable is twisted, the wiring length must be within 10 m.
- *4 The contact between TH1 and TH2 is closed in the normal status and is open at a fault.
- *5 A jumper is installed across terminals P/+ and P1. Do not remove the jumper except when connecting a DC reactor (FR-HEL).

Connection example with the MT-BR5 type resistor unit

After making sure that the wiring is correct and secure, set "1 or 101" in **Pr.30 Regenerative function selection**. Set "2" in **Pr.0 Brake mode selection** in the brake unit FR-BU2.

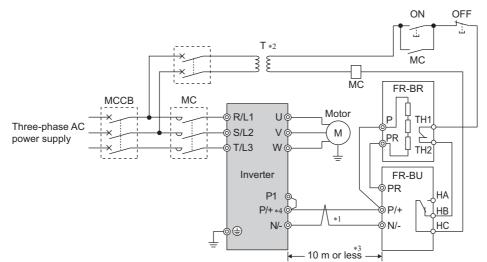


- *1 When wiring, make sure to match the terminal symbols (P/+, N/-) on the inverter and on the brake unit (FR-BU2). (Incorrect connection will damage the inverter and brake unit.)
- *2 When the power supply is 400 V class, install a stepdown transformer.
- *3 The wiring distance between the inverter, brake unit (FR-BU2) and resistor unit (FR-BR) must be within 5 m. Even when the cable is twisted, the wiring length must be within 10 m.
- *4 The contact between TH1 and TH2 is open in the normal status and is closed at a fault.
- *5 The CN8 connector used with the MT-BU5 type brake unit is not used.

 The warning "oL" of the stall prevention (overvoltage) does not occur while Pr.30 Regenerative function selection = "1". (Refer to page 566.)

2.8.2 Connection of the brake unit (FR-BU)

Connect the brake unit (FR-BU(-H)) as follows to improve the braking capability during deceleration. The FR-BU is compatible with the FR-F820-02330(55K) or lower and the FR-F840-01160(55K) and lower.



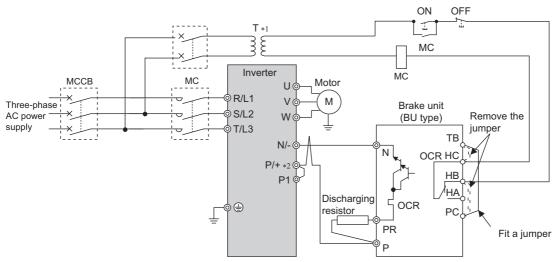
- *1 When wiring, make sure to match the terminal symbols (P/+, N/-) on the inverter and on the brake unit (FR-BU(-H)). (Incorrect connection will damage the inverter.)
- *2 When the power supply is 400 V class, install a stepdown transformer.
- *3 The wiring distance between the inverter, brake unit (FR-BU) and resistor unit (FR-BR) must be within 5 m. Even when the cable is twisted, the wiring length must be within 10 m.
- *4 A jumper is installed across terminals P/+ and P1. Do not remove the jumper except when connecting a DC reactor (FR-HEL).

NOTE

• If the transistors in the brake unit should become faulty, the resistor will overheat. Install a magnetic contactor on the inverter's input side and configure a circuit that shut off the current in case of a fault.

2.8.3 Connection of the brake unit (BU type)

Connect the brake unit (BU type) correctly as follows. Incorrect connection will damage the inverter. Remove the jumpers across terminals HB and PC and terminals TB and HC on the brake unit, and fit one across terminals PC and TB. The BU type brake unit is compatible with the FR-F820-02330(55K) or lower and the FR-F840-01160(55K) or lower.



- *1 When the power supply is 400 V class, install a stepdown transformer.
- *2 A jumper is installed across terminals P/+ and P1. Do not remove the jumper except when connecting a DC reactor (FR-HEL).

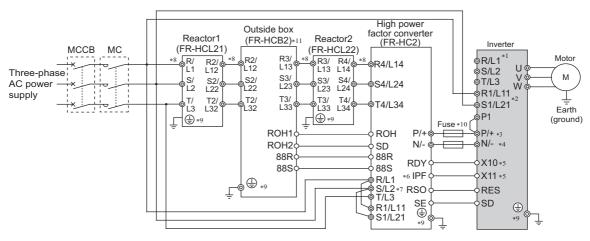
NOTE

- The wiring distance between the inverter, brake unit, and discharging resistor must be within 2 m. Even when the cable is twisted, the wiring length must be within 5 m.
- If the transistors in the brake unit should become faulty, the resistor will overheat and result in a fire. Install a magnetic contactor on the inverter's input side and configure a circuit that shut off the current in case of a fault.

2.8.4 Connection of the high power factor converter (FR-HC2)

When connecting the high power factor converter (FR-HC2) to suppress power harmonics, perform wiring securely as follows. Incorrect connection will damage the high power factor converter and the inverter.

After making sure that the wiring is correct and secure, set the rated motor voltage in **Pr.19 Base frequency voltage** (under V/F control) or **Pr.83 Rated motor voltage** (under other than V/F control) and "2 or 102" in **Pr.30 Regenerative function selection**. (Refer to page 566.)



- *1 Remove jumpers across terminals R/L1 and R1/L11 as well as across terminals S/L2 and S1/L21, and connect the power supply for the control circuit to terminals R1/L11 and S1/L21. Do not connect anything to power input terminals (R/L1, S/L2, and T/L3). Incorrect connection will damage the inverter. (The E.OPT fault (Option fault) occurs. (Refer to page 605.))
- *2 Instead of connecting the terminals to the AC power supply, the control circuit can be powered by connecting terminal R1/L11 to terminal P/+ and terminal S1/L21 to terminal N/-. In this case, do not connect the terminals to the AC power supply. Doing so will damage the inverter.
- *3 When the FR-HC2 is connected, the jumper across terminals P/+ and P1 does not affect the function. (The FR-HC2 can be connected with the jumper connected (initial setting). Refer to page 50 for the jumper connection status in the initial setting.)
- *4 Do not install an MCCB across terminals P/+ and N/- (between terminals P and P/+ or between terminals N and N/-). Connecting the opposite polarity of terminals N/- and P/+ will damage the inverter.
- *5 Use Pr.178 to Pr.189 (Input terminal function selection) to assign the terminals used for the X10 (X11) signal. (Refer to page 373.) For RS-485 or any other communication where the start command is only transmitted once, use the X11 signal to save the operation mode at the time of an instantaneous power failure.
- *6 Assign the IPF signal to a terminal on the FR-HC2. (Refer to the FR-HC2 Instruction Manual.)
- *7 Always connect terminals R/L1, S/L2, and T/L3 on the FR-HC2 to the power supply. Operating the inverter without connecting them will damage the FR-HC2.
- *8 Do not install an MCCB or MC across terminals (R/L1, S/L2, T/L3) on the reactor 1 and terminals (R4/L14, S4/L24, T4/L34) on the FR-HC2. Doing so disrupts proper operation.
- *9 Securely perform grounding (earthing) by using the grounding (earthing) terminal.
- *10 Installation of a fuse is recommended. (Refer to the FR-HC2 Instruction Manual.)
- *11 Outside box is not available for the FR-HC2-H280K or higher. Connect filter capacitors, inrush current limit resistors, and magnetic contactors. (Refer to the FR-HC2 Instruction Manual.)

- NOTE

- The voltage phases of terminals R/L1, S/L2, and T/L3 and the voltage phases of terminals R4/L14, S4/L24, and T4/L34 must be matched.
- The control logic (sink logic/source logic) of the high power factor converter and the inverter must be matched. (Refer to page 64.)
- · Do not connect a DC reactor (FR-HEL) to the inverter when the FR-HC2 is connected.

 Always connect terminal RDY on the FR-HC2 to a terminal where the X10 signal or MRS signal is assigned on the inverter. Always connect terminal SE on the FR-HC2 to terminal SD on the inverter. Not connecting these terminals may damage the FR-HC2.

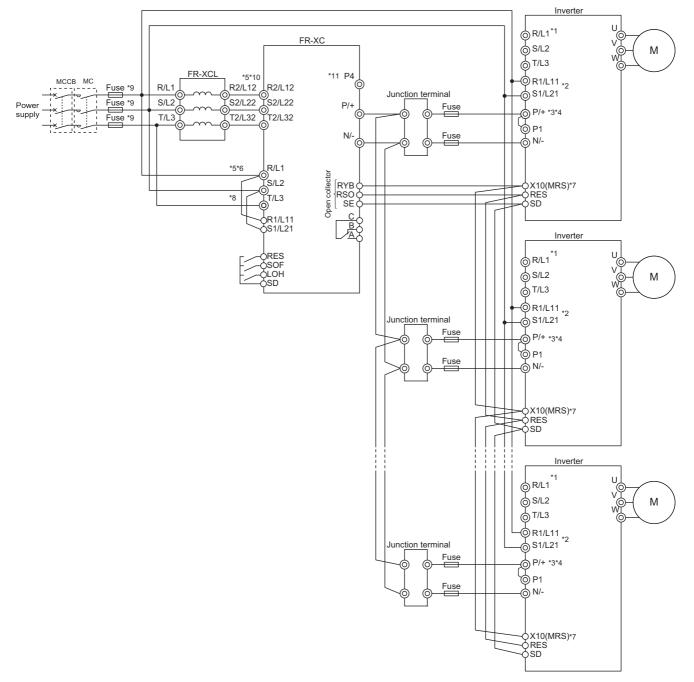
2.8.5 Connection of the multifunction regeneration converter (FR-XC)

Common bus regeneration mode with harmonic suppression disabled (Pr.416 = "0")

When connecting the multifunction regeneration converter (FR-XC) to improve the braking capability, perform wiring securely as follows. Incorrect connection will damage the converter and the inverter.

Turn ON switch 1 (connection mode setting switch) in the function selection switch assembly (SW2). If the switch setting does not match the actual wiring, the connection mode fault "E.T" occurs.

After making sure that the wiring is correct and secure, set "2 or 102" in **Pr.30 Regenerative function selection**. (Refer to page 566.)



Never connect the power supply to terminals R/L1, S/L2, and T/L3 on the inverter. Incorrect connection will damage the inverter and the converter.
 Instead of connecting the terminals to the AC power supply, the control circuit can be powered by connecting terminal R1/L11 to terminal P/+ and

terminal S1/L21 to terminal N/-. In this case, do not connect the terminals to the AC power supply. Doing so will damage the inverter.

*3 When the FR-XC is connected, the jumper across terminals P/+ and P1 does not affect the function. (The FR-XC can be connected with the jumper connected. Refer to page 50 for the jumper connection status in the initial setting.)

- *4 Connect between the inverter terminal P/+ and the converter terminal P/+ and between the inverter terminal N/- and the converter terminal N/- for polarity consistency.
- Connecting opposite polarity of terminals P/+ and N/- will damage the converter and the inverter.
- *5 Confirm the correct phase sequence of three-phase current to connect between the reactor and the converter, and between the power supply and terminals R/L1, S/L2, and T/L3.
- Incorrect connection will damage the converter.
- *6 Be sure to connect the power supply and terminals R/L1, S/L2, and T/L3 of the converter. Operating the inverter without connecting them will damage the converter.
- *7 Use Pr 178 to Pr 189 (Input terminal function selection) to assign the terminals used for the X10 signal (Refer to page 373.)
- *8 To use separate power supply for the control circuit, remove each jumper at terminal R1/L11 and terminal S1/L21.
- *9 Install UE listed fases on the input side of the reactor to meet the UE/CUE standards (refer to the FR-XC instruction Manual for information about the fuse).
- *10 Do not install an MCCB or MC between the reactor and the converter. Doing so disrupts proper operation.
- *11 Do not connect anything to terminal P4.

 In the common bus regeneration mode, always connect between the converter terminal RYB and the inverter terminal to which the X10 (MRS) signal is assigned and between the converter terminal SE and the inverter terminal SD. If the terminals are not connected, the converter may be damaged.

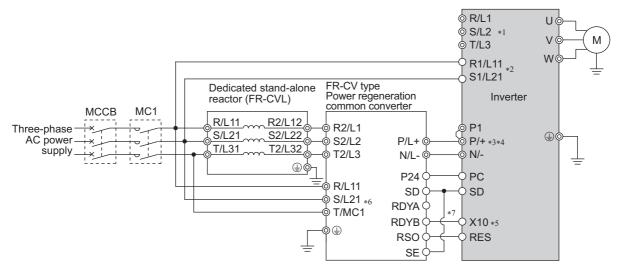
- The control logic (sink logic/source logic) of the converter and the inverter must be matched. The converter does not operate properly if the control logic is not consistent with each other.
- (Refer to page 64 for the switching of the control logic. Refer to the FR-XC Instruction Manual for the switching of the control logic of the converter.)
- Keep the wiring length between terminals as short as possible.
- When the power is distorted or falls off sharply, the reactors may generate abnormal acoustic noise. This acoustic noise is caused by the power supply fault and not by the damage of the converter.
- Configure a system so that the magnetic contactor at the converter input side shuts off the power supply at a failure of the converter or the connected inverter. (The converter does not shut off the power supply by itself.) Failure to do so may overheat and burn the resistors in the converter and the connected inverter.
- Do not connect a DC reactor to the inverter when using the converter in the common bus regeneration mode.
- · For details on model selection and connection, refer to the FR-XC Instruction Manual.
- For details on connection in common bus regeneration mode with harmonic suppression enabled or in power regeneration mode 2, refer to the FR-XC Instruction Manual.

2.8.6 Connection of the power regeneration common converter (FR-CV)

When wiring for connecting the power regeneration common converter (FR-CV) to the inverter, make sure to match the terminal symbols (P/+, N/-) on the inverter and on the power regeneration common converter.

The FR-CV is compatible with the FR-F820-02330(55K) or lower and the FR-F840-01160(55K) or lower.

After making sure that the wiring is correct and secure, set "2 or 102" in **Pr.30 Regenerative function selection**. (Refer to page 566.)



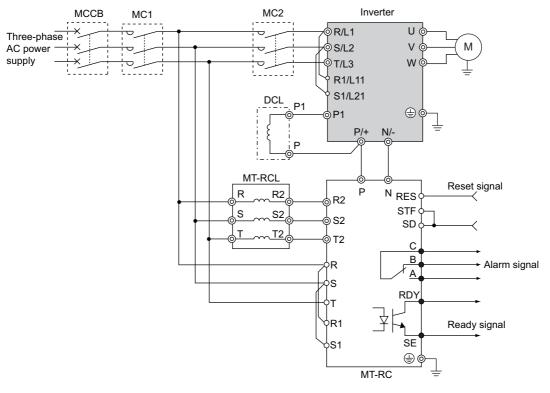
- *1 Remove jumpers across terminals R/L1 and R1/L11 as well as across terminals S/L2 and S1/L21, and connect the power supply for the control circuit to terminals R1/L11 and S1/L21. Do not connect anything to power input terminals (R/L1, S/L2, and T/L3). Incorrect connection will damage the inverter. (The E.OPT fault (Option fault) occurs. (Refer to page 605.))
- *2 Instead of connecting the terminals to the AC power supply, the control circuit can be powered by connecting terminal R1/L11 to terminal P/+ and terminal S1/L21 to terminal N/-. In this case, do not connect the terminals to the AC power supply. Doing so will damage the inverter.
- *3 When the FR-CV is connected, the jumper across terminals P/+ and P1 does not affect the function. (The FR-CV can be connected with the jumper connected.)
- *4 Do not install an MCCB across terminals P/+ and N/- (between terminals P/L+ and P/+ or between N/L- and N/-). Connecting the opposite polarity of terminals N/- and P/+ will damage the inverter.
- *5 Use Pr.178 to Pr.189 (Input terminal function selection) to assign the terminals used for the X10 signal. (Refer to page 373.)
- *6 Be sure to connect the power supply and terminals R/L11, S/L21, and T/MC1. Operating the inverter without connecting them will damage the power regeneration common converter.
- *7 Always connect terminal RDY on the FR-HC2 to a terminal where the X10 signal or MRS signal is assigned on the inverter. Always connect terminal SE on the FR-HC2 to terminal SD on the inverter. Not connecting these terminals may damage the FR-CV.

🖸 NOTE

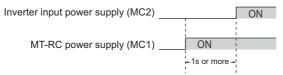
- The voltage phases of terminals R/L11, S/L21, and T/MC1 and the voltage phases of terminals R2/L1, S2/L2, and T2/L3 must be matched.
- Use the sink logic when the FR-CV is connected. It cannot be connected when the source logic is selected.
- Do not connect a DC reactor (FR-HEL) to the inverter when the FR-CV is connected.

2.8.7 Connection of the power regeneration converter (MT-RC)

When connecting the power regeneration converter (MT-RC), perform wiring securely as follows. Incorrect connection will damage the power regeneration converter and the inverter. The MT-RC is compatible with FR-F840-01800(75K) or higher. After making sure that the wiring is correct and secure, set "1 or 101" in **Pr.30 Regenerative function selection**.



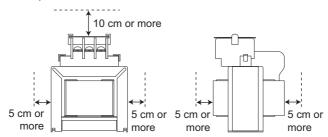
• When using the inverter with the MT-RC, install a magnetic contactor (MC) at the input side of the inverter so that power is supplied to the inverter after one second or more has elapsed after powering ON the MT-RC. When power is supplied to the inverter prior to the MT-RC, the inverter and the MT-RC may be damaged or the MCCB may be shut off or damaged.



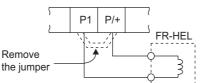
• When connecting the power coordination reactor and others, refer to Instruction Manual of the MT-RC for precautions.

2.8.8 Connection of the DC reactor (FR-HEL)

• Keep the surrounding air temperature within the permissible range (-10°C to +50°C). Keep enough clearance around the reactor because it heats up. (Take 10 cm or more clearance on top and bottom and 5 cm or more on left and right regardless of the installation direction.)



• When using the DC reactor (FR-HEL), connect it to terminals P/+ and P1. In this case, the jumper connected across terminals P/+ and P1 must be removed. Otherwise, the reactor will not be effective. (The jumper is not installed for the FR-F820-03160(75K) or higher and the FR-F840-01800(75K) or higher.)



- Select a DC reactor according to the applied motor capacity (refer to page 638). For the FR-F820-03160(75K) or higher, the FR-F840-01800(75K) or higher, and when a 75 kW or higher motor is used, always connect a DC reactor.
- Since the DC reactor (FR-HEL) is electrically connected to the enclosure through mounting screws, the DC reactor is earthed (grounded) by being securely mounted to the enclosure. However, if the DC reactor is not earthed (grounded) securely enough, an earthing (grounding) cable may be used.

When using an earthing (grounding) cable for the FR-HEL-(H)55K or lower, wire the cable to the installation hole where varnish is removed. (Refer to the Instruction Manual of the FR-HEL.)

For the FR-HEL-(H)75K or higher, use an earth (ground) terminal to perform earthing (grounding). (Refer to the Instruction Manual of the FR-HEL.)

• NOTE

- The wiring distance must be within 5 m.
- As a reference, the cable gauge for the connection must be equal to or larger than that of the power cables (R/L1, S/L2, T/L3) and the earthing (grounding) cable. (Refer to page 53.)

CHAPTER 3 PRECAUTIONS FOR USE OF THE INVERTER

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3 PRECAUTIONS FOR USE OF THE INVERTER

This chapter explains the precautions for use of this product.

Always read the instructions before use.

For the separated converter type, refer to the "PRECAUTIONS FOR USE OF THE INVERTER" in the FR-F802 (Separated Converter Type) Instruction Manual (Hardware).

For the IP55 compatible model, refer to the "PRECAUTIONS FOR USE OF THE INVERTER" in the FR-F806 (IP55/UL Type 12 specification) Instruction Manual (Hardware).

3.1 Electro-magnetic interference (EMI) and leakage currents

3.1.1 Leakage currents and countermeasures

Capacitance exists between the inverter I/O cables, other cables and earth and in the motor, through which a leakage current flows. The amount of current leakage depends on the factors such as the size of the capacitance and the carrier frequency. Low acoustic noise operation at an increased carrier frequency of the inverter will increase current leakage. Take the following precautions to prevent current leakage. Earth leakage circuit breakers should be selected based on their rated current sensitivity, independently of the carrier frequency setting.

To-earth (ground) leakage currents

Leakage currents may flow not only into the power system of the inverter but also into the other power systems through the earthing (grounding) cable, etc. These leakage currents may operate earth leakage circuit breakers and earth leakage relays unnecessarily.

Precautions

- If the carrier frequency setting is high, decrease the Pr.72 PWM frequency selection setting.
 Note that motor noise increases. Selecting Pr.240 Soft-PWM operation selection makes the sound inoffensive.
- By using earth leakage circuit breakers designed to suppress harmonics and surge voltage in the power system of the inverter and other devices, operation can be performed with the carrier frequency kept high (with low noise).



- · Long wiring will increase the leakage current.
- High motor capacity will increase the leakage current. The leakage current of the 400 V class is larger than that of the 200 V class.

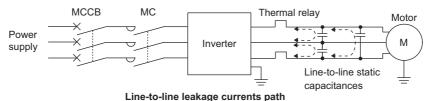
◆ Line-to-line leakage currents

Harmonics of leakage currents flowing in static capacitance between the inverter output cables may operate the external thermal relay unnecessarily. When the wiring length is long (50 m or more) for the 400 V class small-capacity models (FR-F840-00170(7.5K) or lower), the external thermal relay is likely to operate unnecessarily because the ratio of the leakage current to the rated motor current increases.

■ Line-to-line leakage current example (200 V class)

| Motor capacity | Rated motor | Leakage current (mA) ^{*1} | | Condition |
|----------------|-------------|------------------------------------|---------------------|--|
| (kW) | current (A) | Wiring length 50 m | Wiring length 100 m | Condition |
| 0.4 | 1.8 | 310 | 500 | |
| 0.75 | 3.2 | 340 | 530 | |
| 1.5 | 5.8 | 370 | 560 | Motor: SF-JR 4P Carrier frequency: 14.5 kHz |
| 2.2 | 8.1 | 400 | 590 | • Cahle: 2 mm ² , 4 cores |
| 3.7 | 12.8 | 440 | 630 | Cable. 2 mm , 4 cores Cable. 2 mm , 4 cores |
| 5.5 | 19.4 | 490 | 680 | |
| 7.5 | 25.6 | 535 | 725 | |

*1 The leakage currents of the 400 V class are about twice as large.



Precautions

- · Use Pr.9 Electronic thermal O/L relay.
- If the carrier frequency setting is high, decrease the Pr.72 PWM frequency selection setting. Note that motor noise increases. Selecting Pr.240 Soft-PWM operation selection makes the sound inoffensive. To ensure that the motor is protected against line-to-line leakage currents, it is recommended to use a temperature sensor to directly detect motor temperature.

Installation and selection of the molded case circuit breaker

Install a molded case circuit breaker (MCCB) on the power receiving side to protect the wiring at the inverter input side. Select an MCCB according to the inverter input side power factor, which depends on the power supply voltage, output frequency and load. Especially for a completely electromagnetic MCCB, a slightly large capacity must be selected since its operation characteristic varies with harmonic currents. (Check it in the data of the corresponding breaker.) As an earth leakage current breaker, use the Mitsubishi earth leakage current breaker designed for harmonics and surge suppression.

Selecting the rated sensitivity current for the earth leakage circuit breaker

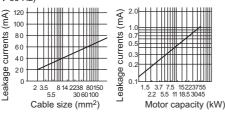
To install the earth leakage circuit breaker on the inverter circuit, select its rated sensitivity current as follows, independently of the PWM carrier frequency.

- · Breaker designed for harmonic and surge suppression Rated sensitivity current $|\Delta n \ge 10 \times (\lg 1 + \lg n + \lg i + \lg 2 + \lg m)$
- Standard breaker Rated sensitivity current

 $|\Delta n \ge 10 \times \{ |g_1 + |g_1 + |g_1 + 3 \times (|g_2 + |g_m) \}$

Example of leakage current of cable path per 1 km during the commercial power supply operation when the CV cable is routed in metal conduit (200 V 60 Hz)

Leakage current example of three-phase induction motor during the commercial power supply operation (200 V 60 Hz)



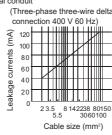
Ig1, Ig2: Leakage currents in wire path during commercial power supply operation

Ign: Leakage current from noise filters on the input side of the inverter

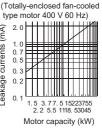
Igm: Leakage current from the motor during commercial power supply operation

Igi: Leakage current of inverter unit

Example of leakage current of cable path per 1km during the commercial power supply operation when the CV cable is routed in metal conduit



Leakage current example of three phase induction motor during the commercial power supply operation

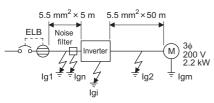


For "人" connection, the amount of leakage current is approx. 1/3 of the above value

(mA)

-eakage currents

Example



| Item | Breaker designed for harmonic and surge suppression | Standard breaker |
|---|---|------------------|
| Leakage current lg1 (mA) | $33 \times \frac{5m}{1000m} = 0.17$ | |
| Leakage current Ign (mA) | 0 (without noise filter) | |
| Leakage current Igi (mA) | 1 (without EMC filter). F of the inverter, refer to | |
| Leakage current Ig2 (mA) | 33 × <u>50m</u> = 1.65 | |
| Motor leakage current Igm (mA) | 0.18 | |
| Total leakage current (mA) | 3.00 | 6.66 |
| Rated sensitivity current (mA) (≥ lg × 10) | 30 | 100 |

Inverter leakage current (with and without EMC filter)

| | Voltage | EMC filter | | Remarks |
|----------------------------------|---------|------------|----------|---|
| | (V) | ON (mA) | OFF (mA) | Remarks |
| | 200 | 22 | 1 | |
| Phase earthing (grounding) | 400 | 35 | 2 | Input power conditions |
| Earthed-neutral system | 400 | 2 | 1 | 220 V/60 Hz (200 V class) or 440 V/60 Hz (400 V class), within 3% of power supply unbalance |

- Install the earth leakage circuit breaker (ELB) on the input side of the inverter.
- In the A connection earthed-neutral system, the sensitivity current is blunt against a ground fault in the inverter output side. Earthing (Grounding) must conform to the requirements of national and local safety regulations and electrical codes. (NEC section 250, IEC 61140 class 1 and other applicable standards)
- When the breaker is installed on the output side of the inverter, it may be unnecessarily operated by harmonics even if the effective value is within the rating.

In this case, do not install the breaker since the eddy current and hysteresis loss will increase, leading to temperature rise.

 The following models and products are standard breakers: the models BV-C1, BC-V, NVB, NV-L, NV-G2N, NV-G3NA, and NV-2F, the earth leakage circuit breakers with AA neutral wire open-phase protection, and the earth leakage relays (except NV-ZHA).

The other series, models, and products are designed for harmonic and surge suppression: the NV-C series, NV-S series, MN series, the models NV30-FA, NV50-FA, NV-H, and BV-C2, earth leakage alarm breaker NF-Z, and the earth leakage relay NV-ZHA.

3.1.2 Techniques and measures for electromagnetic compatibility (EMC)

Some electromagnetic noises enter the inverter to cause the inverter malfunction, and others are radiated by the inverter to cause the peripheral devices to malfunction. (The former is called EMS problem, the latter is called EMI problem, and both is called EMC problem.) Though the inverter is designed to be immune to noises, it requires the following basic measures and EMS measures as it handles low-level signals. Pay attention to the electromagnetic noises that could be generated by the inverter since the inverter chops outputs at high carrier frequency. If these electromagnetic noises cause peripheral devices to malfunction, EMI countermeasures should be taken to suppress noises. These techniques differ slightly depending on EMI paths.

Basic measures

- Do not run the power cables (I/O cables) and signal cables of the inverter in parallel with each other and do not bundle them.
- Use shielded twisted pair cables for the detector connecting and control signal cables and connect the sheathes of the shielded cables to terminal SD.
- Ground (Earth) the inverter, motor, etc. at one point.

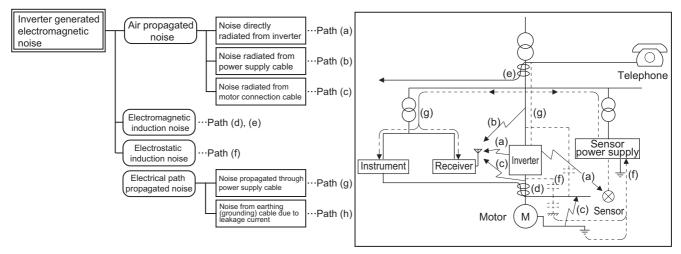
EMS measures to reduce electromagnetic noises that enter the inverter and cause it to malfunction

When devices that generate many electromagnetic noises (which use magnetic contactors, electromagnetic brakes, many relays, for example) are installed near the inverter and the inverter may malfunction due to electromagnetic noises, the following countermeasures must be taken:

- Provide surge suppressors for devices that generate many electromagnetic noises to suppress electromagnetic noises.
- Install data line filters to signal cables (refer to page 94).
- Ground (Earth) the shields of the detector connection and control signal cables with cable clamp metal.

EMI measures to reduce electromagnetic noises that are radiated by the inverter to cause the peripheral devices to malfunction

Inverter-generated noises are largely classified into those radiated by the inverter itself and by the I/O cables connected to its main circuit, those electromagnetically and electrostatically induced to the signal cables of the peripheral devices close to the power cable connected to the inverter main circuit, and those transmitted through the power cables.

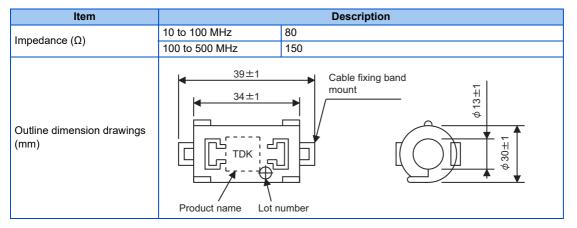


| Noise propagation path | Countermeasure |
|---------------------------|---|
| (a), (b), (c) | When devices that handle low-level signals and are liable to malfunction due to electromagnetic noises, e.g. instruments, receivers and sensors, are contained in the enclosure that contains the inverter or when their signal cables are run near the inverter, the devices may malfunction due to by air-propagated electromagnetic noises. The following countermeasures must be taken: Install easily affected devices as far away as possible from the inverter. Run easily affected signal cables as far away as possible from the inverter and its I/O cables. Do not run the signal cables and power cables (inverter I/O cables) in parallel with each other and do not bundle them. Set the EMC filter ON/OFF connector of the inverter to the ON position. (Refer to page 95.) Inserting a line noise filter into the output suppresses the radiated noise from the cables. Use shielded cables as signal cables and power cables and run them in individual metal conduits to produce further effects. |
| (d), (e), (f) | When the signal cables are run in parallel with or bundled with the power cables, magnetic and static induction noises may be propagated to the signal cables to cause malfunction of the devices and the following countermeasures must be taken: Install easily affected devices as far away as possible from the inverter. Run easily affected signal cables as far away as possible from the inverter and its I/O cables. Do not run the signal cables and power cables (inverter I/O cables) in parallel with each other and do not bundle them. Use shielded cables as signal cables and power cables and run them in individual metal conduits to produce further effects. |
| (g) | When the peripheral devices use the power system of the inverter, its generated noises may flow back through the power supply cables to cause malfunction of the devices and the following countermeasures must be taken: • Set the EMC filter ON/OFF connector of the inverter to the ON position. (Refer to page 95.) • Install the line noise filter (FR-BLF/FR-BSF01) to the power cables (output cables) of the inverter. |
| (h) | When a closed loop circuit is formed by connecting the peripheral device wiring to the inverter, leakage currents may flow through the earthing (grounding) cable of the inverter to cause the device to malfunction. In that case, disconnecting the earthing (grounding) cable from the device may stop the malfunction of the device. |

■ Data line filter

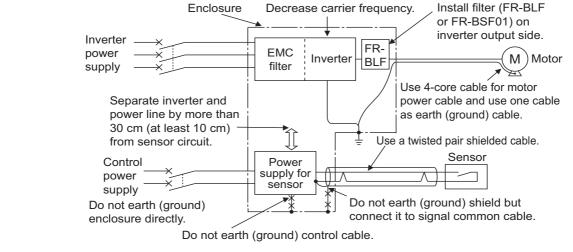
Data line filter is effective as an EMI countermeasure. Provide a data line filter for the detector cable, etc.

- Commercially available data line filter: ZCAT3035-1330 (by TDK), ESD-SR-250 (by TOKIN)
- Specification example (ZCAT3035-1330 by TDK)



The impedance values above are reference values, and not guaranteed values.

■ EMI measure example



🦰 ΝΟΤΕ

• For compliance with the EU EMC Directive, refer to the Instruction Manual (Startup).

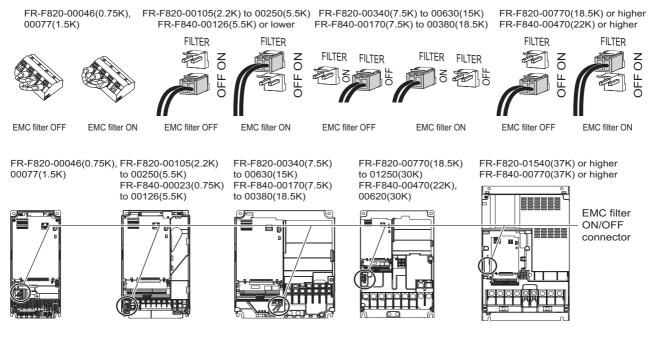
3.1.3 Built-in EMC filter

This inverter is equipped with a built-in EMC filter (capacitive filter) and a common mode choke.

These are effective in reducing air-propagated noise on the input side of the inverter.

To enable the EMC filter, set the EMC filter ON/OFF connector to the ON position. The FM type is initially set to "disabled" (OFF), and the CA type to "enabled" (ON).

The input side common mode choke, which is built in the FR-F820-02330(55K) or lower and the FR-F840-01160(55K) or lower inverter, is always enabled regardless of the EMC filter ON/OFF connector setting.



How to enable or disable the filter

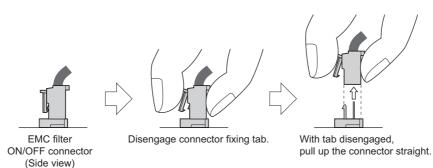
■ For FR-F820-00105(2.2K) or higher and FR-F840-00023(0.75K) or higher

• Before removing a front cover, check to make sure that the indication of the inverter operation panel is OFF, wait for at least 10 minutes after the power supply has been switched OFF, and check that there is no residual voltage using a tester or the like.

• When disconnecting the connector, push the fixing tab and pull the connector straight without pulling the cable or forcibly pulling the connector with the tab fixed.

When installing the connector, also engage the fixing tab securely.

(If it is difficult to disconnect the connector, use a pair of needle-nose pliers, etc.)



■ For FR-F820-00077(1.5K) or lower

- Before removing a front cover, check to make sure that the indication of the inverter operation panel is OFF, wait for at least 10 minutes after the power supply has been switched OFF, and check that there is no residual voltage using a tester or the like.
- Remove the control circuit terminal block. (Refer to page 631.)
- Connect the shorting wire to the corresponding terminal to enable or disable the filter. Connect the wire to the terminal in the same way as general wiring of the control circuit terminal block. (Refer to page 66.)
- After switching, reinstall the control circuit terminal block as it was.



- · Fit the connector or shorting wire to either ON or OFF position.
- Enabling (turning ON) the EMC filter increases leakage current. (Refer to page 91.)

MARNING

• While power is ON or when the inverter is running, do not open the front cover. Otherwise you may get an electric shock.

3.2 Power supply harmonics

3.2.1 Power supply harmonics

The inverter may generate power supply harmonics from its converter circuit to affect the power generator, power factor correction capacitor etc. Power supply harmonics are different from noise and leakage currents in source, frequency band and transmission path. Take the following countermeasure suppression techniques.

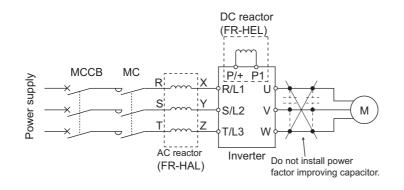
· Differences between harmonics and noises

| Item | Harmonics | Noise |
|-----------------------------|--|---|
| Frequency | Normally 40th to 50th degrees or less (3 kHz or less). | High frequency (several 10 kHz to 1 GHz order). |
| Location | To-electric channel, power impedance. | To-space, distance, wiring path. |
| Quantitative understanding | Theoretical calculation possible. | Random occurrence, quantitative grasping difficult. |
| Generated amount | Nearly proportional to the load capacity. | Changes with the current variation ratio. (Gets larger as switching speed increases.) |
| Affected equipment immunity | Specified by standards per equipment. | Different depending on maker's equipment specifications. |
| Countermeasure | Provide a reactor. | Increase distance. |

· Countermeasures

The harmonic current generated from the inverter to the input side differs according to various conditions such as the wiring impedance, whether a reactor is used or not, and output frequency and output current on the load side.

For the output frequency and output current, we understand that this should be calculated in the conditions under the rated load at the maximum operating frequency.



🖸 NOTE

 The power factor improving capacitor and surge suppressor on the inverter output side may be overheated or damaged by the harmonic components of the inverter output. Also, since an excessive current flows in the inverter to activate overcurrent protection, do not provide a capacitor and surge suppressor on the inverter output side when the motor is driven by the inverter. For power factor improvement, install a reactor on the inverter input side or in the DC circuit.

3.2.2 Harmonic suppression guidelines in Japan

Inverters have a converter section (rectifier circuit) and generate a harmonic current.

Harmonic currents flow from the inverter to a power receiving point via a power transformer. The Harmonic Suppression Guidelines was established to protect other consumers from these outgoing harmonic currents.

The three-phase 200 V input specifications 3.7 kW or lower were previously covered by "the Harmonic Suppression Guidelines for Household Appliances and General-purpose Products" and other models were covered by "the Harmonic Suppression Guidelines for Consumers Who Receive High Voltage or Special High Voltage". However, the transistorized inverter has been excluded from the target products covered by "the Harmonic Suppression Guidelines for Household Appliances and General-purpose Products" in January 2004 and "the Harmonic Suppression Guideline for Household Appliances and General-purpose Products" was repealed on September 6, 2004.

All capacity and all models of general-purpose inverter used by specific consumers are now covered by "the Harmonic Suppression Guidelines for Consumers Who Receive High Voltage or Special High Voltage" (hereinafter referred to as "the Specific Consumer Guidelines").

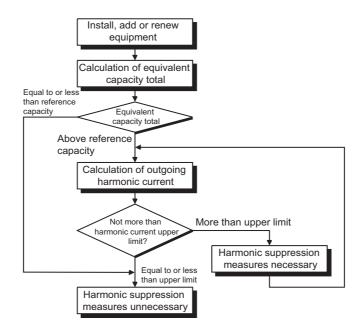
• "Specific Consumer Guidelines"

This guideline sets forth the maximum harmonic currents outgoing from a high-voltage or especially high-voltage receiving consumer who will install, add or renew harmonic generating equipment. If any of the maximum values is exceeded, this guideline requires that consumer to take certain suppression measures.

Maximum values of outgoing harmonic currents per 1 kW contract power

| Received power voltage | 5th | 7th | 11th | 13th | 17th | 19th | 23rd | Over 23rd |
|------------------------|-----|------|------|------|------|------|------|-----------|
| 6.6 kV | 3.5 | 2.5 | 1.6 | 1.3 | 1.0 | 0.9 | 0.76 | 0.70 |
| 22 kV | 1.8 | 1.3 | 0.82 | 0.69 | 0.53 | 0.47 | 0.39 | 0.36 |
| 33 kV | 1.2 | 0.86 | 0.55 | 0.46 | 0.35 | 0.32 | 0.26 | 0.24 |

Application of the specific consumer guidelines



■ Conversion factor

| Classification | Circu | Conversion factor Ki | |
|----------------|------------------------------------|--|-----------|
| | | Without reactor | K31 = 3.4 |
| 3 | ····· | With reactor (AC side) | K32 = 1.8 |
| J | | With reactor (DC side) | K33 = 1.8 |
| | With reactors (AC, DC sides) | K34 = 1.4 | |
| 5 | Self-excitation three-phase bridge | When a high power factor converter is used | K5 = 0 |

■ Equivalent capacity limit

| Received power voltage | Reference capacity |
|------------------------|--------------------|
| 6.6 kV | 50 kVA |
| 22/33 kV | 300 kVA |
| 66 kV or more | 2000 kVA |

■ Harmonic content (when the fundamental current is considered as 100%)

| Reactor | 5th | 7th | 11th | 13th | 17th | 19th | 23rd | 25th |
|---------------------|-----|------|------|------|------|------|------|------|
| Not used | 65 | 41 | 8.5 | 7.7 | 4.3 | 3.1 | 2.6 | 1.8 |
| Used (AC side) | 38 | 14.5 | 7.4 | 3.4 | 3.2 | 1.9 | 1.7 | 1.3 |
| Used (DC side) | 30 | 13 | 8.4 | 5.0 | 4.7 | 3.2 | 3.0 | 2.2 |
| Used (AC, DC sides) | 28 | 9.1 | 7.2 | 4.1 | 3.2 | 2.4 | 1.6 | 1.4 |

■ Calculation of equivalent capacity P0 of harmonic generating equipment

"Equivalent capacity" is the capacity of a 6-pulse converter converted from the capacity of consumer's harmonic generating equipment and is calculated by the following equation. If the sum of equivalent capacities is higher than the limit (refer to the list of the equivalent capacity limits), harmonics must be calculated by the equation in next subheading.

$\underline{P0} = \Sigma (Ki \times Pi) [kVA]$

Ki: Conversion factor (Refer to the list of the conversion factors.)

Pi: Rated capacity of harmonic generating equipment^{*1} [kVA]

i: Number indicating the conversion circuit type

*1 Rated capacity: Determined by the capacity of the applied motor and found in the table "Rated capacities and outgoing harmonic currents of inverter-driven motors". The rated capacity used here is used to calculate the generated harmonic amount and is different from the power supply capacity required for actual inverter drive.

Calculation of outgoing harmonic current

<u>Outgoing harmonic current = fundamental wave current (value converted from received power voltage) × operation ratio ×</u> <u>harmonic content</u>

- Operation ratio: actual load factor × operation time ratio during 30 minutes
- · Harmonic content: Refer to the list of the harmonic content.

Rated capacities and outgoing harmonic currents of inverter-driven motors

| Applicable | | mental rrent (A) | Fundamental wave current | Rated capacity | Outgoir | ng harmor | nic curren | | ed from 6. on ratio) | 6 kV (mA) | (No react | or, 100% |
|------------|-------|---------------------|-------------------------------|----------------|---------|-----------|------------|-------|-------------------------|-----------|-----------|----------|
| motor (kW) | 200 V | 400 V | converted from 6.6 kV (mA) | (kVA) | 5th | 7th | 11th | 13th | 17th | 19th | 23rd | 25th |
| 0.4 | 1.61 | 0.81 | 49 | 0.57 | 31.85 | 20.09 | 4.165 | 3.773 | 2.107 | 1.519 | 1.274 | 0.882 |
| 0.75 | 2.74 | 1.37 | 83 | 0.97 | 53.95 | 34.03 | 7.055 | 6.391 | 3.569 | 2.573 | 2.158 | 1.494 |
| 1.5 | 5.50 | 2.75 | 167 | 1.95 | 108.6 | 68.47 | 14.20 | 12.86 | 7.181 | 5.177 | 4.342 | 3.006 |
| 2.2 | 7.93 | 3.96 | 240 | 2.81 | 156.0 | 98.40 | 20.40 | 18.48 | 10.32 | 7.440 | 6.240 | 4.320 |
| 3.7 | 13.0 | 6.50 | 394 | 4.61 | 257.1 | 161.5 | 33.49 | 30.34 | 16.94 | 12.21 | 10.24 | 7.092 |
| 5.5 | 19.1 | 9.55 | 579 | 6.77 | 376.1 | 237.4 | 49.22 | 44.58 | 24.90 | 17.95 | 15.05 | 10.42 |
| 7.5 | 25.6 | 12.8 | 776 | 9.07 | 504.4 | 318.2 | 65.96 | 59.75 | 33.37 | 24.06 | 20.18 | 13.97 |
| 11 | 36.9 | 18.5 | 1121 | 13.1 | 728.7 | 459.6 | 95.29 | 86.32 | 48.20 | 34.75 | 29.15 | 20.18 |
| 15 | 49.8 | 24.9 | 1509 | 17.6 | 980.9 | 618.7 | 128.3 | 116.2 | 64.89 | 46.78 | 39.24 | 27.16 |
| 18.5 | 61.4 | 30.7 | 1860 | 21.8 | 1209 | 762.6 | 158.1 | 143.2 | 79.98 | 57.66 | 48.36 | 33.48 |
| 22 | 73.1 | 36.6 | 2220 | 25.9 | 1443 | 910.2 | 188.7 | 170.9 | 95.46 | 68.82 | 57.72 | 39.96 |
| 30 | 98.0 | 49.0 | 2970 | 34.7 | 1931 | 1218 | 252.5 | 228.7 | 127.7 | 92.07 | 77.22 | 53.46 |
| 37 | 121 | 60.4 | 3660 | 42.8 | 2379 | 1501 | 311.1 | 281.8 | 157.4 | 113.5 | 95.16 | 65.88 |
| 45 | 147 | 73.5 | 4450 | 52.1 | 2893 | 1825 | 378.3 | 342.7 | 191.4 | 138.0 | 115.7 | 80.10 |
| 55 | 180 | 89.9 | 5450 | 63.7 | 3543 | 2235 | 463.3 | 419.7 | 234.4 | 169.0 | 141.7 | 98.10 |

| Applicable motor (kW) | | mental rrent (A) | Fundamental wave current | Rated capacity | Outgoin | g harmon | | converte 100% opei | | • • | (with a DC | reactor, |
|--------------------------|-------|---------------------|-------------------------------|----------------|---------|----------|------|-----------------------|------|------|------------|----------|
| | 200 V | 400 V | converted from 6.6 kV (mA) | (kVA) | 5th | 7th | 11th | 13th | 17th | 19th | 23rd | 25th |
| 75 | 245 | 123 | 7455 | 87.2 | 2237 | 969 | 626 | 373 | 350 | 239 | 224 | 164 |
| 90 | 293 | 147 | 8909 | 104 | 2673 | 1158 | 748 | 445 | 419 | 285 | 267 | 196 |
| 110 | 357 | 179 | 10848 | 127 | 3254 | 1410 | 911 | 542 | 510 | 347 | 325 | 239 |
| 132 | — | 216 | 13091 | 153 | 3927 | 1702 | 1100 | 655 | 615 | 419 | 393 | 288 |
| 160 | — | 258 | 15636 | 183 | 4691 | 2033 | 1313 | 782 | 735 | 500 | 469 | 344 |
| 220 | — | 355 | 21515 | 252 | 6455 | 2797 | 1807 | 1076 | 1011 | 688 | 645 | 473 |
| 250 | — | 403 | 24424 | 286 | 7327 | 3175 | 2052 | 1221 | 1148 | 782 | 733 | 537 |
| 280 | — | 450 | 27273 | 319 | 8182 | 3545 | 2291 | 1364 | 1282 | 873 | 818 | 600 |
| 315 | — | 506 | 30667 | 359 | 9200 | 3987 | 2576 | 1533 | 1441 | 981 | 920 | 675 |
| 355 | — | 571 | 34606 | 405 | 10382 | 4499 | 2907 | 1730 | 1627 | 1107 | 1038 | 761 |
| 400 | — | 643 | 38970 | 456 | 11691 | 5066 | 3274 | 1949 | 1832 | 1247 | 1169 | 857 |
| 450 | — | 723 | 43818 | 512 | 13146 | 5696 | 3681 | 2191 | 2060 | 1402 | 1315 | 964 |
| 500 | — | 804 | 48727 | 570 | 14618 | 6335 | 4093 | 2436 | 2290 | 1559 | 1462 | 1072 |
| 560 | — | 900 | 54545 | 638 | 16364 | 7091 | 4582 | 2727 | 2564 | 1746 | 1636 | 1200 |
| 630 | — | 1013 | 61394 | 718 | 18418 | 7981 | 5157 | 3070 | 2886 | 1965 | 1842 | 1351 |

Determining if a countermeasure is required

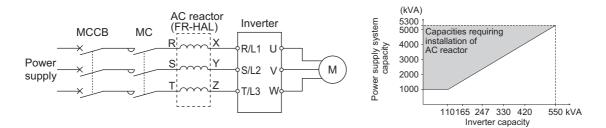
A countermeasure for harmonics is required if the following condition is satisfied: outgoing harmonic current > maximum value per 1 kW contract power × contract power.

■ Harmonic suppression techniques

| No. | ltem | Description |
|-----|---|--|
| 1 | Reactor (FR-HAL or FR- HEL) | Install an AC reactor (FR-HAL) on the AC side of the inverter or a DC reactor (FR-HEL) on its DC side, or install both to suppress outgoing harmonic currents. |
| 2 | High power factor converter (FR-HC2), multifunction regeneration converter (FR-XC) | This converter trims the current waveform to be a sine waveform by switching the rectifier circuit (converter module) with transistors. Doing so suppresses the generated harmonic amount significantly. Connect it to the DC area of an inverter. Use the high power factor converter (FR-HC2) with the accessories that come as standard. To use the FR-XC series converter, use the converter with an FR-XCB box-type reactor and enable the harmonic suppression function. |
| 3 | Power factor improving capacitor | When used with a reactor connected in series, the power factor improving correction capacitor can absorb harmonic currents. |
| 4 | Transformer multi-phase operation | Use two transformers with a phase angle difference of 30° in combinations of \land to Δ and Δ to Δ , to provide an effect corresponding to 12 pulses, reducing low-degree harmonic currents. |
| 5 | Passive filter (AC filter) | A capacitor and a reactor are used together to reduce impedances at specific frequencies. Harmonic currents are expected to be absorbed greatly by using this technique. |
| 6 | Active filter | This filter detects the current in a circuit generating a harmonic current and generates a harmonic current equivalent to a difference between that current and a fundamental wave current to suppress the harmonic current at the detection point. Harmonic currents are expected to be absorbed greatly by using this technique. |

3.3 Installation of a reactor

When the inverter is connected near a large-capacity power transformer (1000 kVA or more) or when a power factor correction capacitor is to be switched over, an excessive peak current may flow in the power input circuit, damaging the converter circuit. To prevent this, always install an AC reactor (FR-HAL), which is available as an option.



3.4 Power shutdown and magnetic contactor (MC)

Inverter input side magnetic contactor (MC)

On the inverter input side, it is recommended to provide an MC for the following purposes.

(Refer to page 28 for selection.)

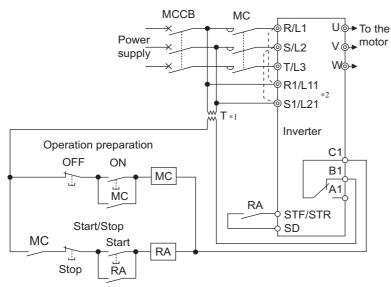
- To disconnect the inverter from the power supply at activation of a protective function or at malfunctioning of the driving system (emergency stop, etc.).
- To prevent any accident due to an automatic restart at power restoration after an inverter stop made by a power failure.
- · To separate the inverter from the power supply to ensure safe maintenance and inspection work.

To use an MC to perform an emergency stop during operation, select the MC conforming to JEM 1038-AC-3 rated current for the inverter rated input current.



- Since repeated inrush currents at power ON will shorten the life of the converter circuit (switching life is about 1,000,000 times), frequent starts and stops of the magnetic contactor must be avoided. Turn ON or OFF the start (STF/STR) signal for the inverter start control to run or stop the inverter.
- Inverter start/stop circuit example

As shown in the following figure, always use the start signal (turn ON or OFF the STF/STR signal) to make a start or stop.



- *1 When the power supply is 400 V class, install a stepdown transformer.
- *2 To hold the Fault signal when the inverter's protective circuit is activated, connect the control circuit power supply terminals R1/L11 and S1/L21 to the input side of the MC. Before connection, remove jumpers across terminals R/L1 and R1/L11 and across terminals S/L2 and S1/L21. (Refer to page 69 for removal of the jumper.)

Handling of the magnetic contactor on the inverter's output side

Switch the magnetic contactor between the inverter and motor only when both the inverter and motor are at a stop. When the magnetic contactor is turned ON while the inverter is operating, overcurrent protection of the inverter and such will activate. When the magnetic contactor is provided to switch to a commercial power supply, for example, it is recommended to use the electronic bypass function **Pr.135 to Pr.139** (refer to page 404). (Note that a PM motor cannot be driven by the commercial power supply.)

Handling of the manual contactor on the inverter's output side

A PM motor is a synchronous motor with high-performance magnets embedded inside. High-voltage is generated at the motor terminals while the motor is running even after the inverter power is turned OFF. In an application where the PM motor is driven by the load even after the inverter is powered OFF, a low-voltage manual contactor must be connected at the inverter's output side.



- Before wiring or inspection for a PM motor, confirm that the PM motor is stopped. In an application, such as fan and blower, where the motor is driven by the load, a low-voltage manual contactor must be connected at the inverter's output side, and wiring and inspection must be performed while the contactor is open. Otherwise you may get an electric shock.
- Do not open or close the contactor while the inverter is running (outputting).

3.5 Countermeasures against deterioration of the 400 V class motor insulation

In the PWM type inverter, a surge voltage attributable to wiring constants is generated at the motor terminals. Especially in a 400 V class motor, the surge voltage may deteriorate the insulation. When the 400 V class motor is driven by the inverter, consider the following countermeasures:

Countermeasures (with induction motor)

It is recommended to take one of the following countermeasures:

Rectifying the motor insulation and limiting the PWM carrier frequency according to the wiring length

For the 400 V class motor, use an <u>insulation-enhanced motor</u>. Specifically,

- Order a "400 V class inverter-driven insulation-enhanced motor".
- For the dedicated motor such as the constant-torque motor and low-vibration motor, use an "inverter-driven dedicated motor".
- · Set Pr.72 PWM frequency selection as indicated below according to the wiring length.

| | Wiring length | | | | | | |
|-------------------------------|------------------------|--------------------|--------------------|--|--|--|--|
| | Shorter than 50 m | 50 to 100 m | Longer than 100 m | | | | |
| Pr.72 PWM frequency selection | 15 (14.5 kHz) or lower | 9 (9 kHz) or lower | 4 (4 kHz) or lower | | | | |

■ Suppressing the surge voltage on the inverter side

- For the FR-F840-01160(55K) or lower, connect the surge voltage suppression filter (FR-ASF-H/FR-BMF-H) to the inverter output side.
- For the FR-F840-01800(75K) or higher, connect the sine wave filter (MT-BSL/BSC) to the inverter output side.

Countermeasures (with PM motor)

When the wiring length exceeds 50 m, set "9" (6 kHz) or less in Pr.72 PWM frequency selection.

NOTE

- For details on **Pr.72 PWM frequency selection**, refer to page 218. (When using an optional sine wave filter (MT-BSL/BSC), set "25" (2.5 kHz) in **Pr.72**.)
- For details on the surge voltage suppression filter (FR-ASF-H/FR-BMF-H) and the sine wave filter (MT-BSL/BSC), refer to the Instruction Manual of each option.
- A surge voltage suppression filter (FR-ASF-H/FR-BMF-H) can be used under V/F control and Advanced magnetic flux vector control.

A sine wave filter (MT-BSL/BSC) can be used under V/F control. Do not use the filters under different control methods.

3.6 Checklist before starting operation

The FR-F800 series inverter is a highly reliable product, but incorrect peripheral circuit making or operation/handling method may shorten the product life or damage the product.

Before starting operation, always recheck the following points.

| Checkpoint | Countermeasure | Refer to page | Check by user |
|--|---|------------------|------------------|
| Crimp terminals are insulated. | Use crimp terminals with insulation sleeves to wire the power supply and the motor. | _ | |
| The wiring between the power supply (terminals R/L1, S/L2, T/ L3) and the motor (terminals U, V, W) is correct. | Application of power to the output terminals (U, V, W) of the inverter will damage the inverter. Never perform such wiring. | 50 | |
| No wire offcuts are left from the time of wiring. | Wire offcuts can cause a fault, failure, or malfunction. Always keep the inverter clean. When drilling mounting holes in an enclosure etc., take caution not to allow chips and other foreign matter to enter the inverter. | _ | |
| The main circuit cable gauge is correctly selected. | Use an appropriate cable gauge to suppress the voltage drop to 2% or less. If the wiring distance is long between the inverter and motor, a voltage drop in the main circuit will cause the motor torque to decrease especially during the output of a low frequency. | 53 | |
| The total wiring length is within the specified length. | Keep the total wiring length within the specified length. In long distance wiring, charging currents due to stray capacitance in the wiring may degrade the fast-response current limit operation or cause the equipment on the inverter's output side to malfunction. Pay attention to the total wiring length. | 53 | |
| Countermeasures are taken against EMI. | The input/output (main circuit) of the inverter includes high frequency components, which may interfere with the communication devices (such as AM radios) used near the inverter. In such case, enable the EMC filter (turn ON the EMC filter ON/OFF connector) to minimize interference. | 95 | |
| On the inverter's output side, there is no power factor correction capacitor, surge suppressor, or radio noise filter installed. | Doing so will shut off the inverter output or damage the capacitor or surge suppressor. If any of the above devices is connected, immediately remove it. | _ | |
| When performing an inspection or rewiring on the product that has been energized, the operator has waited long enough after shutting off the power supply. | For a short time after the power-OFF, a high voltage remains in the smoothing capacitor, and it is dangerous. Before performing an inspection or rewiring, wait 10 minutes or longer after the power supply turns OFF, then confirm that the voltage across the main circuit terminals P/+ and N/- of the inverter is low enough using a tester, etc. | _ | |
| The inverter's output side has no short circuit or ground fault occurring. | A short circuit or ground fault on the inverter's output side may damage the inverter module. Fully check the insulation resistance of the circuit prior to inverter operation since repeated short circuits caused by peripheral circuit inadequacy or an earth (ground) fault caused by wiring inadequacy or reduced motor insulation resistance may damage the inverter module. Fully check the to-earth (ground) insulation and phase-to-phase insulation of the inverter's output side before power-ON. Especially for an old motor or use in hostile atmosphere, securely check the motor insulation resistance, etc. | _ | |
| The circuit is not configured to use the inverter's input-side magnetic contactor to start/stop the inverter frequently. | Since repeated inrush currents at power ON will shorten the life of the converter circuit, frequent starts and stops of the magnetic contactor must be avoided. Turn ON or OFF the inverter's start (STF/STR) signal to run or stop the inverter. | 102 | |
| The voltage applied to the inverter /O signal circuits is within the specifications. | Application of a voltage higher than the permissible voltage to the inverter I/O signal circuits or opposite polarity may damage the I/O devices. Especially check the wiring to prevent the speed setting potentiometer from being connected incorrectly to short circuit terminals 10E and 5. | 60 | |

| Checkpoint | Countermeasure | Refer to page | Check by user |
|---|--|------------------|------------------|
| | When using a switching circuit as shown below, chattering due to misconfigured sequence or arc generated at switching may allow undesirable current to flow in and damage the inverter. Miswiring may also damage the inverter. (Note that a PM motor cannot be driven by the commercial power supply.) MC1 | | |
| | Power supply R/L1 U S/L2 V T/L3 W Inverter | _ | |
| | If switching to the commercial power supply operation while a failure such as an output short circuit has occurred between the magnetic contactor MC2 and the motor, the damage may further spread. If a failure has occurred between the MC2 and the motor, a protection circuit such as using the OH signal input must be provided. | | |
| A countermeasure is provided for power restoration after a power failure. | If the machine must not be restarted when power is restored after a power failure, provide an MC on the inverter's input side and also make up a sequence which will not switch ON the start signal. If the start signal (start switch) remains ON after a power failure, the inverter will automatically restart as soon as the power is restored. | _ | |
| A magnetic contactor (MC) is installed on the inverter's input side. | On the inverter's input side, connect an MC for the following purposes: To disconnect the inverter from the power supply at activation of a protective function or at malfunctioning of the driving system (emergency stop, etc.). To prevent any accident due to an automatic restart at power restoration after an inverter stop made by a power failure. To separate the inverter from the power supply to ensure safe maintenance and inspection work. To use an MC to perform an emergency stop during operation, select the MC conforming to JEM 1038-AC-3 rated current for the inverter rated input current. | 102 | |
| The magnetic contactor on the inverter's output side is properly handled. | Switch the magnetic contactor between the inverter and motor only when both the inverter and motor are at a stop. | 102 | |
| When using a PM motor, a low- voltage manual contactor is installed on the inverter's output side. | A PM motor is a synchronous motor with high-performance magnets embedded inside. High-voltage is generated at the motor terminals while the motor is running even after the inverter power is turned OFF. In an application, such as fan and blower, where the motor is driven by the load, a low-voltage manual contactor must be connected on the inverter's output side, and wiring and inspection must be performed while the contactor is open. Otherwise you may get an electric shock. | 102 | |
| An EMI countermeasure is provided for the frequency setting signals. | If electromagnetic noise generated from the inverter causes the frequency setting signal to fluctuate and the motor rotation speed to be unstable when changing the motor speed with analog signals, the following countermeasures are effective: Do not run the signal cables and power cables (inverter I/O cables) in parallel with each other and do not bundle them. Run the signal cables as far away as possible from the power cables (inverter I/O cables). Use shielded cables. Install a ferrite core on the signal cable (Example: ZCAT3035-1330 TDK). | 93 | |
| A countermeasure is provided for an overload operation. | When performing frequent starts/stops by the inverter, rise/fall in the temperature of the transistor element of the inverter will repeat due to a repeated flow of large current, shortening the life from thermal fatigue. Since thermal fatigue is related to the amount of current, the life can be increased by reducing current at locked condition, starting current, etc. Reducing current may extend the service life but may also cause torque shortage, which leads to a start failure. Adding a margin to the current can eliminate such a condition. For an induction motor, use an inverter of a higher capacity (up to two ranks). For a PM motor, use an inverter and PM motor of higher capacities. | | |
| The specifications and rating match the system requirements. | Make sure that the specifications and rating match the system requirements. | 638 | |

| Checkpoint | Countermeasure | Refer to page | Check by user |
|--|--|------------------|------------------|
| Countermeasures are taken against electrical corrosion on the motor bearing. | When a motor is driven by the inverter, axial voltage is generated on the motor shaft, which may cause electrical corrosion of the bearing in rare cases depending on the wiring, load, operating conditions of the motor or specific inverter settings (high carrier frequency and EMC filter ON). Contact your sales representative to take appropriate countermeasures for the motor. The following shows examples of countermeasures for the inverter. Decrease the carrier frequency. Turn OFF the EMC filter. Provide a common mode choke^{*1} on the output side of the inverter. (This is effective regardless of the EMC filter ON/OFF connector setting.) | _ | |

*1 Recommended common mode choke: FT-3KM F series FINEMET® common mode choke cores manufactured by Hitachi Metals, Ltd. FINEMET is a registered trademark of Hitachi Metals, Ltd.

3.7 Failsafe system which uses the inverter

When a fault is detected by the protective function, the protective function activates and outputs the Fault signal. However, the Fault signal may not be output at an inverter's fault occurrence when the detection circuit or output circuit fails, etc. Although Mitsubishi assures the best quality products, provide an interlock which uses inverter status output signals to prevent accidents such as damage to the machine when the inverter fails for some reason. Also at the same time consider the system configuration where a failsafe from outside the inverter, without using the inverter, is enabled even if the inverter fails.

Interlock method which uses the inverter status output signals

By combining the inverter output signals to provide an interlock as shown below, an inverter failure can be detected.

| No. | Interlock method | Check method | Used signals |
|-----|--|--|---|
| а | Inverter protective function operation | Operation check of an alarm contact. Circuit error detection by negative logic. | Fault (ALM) signal |
| b | Inverter operating status | Operation ready signal check. | Inverter operation ready (RY) signal |
| с | Inverter running status | Logic check of the start signal and running signal. | Start (STF or STR) signal Inverter running (RUN) signal |
| d | Inverter running status | Logic check of the start signal and output current. | Start (STF or STR) signal Output current detection (Y12) signal |

 When using various signals, assign the functions to Pr.190 to Pr.196 (Output terminal function selection) referring to the table on the left.

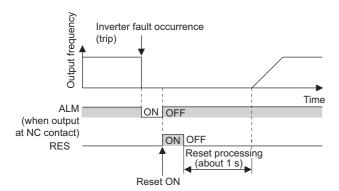
| Output | Pr.190 to Pr.196 setting | | | | | | |
|--------|--------------------------|----------------|--|--|--|--|--|
| signal | Positive logic | Negative logic | | | | | |
| ALM | 99 | 199 | | | | | |
| RY | 11 | 111 | | | | | |
| RUN | 0 | 100 | | | | | |
| Y12 | 12 | 112 | | | | | |

• NOTE

Changing the terminal assignment using **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Checking by using the Fault signal output from the inverter... (a)

When the inverter's protective function activates and the inverter output is stopped, the Fault (ALM) signal is output. (The ALM signal is assigned to terminal A1B1C1 in the initial setting). With this signal, check that the inverter operates properly. In addition, negative logic can be set. (ON when the inverter is normal, OFF when the fault occurs.)

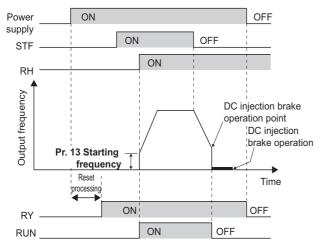


■ Checking the inverter operating status by using the Inverter operation ready signal output from the inverter ... (b)

The Inverter operation ready (RY) signal is output when the inverter power is ON and the inverter becomes operative. Check if the RY signal is output after powering ON the inverter.

■ Checking the inverter operating status by using the start signal input to the inverter and the Inverter running signal output from the inverter ... (c)

The Inverter running (RUN) signal is output when the inverter is running. (The RUN signal is assigned to terminal RUN in the initial setting.) Check if the RUN signal is output while a start signal (the STF/STR signal for forward/reverse rotation command) is input to the inverter. Even after the start signal is turned OFF, the RUN signal is kept output until the inverter makes the motor to decelerate and to stop. For the logic check, configure a sequence considering the inverter's deceleration time.



Checking the motor operating status by using the start signal input to the inverter and the Output current detection signal output from the inverter ... (d)

The Output current detection (Y12) signal is output when the inverter operates and currents flows into the motor.

Check if the Y12 signal is output while a start signal (the STF/STR signal for forward/reverse rotation command) is input to the inverter. The Y12 signal is initially set to be output at 120% (for FM type inverter) or 110% (for CA-type inverter) of the inverter rated current. Adjust the level to around 20% using no load current of the motor as reference with **Pr.150 Output current detection level**.

Like the Inverter running (RUN) signal, even after the start signal is turned OFF, the Y12 signal is kept output until the inverter stops the output to a decelerating motor. For the logic check, configure a sequence considering the inverter's deceleration time.

🖌 🗖 NOTE

• Changing the terminal assignment using **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Backup method which does not use the inverter

Even if the interlock is provided by the inverter status signal, enough failsafe is not ensured depending on the failure status of the inverter itself. For example, if an inverter CPU fails in a system interlocked with the inverter's Fault, start, and RUN signals, no Fault signals will be output and the RUN signal will be kept ON because the inverter CPU is down.

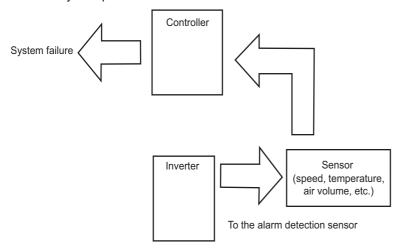
Provide a speed detector to detect the motor speed and current detector to detect the motor current, and consider the backup system such as performing a check as follows according to the level of importance of the system.

Start signal and actual operation check

Check the motor running and motor current while the start signal is input to the inverter by comparing the start signal to the inverter and detected speed of the speed detector or detected current of the current detector. Note that the current is flowing through the motor while the motor coasts to stop, even after the inverter's start signal is turned OFF. For the logic check, configure a sequence considering the inverter's deceleration time. In addition, it is recommended to check the three-phase current when using the current detector.

Command speed and actual operation check

Check for a gap between the actual speed and commanded speed by comparing the inverter's speed command and the speed detected by the speed detector.



CHAPTER 4 BASIC OPERATION

| 4.1 | Operation panel (FR-DU08) | |
|-----|---|--|
| 4.2 | Monitoring the inverter | |
| 4.3 | Easy setting of the inverter operation mode | |
| 4.4 | Frequently-used parameters (simple mode parameters) | |
| 4.5 | Basic operation procedure (PU operation) | |
| 4.6 | Basic operation procedure (External operation) | |
| 4.7 | Basic operation procedure (JOG operation) | |

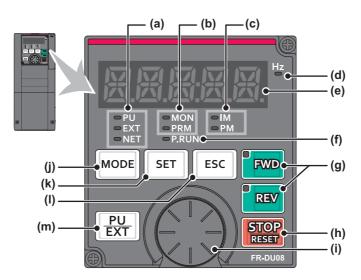
4 BASIC OPERATION

This chapter explains the basic operation of this product. Always read the instructions before use.

4.1 Operation panel (FR-DU08)

4.1.1 Components of the operation panel (FR-DU08)

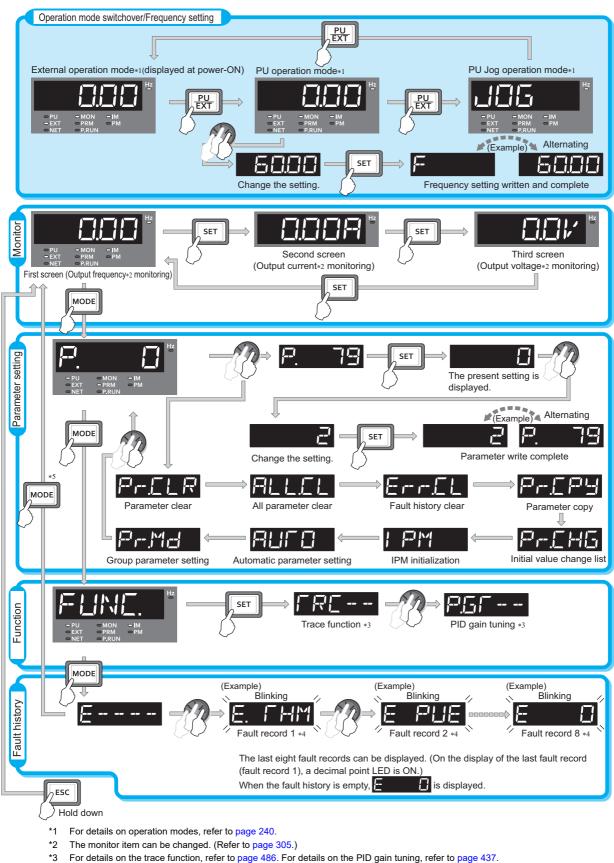
To mount the operation panel (FR-DU08) on the enclosure surface, refer to page 77.



| No. | Appearance | Name | Description |
|-----|------------------------|--|---|
| (a) | © PU © EXT © NET | Inverter operation mode LED indicator | PU: ON when the inverter is in the PU operation mode. EXT: ON when the inverter is in the External operation mode. (ON when the inverter in the initial setting is powered ON.) NET: ON when the inverter is in the Network operation mode. PU and EXT: ON when the inverter runs in the External/PU combined operation mode 1 or 2. |
| (b) | o MON o PRM | Operation panel mode LED indicator | MON: ON when the operation panel is in the monitor mode. Quickly blinks twice intermittently while the protective function is activated. Slowly blinks when the display-off function of the operation panel is valid. PRM: ON when the operation panel is in the parameter setting mode. |
| (c) | ⊂ IM ⊂ PM | Controlled motor type LED indicator | IM: ON when the inverter is set to control the induction motor. PM: ON when the inverter is set to control the PM motor. The indicator blinks during test operation. |
| (d) | Hz | Frequency unit LED indicator | ON when the actual frequency is monitored. (Blinks when the set frequency is monitored.) |
| (e) | | Monitor (5-digit LED) | Shows a numeric value (readout) of a monitor item such as the frequency or a parameter number. (The monitor item can be changed according to the settings of Pr.52 , Pr.774 to Pr.776 .) |
| (f) | ⊂ P.RUN | PLC function LED indicator | ON when the PLC function of the inverter is valid. |
| (g) | FWD REV | FWD key, REV key | FWD key: Starts forward rotation operation. Its LED is ON during forward rotation operation. REV key: Starts reverse rotation operation. Its LED is ON during reverse rotation operation. Either LED blinks under the following conditions. When the frequency command is not given even if the forward/reverse command is given. When the frequency command is equal to the starting frequency or lower. When the MRS signal is being input. |
| (h) | STOP | STOP/RESET key | Stops the operation commands. Used to reset the inverter when the protective function is activated. |
| (i) | | Setting dial | The setting dial of the Mitsubishi Electric inverters. Turn the setting dial to change the setting of frequency or parameter, etc. Press the setting dial to perform the following operations: To display a set frequency on the LED display in the monitor mode. (The monitor item shown on the display can be changed by using Pr.992.) To display the present setting during calibration. To display a fault history number in the fault history mode |
| (j) | MODE | MODE key | Switches the operation panel to a different mode. The easy setting of the inverter operation mode is enabled by pressing this key simultaneously with <u>PU</u> EVERY key on the operation panel becomes inoperable by holding this key for 2 seconds. The key lock function is disabled when Pr.161 = "0 (initial setting)". (Refer to page 202.) |
| (k) | SET | SET key | Confirms each selection. When this key is pressed during inverter operation, the monitor item changes. (The monitor item on each screen can be changed according to the settings of Pr.52 , Pr.774 to Pr.776 .) Initial setting in the monitor mode Output frequency ↓ Output current ↓ Output current ↓ Output ↓ Outp |
| (I) | ESC | ESC key | Goes back to the previous display. Holding this key for a longer time changes the display back to the monitor mode. |
| (m) | PU EXT | PU/EXT key | Switches between the PU operation mode, the PUJOG operation mode, and the External operation mode. The easy setting of the inverter operation mode is enabled by pressing this key simultaneously with MODE. Also cancels the PU stop warning. |

4.1.2 Basic operation of the operation panel

♦ Basic operation



- *4 For details on the fault history, refer to page 594.
- *5 The USB memory mode indication appears while a USB memory device is connected. (Refer to page 78.)

Parameter setting mode

In the parameter setting mode, inverter functions (parameters) are set.

The following table explains the indications in the parameter setting mode.

| Operation panel indication | Function name | Description | Refer to page |
|----------------------------|-----------------------------|--|---------------------|
| P . | Parameter setting mode | Under this mode, the set value of the displayed parameter number is read or changed. | 116 |
| P- <u>C</u> LR | Parameter clear | Clears and resets parameter settings to the initial values. Calibration parameters and offline auto tuning parameters are not cleared. For details on the uncleared parameters, refer to page 668. | 578 |
| ALLEL | All parameter clear | Clears and resets parameter settings to the initial values. Calibration parameters and the offline auto tuning parameters are also cleared. For details on the uncleared parameters, refer to page 668. | 578 |
| ErrEL | Fault history clear | Deletes the fault history. | 590 |
| P- <u>[</u> Py | Parameter copy | Copies the parameter settings saved in the inverter to the operation panel. The parameters copied to the operation panel can be also copied to other inverters. | 579 |
| PrEH6 | Initial value change list | Identifies the parameters that have been changed from their initial settings. | 586 |
| PM | IPM initialization | Changes the parameters to the settings required to drive an IPM motor (MM-EFS or MM-THE4) as a batch. Also changes the parameters back to the settings required to drive an induction motor. | 182 |
| AUCO | Automatic parameter setting | Changes parameter settings as a batch. The target parameters include communication parameters for the Mitsubishi Electric human machine interface (GOT) connection and the parameters for the rated frequency settings of 50 Hz/60 Hz. | 211 |
| PrMd | Group parameter setting | Displays parameter numbers by function groups. | 164 |

4.1.3 Digital characters and their corresponding printed equivalents

Digital characters displayed on the operation panel display are as follows.

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Α | B(b) | С | С | D(d) |
|------|------|------|-------------|----------|------|------|------|------|---|------|------|------|------|------|
| | | 2 | H | ! | 5 | 5 | 7 | Ξ | 9 | A | Ŀ | Ľ | c | ₫ |
| E(e) | F(f) | G(g) | H(h) | l(i) | J(j) | K(k) | L(I) | M(m) | Ν | n | 0 | 0 | P(p) | Q(q) |
| Ε | F | E | <u>}-</u> { | 1 | | K | Ľ | M | Ņ | 1-1 | | | P | |
| R | r | S(s) | T(t) | U | u | V | v | W | w | X(x) | Y(y) | Z(z) | | |
| R | r | 5 | 1 | | | 1. | V | K | M | X | 4 | 7 | | |

4.1.4 Changing the parameter setting value

The following shows the procedure to change the setting of **Pr.1 Maximum frequency**.

| Оре | rating procedure |
|-----|---|
| 1. | Turning ON the power of the inverter The operation panel is in the monitor mode. |
| 2. | Changing the operation mode |
| | Press $\boxed{\frac{PU}{EXT}}$ to choose the PU operation mode. [PU] indicator turns ON. |
| 3. | Selecting the parameter setting mode |
| | Press MODE to choose the parameter setting mode. (The parameter number read previously appears.) |
| 4. | Selecting the parameter |
| | Turn 🕄 until "P. /" (Pr.1) appears. Press SET to read the present set value. |
| | " <i> </i> 2∏∏[]" (initial value) appears. |
| 5. | Changing the setting value |
| | Turn 😳 to change the set value to " 5 🛄 🛛 ". Press 💷 to confirm the selection. " 5 🗐 🗍 " and " P {" |
| | are displayed alternately. |
| | Turn 😳 to read another parameter. |
| | Press SET to show the setting again on the LCD display. |
| | Press SET twice to show the next parameter. |
| | • Press MODE three times to return the monitor display to the indication of the frequency. |
| | NOTE |
| | • If a parameter write condition is not satisfied, a parameter write error appears on the LCD display. (Refer to page 594.) |

| Error indication | Description |
|------------------|------------------------------|
| Er l | Parameter write error |
| Erd | Write error during operation |
| E-3 | Calibration error |
| E 1 | Mode designation error |

• When **Pr.77 Parameter write selection** = "0 (initial setting)," the parameter setting change is only available while the inverter is stopped and under the PU operation mode. To enable the parameter setting change while the inverter is running or under the operation mode other than PU operation mode, change the **Pr.77** setting. (Refer to page 206.)

4.2 Monitoring the inverter

4.2.1 Monitoring of output current and output voltage

Point P

Press SET on the operation panel in the monitor mode to switch the monitor item between output frequency, output current, and output voltage.

Operating procedure

- **1.** Press MODE during inverter operation to monitor the output frequency. [Hz] indicator turns ON.
- 2. Press **SET** to monitor the output current. This operation is valid under any operation mode of the inverter and whether the inverter is running or at a stop. The unit of current "A" appears.
- **3.** Press **SET** to monitor the output voltage. The unit of voltage "V" appears.

- NOTE

Other monitor item, such as output power or set frequency, is also available. Use Pr.52 Operation panel main monitor selection or Pr.774 Operation panel monitor selection 1 to Pr.776 Operation panel monitor selection 3 to change the setting. (Refer to page 305.)

4.2.2 First priority monitor screen

The first priority monitor screen, which is displayed first when the operation panel becomes in the monitor mode, is selectable.

To set it, press SET for a while when the desired monitor item is displayed on a monitor screen.

The following show the procedure to set the monitor screen displaying the output current as the first priority monitor screen.

Operating procedure

- **1.** Change the mode of the operation panel to the monitor mode, and switch the monitor screen to the one on which the output current can be monitored.
- 2. Press set as the first priority monitor screen is set as the first priority monitor screen.
- 3. When the operation panel is in the monitor mode next time, the output current monitored value is displayed first.

- NOTE

• Use Pr.52 Operation panel main monitor selection or Pr.774 Operation panel monitor selection 1 to Pr.776 Operation panel monitor selection 3 to change the monitor item. (Refer to page 305.)

4.2.3 Displaying the set frequency

To display the present set frequency, change the mode of the operation panel to the monitor mode and press the setting dial

>) while the inverter runs in the PU operation mode or in the External/PU combined operation mode 1 (Pr.79 Operation

mode selection = "3").



• Use Pr.992 Operation panel setting dial push monitor selection to change the item to be displayed. (Refer to page 305.)

4.3 Easy setting of the inverter operation mode

The operation mode suitable for start and speed command combinations can be set easily using **Pr.79 Operation mode selection**.

The following shows the procedure to operate with the external start command (STF/STR) and the frequency command by using .

Operating procedure

1. Press PU and MODE for 0.5 second.



2. Turn i until "79 --- 3" (External/PU combined operation mode 1) appears. (For other settings, refer to the following table.)



3. Press **SET** to confirm the selection. External/PU combined operation mode 1 (**Pr.79** = "3") is set.

| | Operatio | n method | |
|---|------------------------|-------------------------|---------------------------------------|
| Operation panel indication | Start command | Frequency command | Operation mode |
| | FWD, REV | *1 | PU operation mode |
| $Blinking \rightarrow \begin{array}{c} & & & \\ & & & \\ & & & \\ & \\ & $ | External (STF, STR) | Analog voltage input | External operation mode |
| | External (STF, STR) | * 1 | External/PU combined operation mode 1 |
| | FWD, REV | Analog voltage input | External/PU combined operation mode 2 |

*1 To use the setting dial as a potentiometer, refer to page 202.



- "- " appears if the **Pr.79** setting is tried to be changed while the inverter is set that only the parameters registered in the user group are read (**Pr.160** = "1") but **Pr.79** is not included in the user group.
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- If MODE is pressed before pressing SET, the easy setting is terminated and the operation panel returns to the monitor mode. If the easy setting is terminated while Pr.79 = "0 (initial value)", check the inverter operation mode because the inverter may switch its operation mode between the PU operation mode and the External operation mode.
- Reset by pressing STOP BEST is enabled.
- The priorities of the frequency commands while Pr.79 = "3" are "Multi-speed operation (RL/RM/RH/REX) > PID control (X14)
 > terminal 4 analog input (AU) > digital input from the operation panel".

4.4 Frequently-used parameters (simple mode parameters)

Parameters that are frequently used for the FR-F800 series are grouped as simple mode parameters.

When **Pr.160 User group read selection** = "9999", only the simple mode parameters are displayed on the operation panel. This section explains the simple mode parameters.

4.4.1 Simple mode parameter list

For simple variable-speed operation of the inverter, the initial values of the parameters may be used as they are. Set the necessary parameters to meet the load and operational specifications. Parameter's setting, change and check can be made on the operation panel (FR-DU08).

Point P

• **Pr.160 User group read selection** can narrow down the displayed parameters to only the simple mode parameters. Set **Pr.160 User group read selection** as required. (To change the parameter setting, refer to page 116.)

| Pr.160 setting | Description |
|------------------------------|--|
| 9999 (FM type initial value) | Only simple mode parameters are displayed. |
| 0 (CA type initial value) | All parameters (simple mode parameters and extended parameters) are displayed. |
| 1 | Only parameters registered in user groups are displayed. |

| | | | | Initial value ^{*11} | | | | Refer | |
|-----|-----------|--|----------------------|--|-------|--------------------------|--|---------------------|--|
| Pr. | Pr. group | Name | Increment | FM | СА | Range | Application | to page | |
| | | | | 6% ^{*1} | | - | | | |
| | | | | 4% ^{*2} | | | Set this parameter to obtain a higher starting torque under V/F control. Also set this when a | | |
| 0 | G000 | Torque boost | 0.1% | 3% ^{*3} | | 0% to 30% | loaded motor cannot be driven, the warning | 551 | |
| | | | | 2% ^{*4} | | - | "OL" occurs, and the inverter output is shut off with the fault indication "E.OC1". | | |
| | | | | 1.5% ^{*5} 1% ^{*6} | | - | | | |
| | | | | 1% ° 120 Hz ^{**} | 7 | | | | |
| 1 | H400 | Maximum frequency | 0.01 Hz | 120 Hz 60Hz ^{*8} | | 0 to 120Hz | Set the upper limit for the output frequency. | 287 | |
| 2 | H401 | Minimum frequency | 0.01 Hz | 0 Hz | | 0 to 120 Hz | Set the lower limit for the output frequency. |] | |
| 3 | G001 | Base frequency | 0.01 Hz | 60 Hz | 50 Hz | 0 to 590 Hz | Set this parameter when the rated motor frequency is 50 Hz. Check the rating plate of the motor. | 552 | |
| 4 | D301 | Multi-speed setting (high speed) | 0.01 Hz | 60 Hz | 50 Hz | 0 to 590 Hz | | | |
| 5 | D302 | Multi-speed setting (middle speed) | 0.01 Hz | 30 Hz | | 0 to 590 Hz | Pre-set the speeds that will be switched among by terminals. | 125, 130, 263 | |
| 6 | D303 | Multi-speed setting (low speed) | 0.01 Hz | 10 Hz | | 0 to 590 Hz | | | |
| 7 | F010 | Acceleration | 0.1 s | 5 s ^{*9} | | 0 to 3600 s | Set the acceleration time. | | |
| ' | FUIU | time | 0.15 | 15 s ^{*10} | | 01030005 | | - 228 | |
| 8 | F011 | Deceleration | 0.1 s | 10 s ^{*9} | | 0 to 3600 s | Set the deceleration time. | 220 | |
| 0 | 1011 | time | - | 30s ^{*10} | | 0.000000 | | | |
| 9 | H000 | Electronic thermal O/L | 0.01 A ^{*7} | Inverter | rated | 0 to 500 A ^{*7} | Protects the motor from heat. | 266 | |
| 5 | C103 | relay | 0.1A ^{*8} | current | | 0 to 3600A ^{*8} | Set the rated motor current. | 200 | |
| 79 | D000 | Operation mode selection | 1 | 0 | | 0 to 4, 6, 7 | Select the start and frequency command sources. | 240 | |

| | | | | Initial value ^{*11} | | | | Refer |
|---------------|------|--|-----------|------------------------------|-------|--|---|-------------|
| Pr. Pr. group | | Name | Increment | FM | CA | Range | Application | to page |
| 125 | T022 | Terminal 2 frequency setting gain frequency | 0.01 Hz | 60 Hz | 50 Hz | 0 to 590 Hz | Allows the frequency at the maximum potentiometer setting (5 V in the initial setting) to be changed. | 133, 357 |
| 126 | T042 | Terminal 4 frequency setting gain frequency | 0.01 Hz | 60 Hz | 50 Hz | 0 to 590 Hz | Allows the frequency at the maximum current input (20 mA in the initial setting) to be changed. | 135, 357 |
| 160 | E440 | User group read selection | 1 | 9999 | 0 | 0, 1, 9999 | This function restricts the parameters that are read by the operation panel and parameter unit. | 215 |
| 998 | E430 | PM parameter initialization | 1 | 0 | | 0, 12, 112, 8009, 8109, 9009, 9109 | Selects the PM motor control and set the parameters that are required to drive a PM motor. | 182 |
| 999 | E431 | Automatic parameter setting | 1 | 9999 | | 1, 2, 10 to 13, 20, 21, 9999 | Changes parameter settings as a batch. The target parameters include communication parameters for the Mitsubishi Electric human machine interface (GOT) connection and the parameters for the rated frequency settings of 50/60 Hz. | 211 |

*1 Initial value for the FR-F820-00046(0.75K) or lower and FR-F840-00023(0.75K) or lower.

*2 Initial value for the FR-F820-00077(1.5K) to FR-F820-00167(3.7K) and the FR-F840-00038(1.5K) to FR-F840-00083(3.7K).

*3 Initial value for the FR-F820-00250(5.5K), FR-F820-00340(7.5K), FR-F840-00126(5.5K), and FR-F840-00170(7.5K).

*4 Initial value for the FR-F820-00490(11K) to FR-F820-01540(37K), FR-F840-00250(11K) to FR-F840-00770(37K).

*5 Initial value for the FR-F820-01870(45K), FR-F820-02330(55K), FR-F840-00930(45K), and FR-F840-01160(55K).

 *6 Initial value for the FR-F820-03160(75K) or higher and FR-F840-01800(75K) or higher.

*7 For the FR-F820-02330(55K) or lower and FR-F840-01160(55K) or lower.

*8 For the FR-F820-75K(03160) or higher and FR-F840-75K(01800) or higher.
 *9 Initial value for the FR-F820-00340(7.5K) or lower and FR-F840-00170(7.5K) or lower.

*10 Initial value for the FR-F820-00490(11K) or higher and FR-F840-00250(11K) or higher.

*11 The initial value in "FM" column is for the FM-type inverter that has terminal FM, and that in "CA" column is for the CA-type inverter that has terminal CA.

4.5 Basic operation procedure (PU operation)

Select a method to give the frequency command from the list below, and refer to the specified page for its procedure.

| Method to give the frequency command | Refer to page |
|--|---------------|
| Setting the frequency on the operation panel in the frequency setting mode | 123 |
| Give commands by turning the setting dial like a potentiometer | 124 |
| Give commands by turning ON/OFF switches wired to inverter's terminals (multi-speed setting) | 125 |
| Setting the frequency by inputting voltage signals | 126 |
| Setting the frequency by inputting current signals | 127 |

4.5.1 Setting the frequency on the operation panel (example: operating at 30 Hz)

Point P

Use the operation panel (FR-DU08) to give a start command and a frequency command. (PU operation)

Operation panel (FR-DU08)



The following shows the procedure to operate at 30 Hz.

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- **2.** Changing the operation mode

Press $\left[\frac{PU}{FXT}\right]$ to choose the PU operation mode. [PU] indicator turns ON.

3. Setting the frequency

While the indication is flashing, press set to confirm the selection for the frequency. "F" and "

displayed alternately. After about three seconds of alternate display, the monitor display goes back to "

(If SET is not pressed during the flashing for about five seconds, the monitor display goes back to "[]][]" (0.00

Hz). In that case, turn 💮 again and set the frequency.)

4. Start \rightarrow acceleration \rightarrow constant speed

Press FWD or REV to start running. The frequency value on the monitor increases according to the setting of

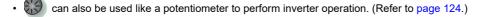
(To change the set frequency, return to step 3. The previously set frequency appears.)

5. Deceleration \rightarrow stop

Press to stop. The frequency value on the monitor decreases according to the setting of **Pr.8 Deceleration time**, the monitor displays "[[[[]]]" (0.00 Hz), and the motor stops rotating.

NOTE

To display the set frequency under PU operation mode or External/PU combined operation mode 1 (**Pr.79** = "3"), press ((Refer to page 305.))



Pr.7 Acceleration time, Pr.8 Deceleration time 3 page 228 Pr.79 Operation mode selection 3 page 240

Perform PU operation using the setting dial like a 4.5.2 potentiometer

Point P

Set Pr.161 Frequency setting/key lock operation selection = "1" (setting dial potentiometer).

The following shows the procedure to change the frequency from 0 Hz to 60 Hz during operation.

Operating procedure

- 1. Turning ON the power of the inverter The operation panel is in the monitor mode.
- 2. Changing the operation mode
 - Press $\left|\frac{PU}{FxT}\right|$ to choose the PU operation mode. [PU] indicator turns ON.
- 3. Changing the parameter setting Change Pr.161 setting to "1". (To change the setting, refer to page 116.)
- 4. Start

Press **FWD** or **REV** to start the inverter operation.

5. Setting the frequency

Turn 🕄 until "🖅 🗍 " appears. The value in the flashing indication is set as the value of a set frequency (The

indication blinks for about five seconds). SET needs not to be pressed.

- If the indication changes from the blink of "60.00" to the display of "0.00", Pr.161 Frequency setting/key lock operation selection may be set to a value other than "1".
- Simply turning 🐨 enables frequency setting whether the inverter is running or at a stop.
- The newly-set frequency is saved as the set frequency in EEPROM after 10 seconds.
- With the setting dial, the frequency can go up to the setting value of Pr.1 Maximum frequency. Check the Pr.1 Maximum frequency setting, and adjust the setting according to the application.

Parameters referred to

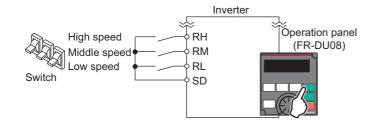
Pr.1 Maximum frequency ☞ page 287 Pr.161 Frequency setting/key lock operation selection ☞ page 202

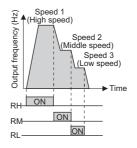
4.5.3 Setting the frequency with switches (multi-speed setting)

Point P

- Use **FWD** or **REV** on the operation panel (FR-DU08) to give a start command.
- Turn ON the RH, RM, or RL signal to give a frequency command (multi-speed setting).
- Set Pr.79 Operation mode selection = "4" (External/PU combination operation mode 2).

[Connection diagram]





The following shows the procedure to operate at a low speed (10 Hz).

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- 2. Changing the operation mode Set "4" in **Pr.79**. [PU] and [EXT] indicators are ON. (To change the setting, refer to page 118.)
- **3.** Setting the frequency Turn ON the low-speed switch (RL signal).
- **4.** Start \rightarrow acceleration \rightarrow constant speed

Press **FWD** or **REV** to start running. The frequency value on the monitor increases according to the setting of **Pr.7** Acceleration time, and " **[**], **[**], " (10.00 Hz) appears on the monitor.

5. Deceleration \rightarrow stop

Press **STOP** to stop. The frequency value on the monitor decreases according to the setting of **Pr.8 Deceleration time**, the monitor displays "[][][]" (0.00 Hz), and the motor stops rotating. Turn OFF the low-speed switch (RL signal).

- NOTE

- Initially, the high-speed switch (RH signal) is set to 60 Hz for the FM type inverter or 50 Hz for the CA type inverter. The middle-speed switch (RM signal) is set to 30 Hz, and the low-speed switch (RL signal) is set to 10 Hz. (To change the settings, use Pr.4, Pr.5, and Pr.6, respectively.)
- In the initial setting, if two or more speed switches (signals) are simultaneously turned ON, priority is given to the switch (signal) for the lower speed. For example, when both RH and RM signals turn ON, the RM signal (**Pr.5**) has the higher priority.
- Up to 15-speed switching operation can be performed.

4

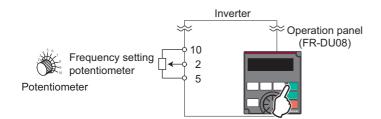
Pr.4 to Pr.6 (Multi-speed setting) > page 263 Pr.7 Acceleration time, Pr.8 Deceleration time > page 228 Pr.79 Operation mode selection > page 240

4.5.4 Setting the frequency using an analog signal (voltage input)

Point P

- Use FWD or REV on the operation panel (FR-DU08) to give a start command.
- Use the frequency setting potentiometer to give a frequency command (by connecting it to terminals 2 and 5 (voltage input)).
- Set Pr.79 Operation mode selection = "4" (External/PU combination operation mode 2).

[Connection diagram] (The inverter supplies 5 V power to the frequency setting potentiometer via terminal 10.)



The following shows the procedure to operate at 60 Hz.

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- Changing the operation mode
 Set "4" in Pr.79. [PU] and [EXT] indicators are ON. (To change the setting, refer to page 116.)
- 3. Start

Press FWD or REV. [FWD] or [REV] indicator blinks as no frequency command is given.

4. Acceleration \rightarrow constant speed

Turn the frequency setting potentiometer clockwise slowly to full. The frequency value on the monitor increases according to the setting of **Pr.7 Acceleration time**, and " $\Box \Box \Box \Box$ " (60.00 Hz) appears on the monitor.

5. Deceleration

Turn the frequency setting potentiometer counterclockwise slowly to full. The frequency value on the monitor decreases according to the setting of **Pr.8 Deceleration time**, the monitor displays "[]]][] (0.00 Hz), and the motor stops rotating. [FWD] or [REV] indicator blinks.

6. Stop

Press STOP. [FWD] or [REV] indicator turns OFF.

NOTE

- To change the frequency (60 Hz) at the maximum voltage input (initial value: 5 V), adjust **Pr.125 Terminal 2 frequency setting** gain frequency.
- To change the frequency (0 Hz) at the minimum voltage input (initial value: 0 V), adjust the calibration parameter C2 Terminal 2 frequency setting bias frequency.
- When terminal 10 is used, the maximum output frequency may fluctuate in a range of ±6 Hz due to fluctuations in the output voltage (5 ±0.5 VDC). Use **Pr. 125** or **Pr. C4** to adjust the output frequency at the maximum analog input as required. (Refer to page 357.)
- When terminal 10E is used, the maximum output frequency may fluctuate (in a range of ±2 to 3 Hz) due to fluctuations in the output voltage (10 ±0.4 VDC). Use Pr. 125 or Pr. C4 to adjust the output frequency at the maximum analog input as required. (Refer to page 357.)

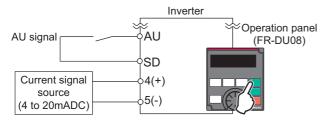
Parameters referred to

Pr.7 Acceleration time, Pr.8 Deceleration time r page 228 Pr.79 Operation mode selection r page 240

4.5.5 Setting the frequency using an analog signal (current input)

- Point P
 - Use **FWD** or **REV** on the operation panel (FR-DU08) to give a start command.
 - Use the current regulator which outputs 4 to 20 mA to give a frequency command (by connecting it across terminals 4 and 5 (current input)).
 - Turn ON the AU signal.
 - Set Pr.79 Operation mode selection = "4" (External/PU combination operation mode 2).

[Connection diagram]



The following shows the procedure to operate at 60 Hz.

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- 2. Changing the operation mode Set "4" in **Pr.79**. [PU] and [EXT] indicators are ON. (To change the setting, refer to page 116.)
- **3.** Selecting the input via terminal 4 Turn ON the Terminal 4 input selection (AU) signal. Input via terminal 4 to the inverter is enabled.
- 4. Start

Press **FWD** or **REV**. [FWD] or [REV] indicator blinks as no frequency command is given.

5. Acceleration \rightarrow constant speed

Input a current of 20 mA to the inverter from the regulator. The frequency value on the monitor increases according to the setting of **Pr.7 Acceleration time**, and " $\Box \Box \Box \Box$ " (60.00 Hz) appears on the monitor.

6. Deceleration

Input a current of 4 mA or less. The frequency value on the monitor decreases according to the setting of **Pr.8 Deceleration time**, the monitor displays "[],[],[]," (0.00 Hz), and the motor stops rotating. [FWD] or [REV] indicator blinks.

7. Stop

Press STOP . [FWD] or [REV] indicator turns OFF.

NOTE

- Pr.184 AU terminal function selection must be set to "4 (initial value)" (AU signal).
- To change the frequency (60 Hz) at the maximum current input (initial value: 20 mA), adjust **Pr.126 Terminal 4 frequency** setting gain frequency.
- To change the frequency (0 Hz) at the minimum current input (initial value: 4 mA), adjust the calibration parameter C5 Terminal 4 frequency setting bias frequency.

Parameters referred to Pr.7 Acceleration time, Pr.8 Deceleration time [™] page 228 Pr.79 Operation mode selection [™] page 240 Pr.126 Terminal 4 frequency setting gain frequency [™] page 357 Pr.184 AU terminal function selection [™] page 373 C5(Pr.904) Terminal 4 frequency setting bias frequency [™] page 357

4.6 Basic operation procedure (External operation)

Select a method to give the frequency command from the list below, and refer to the specified page for its procedure.

| Method to give the frequency command | | | | | | |
|---|-----|--|--|--|--|--|
| Setting the frequency on the operation panel in the frequency setting mode | 129 | | | | | |
| Turning ON/OFF switches wired to inverter's terminals (multi-speed setting) | 130 | | | | | |
| Setting the frequency by inputting voltage signals | 131 | | | | | |
| Setting the frequency by inputting current signals | 134 | | | | | |

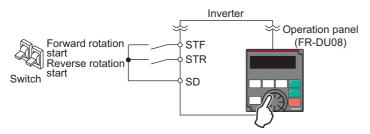
4.6.1 Setting the frequency on the operation panel

Point P

Turn ON the STF/STR signal to give a start command.

- Use on the operation panel (FR-DU08) to give a frequency command.
- Set Pr.79 = "3" (External/PU combined operation mode 1).

[Connection diagram]



The following shows the procedure to operate at 30 Hz.

Operating procedure

- Changing the operation mode Set "3" in Pr.79. [PU] and [EXT] indicators are ON. (To change the setting, refer to page 116.)
- **2.** Setting the frequency

Turn 🞲 until the target frequency " - [] [] [] (30.00 Hz) appears. The indication blinks for about five seconds.

While the indication is flashing, press set to confirm the selection for the frequency. "F" and " $\exists \square \square \square$ " are displayed alternately. After about three seconds of alternate display, the monitor display goes back to " $\square \square \square$ " (the indication of a monitored value). (If set is not pressed during the flashing for about five seconds, the monitor

display goes back to "

3. Start \rightarrow acceleration \rightarrow constant speed

Turn ON the start switch (STF/STR signal). The frequency value on the monitor increases according to the setting of **Pr.7 Acceleration time**, and " $\exists \Box \Box \Box \Box$ " (30.00 Hz) appears on the monitor. [FWD] indicator is ON during the forward rotation, and [REV] indicator is ON during the reverse rotation. (To change the set frequency, return to step 2. The previously set frequency appears.)

4. Deceleration \rightarrow stop



- When both the forward rotation start switch (STF signal) and the reverse rotation start switch (STR signal) are turned ON, the motor cannot be started. If both are turned ON while the inverter is running, the inverter decelerates to a stop.
- Pr.178 STF terminal function selection must be set to "60" (or Pr.179 STR terminal function selection must be set to "61") (initial value).
- Setting Pr.79 Operation mode selection = "3" enables multi-speed operation.
- If STOP RESET on the operation panel is pressed during the External operation, the inverter stops and the PU stop warning is

activated (" 7 5" appears on the LCD display of the operation panel). To reset the PU stop warning, turn OFF the start switch

(STF or STR signal), and then press $\left\|\frac{PU}{EXT}\right\|$ (refer to page 199).

Parameters referred to

Pr.4 to Pr.6 Multi-speed setting F page 263, Pr.7 Acceleration time, Pr.8 Deceleration time r page 228

Pr.178 STF terminal function selection, Pr.179 STR terminal function selection 🖙 page 373

Pr.79 Operation mode selection Car page 240

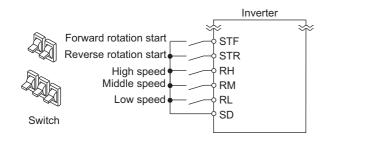
4.6.2 Setting the frequency and giving a start command with switches (multi-speed setting) (Pr.4 to Pr.6)

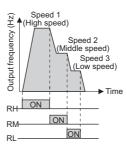


Turn ON the STF/STR signal to give a start command.

• Turn ON the RH, RM, or RL signal to give a frequency command (multi-speed setting).

[Connection diagram]





The following shows the procedure to operate at a high speed (60 Hz).

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- **2.** Setting the frequency Turn ON the high-speed switch (RH signal).
- **3.** Start \rightarrow acceleration \rightarrow constant speed

4. Deceleration \rightarrow stop

Turn OFF the start switch (STF/STR signal). The frequency value on the monitor decreases according to the setting of **Pr.8 Deceleration time**, the monitor displays "[], [], [], (0.00 Hz), and the motor stops rotating. [FWD] or [REV] indicator turns OFF. Turn OFF the high-speed switch (RH signal).



- When both the forward rotation start switch (STF signal) and the reverse rotation start switch (STR signal) are turned ON, the motor cannot be started. If both are turned ON while the inverter is running, the inverter decelerates to a stop.
- Initially, the high-speed switch (RH signal) is set to 60 Hz for the FM type inverter or 50 Hz for the CA type inverter. The middlespeed switch (RM signal) is set to 30 Hz, and the low-speed switch (RL signal) is set to 10 Hz. (To change the settings, use **Pr.4**, **Pr.5**, and **Pr.6**, respectively.)
- In the initial setting, if two or more speed switches (signals) are simultaneously turned ON, priority is given to the switch (signal) for the lower speed. For example, when both RH and RM signals turn ON, the RM signal (**Pr.5**) has the higher priority.
- Up to 15-speed switching operation can be performed.

Parameters referred to

Pr.4 to Pr.6 (Multi-speed setting) ☞ page 263 Pr.7 Acceleration time, Pr.8 Deceleration time ☞ page 228

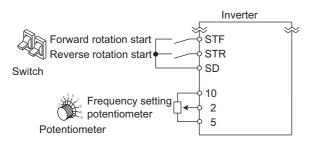
4.6.3 Setting the frequency using an analog signal (voltage input)

Point P

- Turn ON the STF/STR signal to give a start command.
- Use the frequency setting potentiometer to give a frequency command (by connecting it across terminals 2 and 5 (voltage input)).

[Connection diagram]

(The inverter supplies 5 V power to the frequency setting potentiometer via terminal 10.)



The following shows the procedure to operate at 60 Hz.

Operating procedure

- **1.** Turning ON the power of the inverter
 - The operation panel is in the monitor mode.
- 2. Start

Turn ON the start switch (STF/STR signal). [FWD] or [REV] indicator blinks as no frequency command is given.

3. Acceleration \rightarrow constant speed

Turn the frequency setting potentiometer clockwise slowly to full. The frequency value on the monitor increases according to the setting of **Pr.7 Acceleration time**, and " \Box \Box \Box " (60.00 Hz) appears on the monitor. [FWD] indicator is ON during the forward rotation, and [REV] indicator is ON during the reverse rotation.

4. Deceleration

Turn the frequency setting potentiometer counterclockwise slowly to full. The frequency value on the monitor decreases according to the setting of **Pr.8 Deceleration time**, the monitor displays "[],[],[]," (0.00 Hz), and the motor stops rotating. [FWD] or [REV] indicator blinks.

5. Stop

Turn OFF the start switch (STF/STR signal). [FWD] or [REV] indicator turns OFF.



- When both the forward rotation start switch (STF signal) and the reverse rotation start switch (STR signal) are turned ON, the motor cannot be started. If both are turned ON while the inverter is running, the inverter decelerates to a stop.
- Pr.178 STF terminal function selection must be set to "60" (or Pr.179 STR terminal function selection must be set to "61") (initial value).
- When terminal 10 is used, the maximum output frequency may fluctuate in a range of ±6 Hz due to fluctuations in the output voltage (5 ±0.5 VDC). Use **Pr. 125** or **Pr. C4** to adjust the output frequency at the maximum analog input as required. (Refer to page 357.)
- When terminal 10E is used, the maximum output frequency may fluctuate (in a range of ±2 to 3 Hz) due to fluctuations in the output voltage (10 ±0.4 VDC). Use Pr. 125 or Pr. C4 to adjust the output frequency at the maximum analog input as required. (Refer to page 357.)

Parameters referred to

Pr.7 Acceleration time, Pr.8 Deceleration time Page 228 Pr.178 STF terminal function selection, Pr.179 STR terminal function selection Page 373

4.6.4 Changing the frequency (60 Hz, initial value) at the maximum voltage input (5 V, initial value)

Point P

Change the maximum frequency.

The following shows the procedure to change the frequency at 5 V from 60 Hz (initial value) to 50 Hz using a frequency setting potentiometer for 0 to 5 VDC input. Set 50 Hz in **Pr.125** so that the inverter outputs 50 Hz at 5 V input.

Operating procedure

1. Selecting the parameter

Turn 🕄 until "₽. |25" (**Pr.125**) appears.

Press SET to read the present set value. (60.00 Hz)

2. Changing the maximum frequency

Turn O to change the set value to " $\Box \Box \Box$ ". (50.00 Hz)

Press SET to confirm the selection. "5000" and "P. 125" are displayed alternately.

3. Selecting the mode and the monitor item

Press MODE three times to select the monitor mode, and change the monitor item to the frequency.

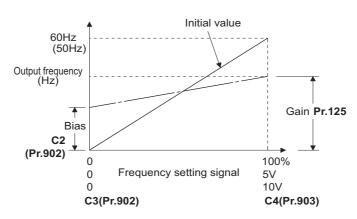
4. Start

Turn ON the start switch (STF/STR signal), and turn the frequency setting potentiometer clockwise slowly to full. (Refer to steps 2 and 3 in 4.6.3.)

The motor is operated at 50 Hz.



• To change the frequency at the input of 0 V (minimum voltage), use the calibration parameter C2.



• Other adjustment methods for the frequency setting voltage gain are the following: adjustment by applying a voltage directly across terminals 2 and 5, and adjustment using a specified point without applying a voltage across terminals 2 and 5. (Refer to page 357.)

Parameters referred to

Pr.125 Terminal 2 frequency setting gain frequency S[™] page 357 C2 (Pr.902) Terminal 2 frequency setting bias frequency S[™] page 357 C4 (Pr.903) Terminal 2 frequency setting gain S[™] page 357

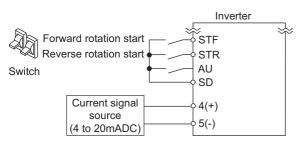
4.6 Basic operation procedure (External operation)

4.6.5 Setting the frequency using an analog signal (current input)

Point P

- Turn ON the STF/STR signal to give a start command.
- Turn ON the AU signal.
- Set Pr.79 Operation mode selection = "2" (External operation mode).

[Connection diagram]



The following shows the procedure to operate at 60 Hz.

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- **2.** Selecting the input via terminal 4 Turn ON the Terminal 4 input selection (AU) signal. Input via terminal 4 to the inverter is enabled.
- 3. Start

Turn ON the start switch (STF/STR signal). [FWD] or [REV] indicator blinks as no frequency command is given.

4. Acceleration \rightarrow constant speed

Input a current of 20 mA to the inverter from the regulator. The frequency value on the monitor increases according to the setting of **Pr.7 Acceleration time**, and " $\Box \Box \Box \Box$ " (60.00 Hz) appears on the monitor. [FWD] indicator is ON during the forward rotation, and [REV] indicator is ON during the reverse rotation.

5. Deceleration

Input a current of 4 mA or less. The frequency value on the monitor decreases according to the setting of **Pr.8 Deceleration time**, the monitor displays "[][][]" (0.00 Hz), and the motor stops rotating. [FWD] or [REV] indicator blinks.

6. Stop

Turn OFF the start switch (STF/STR signal). [FWD] or [REV] indicator turns OFF.

NOTE

- When both the forward rotation start switch (STF signal) and the reverse rotation start switch (STR signal) are turned ON, the motor cannot be started. If both are turned ON while the inverter is running, the inverter decelerates to a stop.
- Pr.184 AU terminal function selection must be set to "4 (initial value)" (AU signal).

Parameters referred to

Pr.7 Acceleration time, Pr.8 Deceleration time 🖙 page 228 Pr.184 AU terminal function selection 🖙 page 373

4.6.6 Changing the frequency (60 Hz, initial value) at the maximum current input (at 20 mA, initial value)

Point P

Change the maximum frequency.

The following shows the procedure to change the frequency at 20 mA from 60 Hz (initial value) to 50 Hz using a frequency setting potentiometer for 4 to 20 mA input. Set 50 Hz in **Pr.126** so that the inverter outputs 50 Hz at 20 mA input.

Operating procedure

1. Selecting the parameter

Turn 💭 until "P. 125" (**Pr.126**) appears.

Press SET to read the present set value (60.00 Hz).

2. Changing the maximum frequency

Turn O to change the set value to " $\Box \Box \Box$ " (50.00 Hz).

Press SET to confirm the selection. "5[]] and "P. [26] are displayed alternately.

3. Selecting the mode and the monitor item

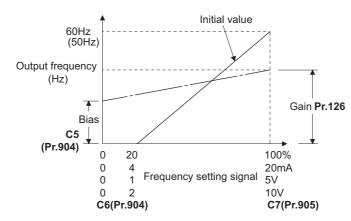
Press MODE three times to select the monitor mode and to monitor a frequency.

4. Start

Turn ON the start switch (STF or STR) to apply a 20 mA current (refer to steps 3 and 4 in 4.6.5). Operate at 50 Hz.

NOTE

• To change the frequency at the input of 4 mA (minimum current), use the calibration parameter C5.



 Other adjustment methods for the frequency setting current gain are the following: adjustment by applying a current through terminals 4 and 5, and adjustment using a specified point without applying a current through terminals 4 and 5. (Refer to page 357.)

Parameters referred to

Pr.126 Terminal 4 frequency setting gain frequency 5 page 357 C5 (Pr.904) Terminal 4 frequency setting bias frequency 5 page 357 C7 (Pr.905) Terminal 4 frequency setting gain 9 page 357

4.7 Basic operation procedure (JOG operation)

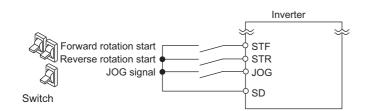
4.7.1 Giving a start command by using external signals for JOG operation

Point *P*

JOG operation is performed while the JOG signal is ON.

- Use Pr.15 Jog frequency to set a frequency, and set Pr.16 Jog acceleration/deceleration time to set the acceleration/ deceleration time for JOG operation.
- Set Pr.79 Operation mode selection = "2" (External operation mode).

[Connection diagram]



The following shows the procedure to operate at 5 Hz.

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- **2.** Turning ON the JOG signal Turn ON the JOG switch (JOG signal). The inverter is set ready for the JOG operation.
- **3.** Start \rightarrow acceleration \rightarrow constant speed

Turn ON the start switch (STF/STR signal). The frequency increases according to the setting of **Pr.16 Jog acceleration/deceleration time**, and "5,00 Hz) appears on the LCD display. [FWD] indicator is ON during the forward rotation, and [REV] indicator is ON during the reverse rotation.

4. Deceleration \rightarrow stop

Turn OFF the start switch (STF/STR signal). The frequency decreases according to the setting of **Pr.16 Jog acceleration/deceleration time**. "[][][]" (0.00 Hz) appears on the LCD display, and the motor stops rotating. [FWD] or [REV] indicator turns OFF. Turn OFF the JOG switch (JOG signal).

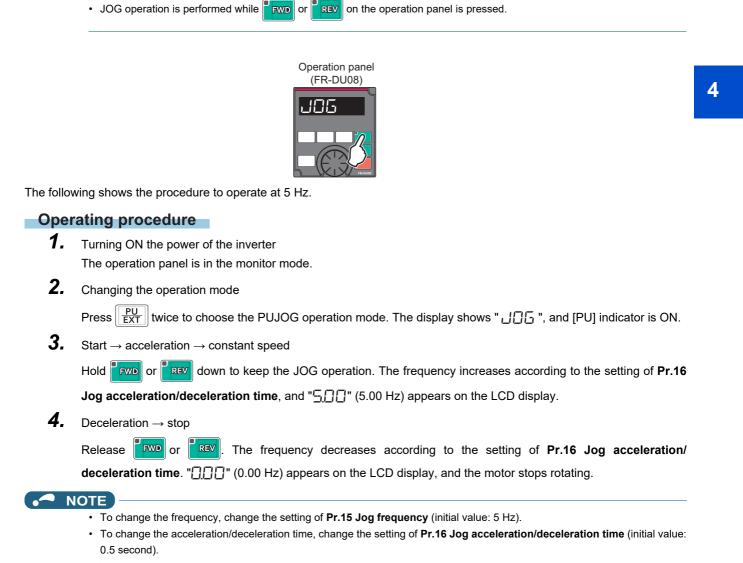
NOTE

- To change the frequency, change the setting of **Pr.15 Jog frequency** (initial value: 5 Hz).
- To change the acceleration/deceleration time, change the setting of **Pr.16 Jog acceleration/deceleration time** (initial value: 0.5 second).

Parameters referred to

Pr.15 Jog frequency, Pr.16 Jog acceleration/deceleration time 🖙 page 261 Pr.79 Operation mode selection 🖙 page 240

4.7.2 Giving a start command from the operation panel for JOG operation



Parameters referred to

Point P

Pr.15 Jog frequency, Pr.16 Jog acceleration/deceleration time 3 page 261

MEMO

CHAPTER 5 PARAMETERS

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| 5.8 | (M) Item and output signal for monitoring | |
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| 5.17 | Checking parameters changed from their initial values (initial value change list) | |
| | | |

This chapter explains the function setting for use of this product.

Always read the instructions before use.

The following marks are used to indicate the controls. (Parameters without any mark are valid for all the controls.)

| Mark | Control method | Applied motor | | | | |
|---------------|---------------------------------------|-----------------------------|--|--|--|--|
| | V/F control | Three phase induction motor | | | | |
| Magneticiflux | Advanced magnetic flux vector control | Three-phase induction motor | | | | |
| PM | PM motor control | PM motor | | | | |

The setting range and the initial value of parameters differ depending on the structure or functions of the inverter. The following common designations are used for each type of the inverter models.

| Inverter model | Common designation |
|----------------|--------------------------|
| FR-F8[]0 | Standard model |
| FR-F8[]2 | Separated converter type |
| FR-F8[]6 | IP55 compatible model |

5.1 Parameter list

5.1.1 Parameter list (by parameter number)

For simple variable-speed operation of the inverter, the initial values of the parameters may be used as they are. Set the necessary parameters to meet the load and operational specifications. Parameter's setting, change and check can be made on the operation panel (FR-DU08).



- Simple indicates simple mode parameters. Use **Pr.160 User group read selection** to indicate the simple mode parameters only.
- The changing of the parameter settings may be restricted in some operating status. Use **Pr.77 Parameter write selection** to change the setting of the restriction.
- Refer to page 668 for instruction codes for communication and availability of Parameter clear, all clear, and Parameter copy.

| _ | _ | Pr. | | | Minimum | Initia | value | Refer | Customer | | | | |
|--------------------------------|-----|------------------------------|---|----------------------------|----------------------|---|--------------------|-------------|----------|------|--|-----|--|
| Function | Pr. | group | Name | Setting range | setting increments | FM | СА | to page | setting | | | | |
| | | | | | | 6% ^{*1} | | | | | | | |
| | | | | 0% to 30% | | 4% ^{*1} | | | | | | | |
| | 0 | 0 G000 т | Torque boost | | 0.1% | 3% ^{*1} | | 551 | | | | | |
| | - | | | | | 2% ^{*1} | | | | | | | |
| | | | | | | 1.5% ^{*1} | | | | | | | |
| | | | | | | 1% ^{*1} | | | | | | | |
| | 1 | H400 | Maximum frequency Simple | 0 to 120 Hz | 0.01 Hz | 120 Hz | | 287 | | | | | |
| | | | | | | 60 Hz [*] | 3 | | | | | | |
| _ | 2 | H401 | Minimum frequency Simple | 0 to 120 Hz | 0.01 Hz | 0 Hz | | 287 | | | | | |
| tion | 3 | G001 | Base frequency Simple | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 552 | | | | | |
| Basic function | 4 | D301 | Multi-speed setting (high speed) Simple | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 263 | | | | | |
| asio | 5 | D302 | Multi-speed setting (middle | 0 to 590 Hz | 0.01 Hz | 30 Hz | | 263 | | | | | |
| ш | - | | speed) <u>Simple</u> | | 0.01.12 | | | | | | | | |
| | 6 | D303 | Multi-speed setting (low speed) <u>Simple</u> | 0 to 590 Hz | 0.01 Hz | 10 Hz | | 263 | | | | | |
| | 7 | F010 | Acceleration time Simple | 0 to 3600 s | 0.1 s | 5 s ^{*4} | | 228 | | | | | |
| | • | | | | 0.10 | | 15 s ^{*5} | | | | | | |
| | 8 | F011 | Deceleration time Simple | 0 to 3600 s | 0.1 s | 10 s ^{*4} | 228 | | | | | | |
| | | | | | | 30 s ^{*5} | | | | | | | |
| | | H000 | Electronic thermal O/L | 0 to 500 A ^{*2} | 0.01 A ^{*2} | Inverter rated | | 266, | | | | | |
| | 9 | C103 | relay Simple | 0 to 3600 A ^{*3} | 0.1 A ^{*3} | curren | 1383 | | | | | | |
| | | | Rated motor current Simple | | | | | 002 | | | | | |
| rake | 10 | G100 | DC injection brake operation frequency | 0 to 120 Hz, 9999 | 0.01 Hz | 3 Hz | | 3 Hz | | 3 Hz | | 560 | |
| DC injection brake | 11 | G101 | DC injection brake operation time | 0 to 10 s, 8888 | 0.1 s | 0.5 s | | 560 | | | | | |
| nject | | DC injection brake operation | | | 4% ^{*6} | | | | | | | | |
| C ir | 12 | G110 | voltage | 0% to 30% | 0.1% | 2% ^{*6} | | 560 | | | | | |
| | | | - | | | 1% ^{*6} | | | | | | | |
| — | 13 | F102 | Starting frequency | 0 to 60 Hz | 0.01 Hz | 0.5 Hz | | 238, 239 | | | | | |
| — | 14 | G003 | Load pattern selection | 0, 1, 12 to 15 | 1 | 1 | | 554 | | | | | |
| ion | 15 | D200 | Jog frequency | 0 to 590 Hz | 0.01 Hz | 5 Hz | | 261 | | | | | |
| JOG operation | 16 | F002 | Jog acceleration/ deceleration time | 0 to 3600 s | 0.1 s | 0.5 s | | 261 | | | | | |
| _ | 17 | T720 | MRS input selection | 0, 2, 4 | 1 | 0 | | 375 | | | | | |
| _ | 18 | H402 | High speed maximum frequency | 0 to 590 Hz | 0.01 Hz | 120 Hz ^{*2} 60 Hz ^{*3} | | 287 | | | | | |
| _ | 19 | G002 | Base frequency voltage | 0 to 1000 V, 8888, 9999 | 0.1 V | 9999 | 8888 | 552 | | | | | |
| a | 20 | F000 | Acceleration/deceleration | 1 to 590 Hz | 0.01 Hz | 60 H- | 50 Hz | 228 | | | | | |
| n tin | 20 | F000 | reference frequency | | U.UI TZ | 00 112 | JU 172 | 220 | | | | | |
| Acceleration/deceleration time | 21 | F001 | Acceleration/deceleration time increments | 0, 1 | 1 | 0 | | 228 | | | | | |

| | Pr. | Pr. | | Setting range | Minimum | Initial value | | Refer | Customer |
|---------------------|-------------|-----------------|--|---|-----------------------|---------------|------|-------------|----------|
| Function | | group | p Name | | setting increments | FM | CA | to page | setting |
| ntion | 22 | H500 | Stall prevention operation level | 0% to 400% | 0.1% | 120% | 110% | 290 | |
| Stall prevention | 23 | H610 | Stall prevention operation level compensation factor at double speed | 0% to 200%, 9999 | 0.1% | 9999 | | 290 | |
| Multi-speed setting | 24 to 27 | D304 to D307 | Multi-speed setting (speed 4 to speed 7) | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 263 | |
| _ | 28 | D300 | Multi-speed input compensation selection | 0, 1 | 1 | 0 | | 263 | |
| _ | 29 | F100 | Acceleration/deceleration pattern selection | 0 to 3, 6 | 1 | 0 | | 231 | |
| | | | Regenerative function | 0 to 2, 10, 11, 20, 21, 100 to 102, 110, 111, 120, 121 ^{*10} | 1 | 0 | | | |
| _ | 30 E300 | E300 selection | 2, 10, 11, 102, 110, 111 ^{*11} | 1 | 10 | | 566 | | |
| | | | | 0, 2, 10, 20, 100, 102, 110, 120 ^{*12} | 1 | 0 | | | |
| đ | 31 | H420 | Frequency jump 1A | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 289 | |
| jum | 32 | H421 | Frequency jump 1B | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 289 | |
| رک دک | 33 | H422 | Frequency jump 2A | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 289 | |
| Frequency jump | 34 | H423 | Frequency jump 2B | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 289 | |
| edr | 35 | H424 | Frequency jump 3A | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 289 | |
| Ľ | 36 | H425 | Frequency jump 3B | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 289 | |
| — | 37 | M000 | Speed display | 0, 1 to 9998 | 1 | 0 | | 303 | |
| u | 41 | M441 | Up-to-frequency sensitivity | 0% to 100% | 0.1% | 10% | | 337 | |
| ectio | 42 | M442 | Output frequency detection | 0 to 590 Hz | 0.01 Hz | 6 Hz | | 337 | |
| Frequency detection | 43 | M443 | Output frequency detection for reverse rotation | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 337 | |
| | 44 | F020 | Second acceleration/ deceleration time | 0 to 3600 s | 0.1 s | 5 s | | 228 | |
| | 45 | F021 | Second deceleration time | 0 to 3600 s, 9999 | 0.1 s | 9999 | | 228 | |
| | 46 | G010 | Second torque boost | 0% to 30%, 9999 | 0.1% | 9999 | | 551 | |
| ion | 47 | G011 | Second V/F (base frequency) | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 552 | |
| funct | 48 | H600 | Second stall prevention operation level | 0% to 400% | 0.1% | 120% | 110% | 290 | |
| Second function | 49 | H601 | Second stall prevention operation frequency | 0 to 590 Hz, 9999 | 0.01 Hz | 0 Hz | | 290 | |
| Ň | 50 | M444 | Second output frequency detection | 0 to 590 Hz | 0.01 Hz | 30 Hz | | 337 | |
| | - 4 | H010 | H010 Second electronic thermal O/ 0 to 500 A, 9999 ^{*2} | 0 to 500 A, 9999 ^{*2} | 0.01 A ^{*2} | 9999 | | 266, | |
| | 51 | C203 | L relay Rated second motor current | 0 to 3600 A, 9999 ^{*3} | 0.1 A ^{*3} | | | 383, 392 | |

| | | Pr. Pr. group Name | | Minimum | Initial value | | Refer | Customer | |
|---------------------|----------|--------------------|---|--|---|-------------------|-------|-----------------------------|---------|
| Function | Pr. | | Name Setting range | Setting range | setting increments | FM | CA | to page | setting |
| ction | 52 | M100 | Operation panel main monitor selection | 0, 5 to 14, 17, 18, 20, 23 to 25, 34, 38, 40 to 45, 50 to 57, 61, 62, 64, 67 to 69, 81 to 96, 98, 100 | 1 | 0 | | 305, 533 | |
| Monitoring function | 54 | M300 | FM/CA terminal function selection | 1 to 3, 5 to 14, 17, 18, 21, 24, 34, 50, 52, 53, 61, 62, 67, 69, 70, 85, 87 to 90, 92, 93, 95, 98 | 1 | 1 | | 314 | |
| Mon | 55 | M040 | Frequency monitoring reference | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 314 | |
| | 56 | M041 | Current monitoring reference | 0 to 500 A ^{*2} 0 to 3600 A ^{*3} | 0.01 A ^{*2} 0.1 A ^{*3} | Inverte curren | | 314 | |
| start | 57 | A702 | Restart coasting time | 0, 0.1 to 30 s, 9999 | 0.1 s | 9999 | | 466, 472 | |
| Automatic restart | 58 | A703 | Restart cushion time | 0 to 60 s | 0.1 s | 1 s | | 466 | |
| — | 59 | F101 | Remote function selection | 0 to 3, 11 to 13 | 1 | 0 | 0 | | |
| _ | 60 | G030 | Energy saving control selection | 0, 4, 9 | 1 | 0 | | 557 | |
| | 65 | H300 | Retry selection | 0 to 5 | 1 | 0 | | 276 | |
| _ | 66 | H611 | Stall prevention operation reduction starting frequency | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 290 | |
| Retry | 67 | H301 | Number of retries at fault occurrence | 0 to 10, 101 to 110 | 1 | 0 | | 276 | |
| Re | 68 | H302 | Retry waiting time | 0.1 to 600 s | 0.1 s | 1 s | | 276 | |
| | 69 70 | H303 G107 | Retry count display erase Parameter for manufacturer sett | 0 | 1 | 0 | | 276 | |
| _ | 71 | C100 | Applied motor | 0 to 6, 13 to 16, 20, 23, 24, 40, 43, 44, 50, 53, 54, 70, 73, 74, 210, 213, 214, 240, 243, 244, 8090, 8093, 8094, 9090, 9093, 9094 ^{*10*11} 0 to 6, 13 to 16, 20, 23, 24, 40, 43, 44, 50, 53, 54, 70, 73, 74, 8090, 8093, 8094, 9090, 9093, 9094 ^{*12} | 1 | 0 | | 177, 379, 383, 392 | |
| - | 72 | E600 | PWM frequency selection | 0 to 15 ^{*2} 0 to 6, 25 ^{*3} | 1 | 2 | | 218 | |
| _ | 73 | тооо | Analog input selection | 0 to 7, 10 to 17 | 1 | 1 | | 349, 353 | |
| — | 74 | T002 | Input filter time constant | 0 to 8 | 1 | 1 | | 355 | |
| _ | 75 | _ | Reset selection/ disconnected PU detection/ PU stop selection | 0 to 3, 14 to 17, 1000 to 1003, 1014 to 1017 ^{*2} 0 to 3, 14 to 17, 100 to 103, 114 to 117, 1000 to 1003, 1014 to 1017, 1100 to 1103, 1114 to 1117 ^{*3} | 1 | 14 | | 196 | |
| | | E100 | Reset selection | 0 to 3 | | 0 | | | |
| | | E101 | Disconnected PU detection | 0, 1 | | | | - | |
| | | E102 | PU stop selection | 0*2 | | 1 | | - | |
| | | E107 | Reset limit | 0 ^{*2} 0, 1 ^{*3} | 1 | 0 | | | |
| — | 76 | M510 | Fault code output selection | 0 to 2 | 1 | 0 | | 345 | |
| | 77 | E400 | Parameter write selection | 0 to 2 | 1 | 0 | | 206 | |

| | | Pr. | | | Minimum | Initial | value | Refer | Customer |
|-------------------------|------------|--------------|--|----------------------------------|---|--|-------------|---------------------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | СА | to page | setting |
| — | 78 | D020 | Reverse rotation prevention selection | 0 to 2 | 1 | 0 | | 257 | |
| — | 79 | D000 | Operation mode selection Simple | 0 to 4, 6, 7 | 1 | 0 | | 240, 250 | |
| | | | | 0.4 to 55 kW, 9999 ^{*2} | 0.01 kW ^{*2} | | | 177, | |
| | 80 | C101 | Motor capacity | 0 to 3600 kW, 9999 ^{*3} | 0.1 kW ^{*3} | 9999 | | 383, 392 | |
| Motor constant | 81 | C102 | Number of motor poles | 2, 4, 6, 8, 10, 12, 9999 | 1 | 9999 | | 177, 383, 392 | |
| suo: | 82 | C125 | Motor excitation current | 0 to 500 A, 9999 ^{*2} | 0.01 A ^{*2} | 9999 | | 383 | |
| for c | •- | | | 0 to 3600 A, 9999 ^{*3} | 0.1 A ^{*3} | | | | |
| Mot | 83 | C104 | Rated motor voltage | 0 to 1000 V | 0.1 V | 200 V [*] 400 V [*] | | 177, 383, 392 | |
| - | 84 | C105 | Rated motor frequency | 10 to 400 Hz, 9999 | 0.01 Hz | 9999 | | 177, 383, 392 | |
| _ | 85 | G201 | Excitation current break point | 0 to 400 Hz, 9999 | 0.01 Hz | 9999 | | 555 | |
| _ | 86 | G202 | Excitation current low-speed scaling factor | 0% to 300%, 9999 | 0.1% | 9999 | | 555 | |
| | 89 | G932 | Speed control gain (Advanced magnetic flux vector) | 0% to 200%, 9999 | 0.1% | 9999 | | 180 | |
| | | 0400 | Madama and the (D4) | 0 to 50 Ω, 9999 ^{*2} | 0.001 Ω ^{*2} | 9999 | 383, | | |
| | 90 | C120 | Motor constant (R1) | 0 to 400 mΩ, 9999 ^{*3} | 0.01 mΩ ^{*3} | | 392, 474 | | |
| | 91 | C121 | Motor constant (R2) | 0 to 50 Ω, 9999 ^{*2} | 0.001 Ω ^{*2} | 9999 | | 383 | |
| ant | 31 | 0121 | Motor constant (KZ) | 0 to 400 mΩ, 9999 ^{*3} | 0.01 mΩ ^{*3} | 9999 | | 303 | |
| Motor constant | 92 | C122 | Motor constant (L1)/d-axis | 0 to 6000 mH, 9999 ^{*2} | 0.1 mH ^{*2} | 9999 | | 383, | |
| or co | | | inductance (Ld) | 0 to 400 mH, 9999 ^{*3} | 0.01 mH ^{*3} | | | 392 | |
| Mote | 93 | C123 | Motor constant (L2)/q-axis | 0 to 6000 mH, 9999 ^{*2} | 0.1 mH ^{*2} | 9999 | | 383, | |
| _ | | | inductance (Lq) | 0 to 400 mH, 9999 ^{*3} | 0.01 mH ^{*3} | | | 392 | |
| | 94 | C124 | Motor constant (X) | 0% to 100%, 9999 | 0.1% ^{*2} 0.01% ^{*3} | 9999 | | 383 | |
| - | 95 | C111 | Online auto tuning selection | 0, 1 | 1 | 0 | | 400 | |
| | 96 | C110 | Auto tuning setting/status | 0, 1, 11, 101 | 1 | 0 | | 383, 392, 474 | |
| | 100 | G040 | V/F1 (first frequency) | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 558 | |
| | 101 | G041 | V/F1 (first frequency voltage) | 0 to 1000 V | 0.1 V | 0 V | | 558 | |
| V/F | 102 | G042 | V/F2 (second frequency) | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 558 | |
| oints | 103 | G043 | V/F2 (second frequency voltage) | 0 to 1000 V | 0.1 V | 0 V | | 558 | |
| 5 | 104 | G044 | V/F3 (third frequency) | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 558 | |
| able | 105 | G045 | V/F3 (third frequency voltage) | 0 to 1000 V | 0.1 V | 0 V 0000 | | 558 | |
| Adjustable 5 points V/F | 106 107 | G046 G047 | V/F4 (fourth frequency) V/F4 (fourth frequency | 0 to 590 Hz, 9999 0 to 1000 V | 0.01 Hz 0.1 V | 9999 0 V | | 558 558 | |
| 4 | 108 | G048 | voltage) V/F5 (fifth frequency) | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 558 | |
| | 109 | G049 | V/F5 (fifth frequency voltage) | 0 to 1000 V | 0.1 V | 0 V | | 558 | |
| | 111 | F031 | Check valve deceleration time | 0 to 3600 s, 9999 | 0.1 s | 9999 | | 459 | |

| | | Pr. | | | Minimum | Initial | value | Refer | Customer |
|----------------------------|-----|-------|--|--|-----------------------|---------|-------|---------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| | 117 | N020 | PU communication station number | 0 to 31 | 1 | 0 | | 505 | |
| | 118 | N021 | PU communication speed | 48, 96, 192, 384, 576, 768, 1152 | 1 | 192 | | 505 | |
| u | | _ | PU communication stop bit length / data length | 0, 1, 10, 11 | | 1 | | | |
| Inicat | 119 | N022 | PU communication data length | 0, 1 | 1 | 0 | | 505 | |
| ommu | | N023 | PU communication stop bit length | 0, 1 | | 1 | | | |
| ctor c | 120 | N024 | PU communication parity check | 0 to 2 | 1 | 2 | | 505 | |
| PU connector communication | 121 | N025 | PU communication retry count | 0 to 10, 9999 | 1 | 1 | | 505 | |
| P | 122 | N026 | PU communication check time interval | 0, 0.1 to 999.8 s, 9999 | 0.1 s | 9999 | | 505 | |
| | 123 | N027 | PU communication waiting time setting | 0 to 150 ms, 9999 | 1 ms | 9999 | | 505 | |
| | 124 | N028 | PU communication CR/LF selection | 0 to 2 | 1 | 1 | | 505 | |
| — | 125 | T022 | Terminal 2 frequency setting gain frequency Simple | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 357 | |
| — | 126 | T042 | Terminal 4 frequency setting gain frequency Simple | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 357 | |
| | 127 | A612 | PID control automatic switchover frequency | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | 1 | 419 | |
| PID operation | 128 | A610 | PID action selection | 0, 10, 11, 20, 21, 50, 51, 60, 61, 70, 71, 80, 81, 90, 91, 100, 101, 1000, 1001, 1010, 1011, 2000, 2001, 2010, 2011 | 1 | 0 | | 419 | |
| Ō | 129 | A613 | PID proportional band | 0.1% to 1000%, 9999 | 0.1% | 100% | | 419 | |
| E | 130 | A614 | PID integral time | 0.1 to 3600 s, 9999 | 0.1 s | 1 s | | 419 | |
| | 131 | A601 | PID upper limit | 0% to 100%, 9999 | 0.1% | 9999 | | 419 | |
| - | 132 | A602 | PID lower limit | 0% to 100%, 9999 | 0.1% | 9999 | | 419 | |
| - | 133 | A611 | PID action set point | 0% to 100%, 9999 | 0.01% | 9999 | | 419 | |
| - | 134 | A615 | PID differential time | 0.01 to 10 s, 9999 | 0.01 s | 9999 | | 419 | |
| | 135 | A000 | Electronic bypass sequence selection | 0, 1 | 1 | 0 | | 404 | |
| | 136 | A001 | MC switchover interlock time | 0 to 100 s | 0.1 s | 1 s | | 404 | |
| Bypass | 137 | A002 | Start waiting time | 0 to 100 s | 0.1 s | 0.5 s | | 404 | |
| yp | 138 | A003 | Bypass selection at a fault | 0, 1 | 1 | 0 | | 404 | |
| | 139 | A004 | Automatic switchover frequency from inverter to bypass operation | 0 to 60 Hz, 8888, 9999 | 0.01 Hz | 9999 | | 404 | |
| ure | 140 | F200 | Backlash acceleration stopping frequency | 0 to 590 Hz | 0.01 Hz | 1 Hz | | 231 | |
| meas | 141 | F201 | Backlash acceleration stopping time | 0 to 360 s | 0.1 s | 0.5 s | | 231 | |
| Backlash measure | 142 | F202 | Backlash deceleration stopping frequency | 0 to 590 Hz | 0.01 Hz | 1 Hz | | 231 | |
| Bac | 143 | F203 | Backlash deceleration stopping time | 0 to 360 s | 0.1 s | 0.5 s | | 231 | |
| _ | 144 | M002 | Speed setting switchover | 0, 2, 4, 6, 8, 10, 12, 102, 104, 106, 108, 110, 112 | 1 | 4 | | 303 | |
| ΡU | 145 | E103 | PU display language selection | 0 to 7 | 1 | _ | | 200 | |
| — | 147 | F022 | Acceleration/deceleration time switching frequency | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 228 | |

| | | Pr. | | | Minimum | Initial | value | Refer | Customer |
|--------------------|-----|-------|--|--|-----------------------|---------|-------|---------------------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | СА | to page | setting |
| | 148 | H620 | Stall prevention level at 0 V input | 0% to 400% | 0.1% | 120% | 110% | 290 | |
| ection | 149 | H621 | Stall prevention level at 10 V input | 0% to 400% | 0.1% | 150% | 120% | 290 | |
| it dete | 150 | M460 | Output current detection level | 0% to 400% | 0.1% | 120% | 110% | 339 | |
| Current detection | 151 | M461 | Output current detection signal delay time | 0 to 10 s | 0.1 s | 0 s | | 339 | |
| | 152 | M462 | Zero current detection level | 0% to 400% | 0.1% | 5% | | 339 | |
| | 153 | M463 | Zero current detection time | 0 to 10 s | 0.01 s | 0.5 s | | 339 | |
| _ | 154 | H631 | Voltage reduction selection during stall prevention operation | 0, 1, 10, 11 | 1 | 1 | | 290 | |
| - | 155 | T730 | RT signal function validity condition selection | 0, 10 | 1 | 0 | | 377 | |
| — | 156 | H501 | Stall prevention operation selection | 0 to 31, 100, 101 | 1 | 0 | | 290 | |
| — | 157 | M430 | OL signal output timer | 0 to 25 s, 9999 | 0.1 s | 0 s | | 290 | |
| _ | 158 | M301 | AM terminal function selection | 1 to 3, 5 to 14, 17, 18, 21, 24, 34, 50, 52 to 54, 61, 62, 67, 69, 70, 86 to 96, 98 | 1 | 1 | | 314 | |
| _ | 159 | A005 | Automatic switchover frequency range from bypass to inverter operation | 0 to 10 Hz, 9999 | 0.01 Hz | 9999 | | 404 | |
| — | 160 | E440 | User group read selection <i>Simple</i> | 0, 1, 9999 | 1 | 9999 | 0 | 215 | |
| _ | 161 | E200 | Frequency setting/key lock operation selection | 0, 1, 10, 11 | 1 | 0 | • | 202 | |
| Automatic restart | 162 | A700 | Automatic restart after instantaneous power failure selection | 0 to 3, 10 to 13, 1000 to 1003, 1010 to 1013 | 1 | 0 | | 466, 472, 474 | |
| ic r | 163 | A704 | First cushion time for restart | 0 to 20 s | 0.1 s | 0 s | | 466 | |
| tomat | 164 | A705 | First cushion voltage for restart | 0% to 100% | 0.1% | 0% | | 466 | |
| Au | 165 | A710 | Stall prevention operation level for restart | 0% to 400% | 0.1% | 120% | 110% | 466 | |
| ction | 166 | M433 | Output current detection signal retention time | 0 to 10 s, 9999 | 0.1 s | 0.1 s | | 339 | |
| Current detection | 167 | M464 | Output current detection operation selection | 0, 1, 10, 11 | 1 | 0 | | 339 | |
| | 168 | E000 | | | | | | | |
| | | E080 | Parameter for manufacturer sett | ing. Do not set. | | | | | |
| _ | 169 | E001 | | J | | | | | |
| | | E081 | Watt hour mater als | 0 10 0000 | 4 | 0000 | | 205 | |
| lito | 170 | M020 | Watt-hour meter clear | 0, 10, 9999 | 1 | 9999 | | 305 | |
| Cumulative monitor | 171 | M030 | Operation hour meter clear | 0, 9999 | 1 | 9999 | | 305 | |
| User group | 172 | E441 | User group registered display/batch clear | 9999, (0 to 16) | 1 | 0 | | 215 | |
| er g | 173 | E442 | User group registration | 0 to 1999, 9999 | 1 | 9999 | | 215 | |
| Us¢ | 174 | E443 | User group clear | 0 to 1999, 9999 | 1 | 9999 | | 215 | |

| | _ | Pr. | | | Minimum | Initial | value | Refer | Customer |
|------------------------------------|-----|-------|-------------------------------------|---|-----------------------|--|-------|---------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| | 178 | T700 | STF terminal function selection | 0 to 8, 10 to 14, 16, 18, 24, 25, 28, 37 to 40, 46 to 48, 50, 51, 57, 58, 60, 62, 64 to 67, 70 to 73, 77 to 81, 84, 94 to 98, 128, 129, 9999 | | 60 | | 373 | |
| nent | 179 | T701 | STR terminal function selection | 0 to 8, 10 to 14, 16, 18, 24, 25, 28, 37 to 40, 46 to 48, 50, 51, 57, 58, 61, 62, 64 to 67, 70 to 73, 77 to 81, 84, 94 to 98, 128, 129, 9999 | 1 | 61 | | 373 | |
| signn | 180 | T702 | RL terminal function selection | - | 1 | 0 | | 373 | |
| ion as | 181 | T703 | RM terminal function selection | | 1 | 1 | | 373 | |
| functi | 182 | T704 | RH terminal function selection | | 1 | 2 | | 373 | |
| minal | 183 | T705 | RT terminal function selection | | 1 | 3 | | 373 | |
| Input terminal function assignment | 184 | T706 | AU terminal function selection | 0 to 8, 10 to 14, 16, 18, 24, 25, 28, 37 to 40, 46 to 48, 50, 51, 57, 58, | 1 | 4 | | 373 | |
| <u>r</u> | 185 | T707 | JOG terminal function selection | 62, 64 to 67, 70 to 73, 77 to 81, 84, 94 to 98, | 1 | 5 | | 373 | |
| | 186 | T708 | CS terminal function selection | 128, 129, 9999 | 1 | 9999 | | 373 | |
| | 187 | T709 | MRS terminal function selection | | 1 | 24 ^{*10*1} 10 ^{*11} | 2 | 373 | |
| | 188 | T710 | STOP terminal function selection | | 1 | 25 | | 373 | |
| | 189 | T711 | RES terminal function selection | | 1 | 62 | | 373 | |

| Function Pr. | | Pr. | | | Minimum | Initial value | | Refer | |
|-------------------------------------|---------------|-----------------|---|--|-----------------------|---------------------|----|---------|---------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | СА | to page | setting |
| | 190 | M400 | RUN terminal function selection | 0 to 5, 7, 8, 10 to 19, 25, 26, 35, 39 to 42, 45 to 54, 57, 64 to 68, 70 | 1 | 0 | | 330 | |
| | 191 | M401 | SU terminal function selection | to 80, 82, 85, 90 to 96, 98 to 105, 107, 108, 110 to 116, 125, 126, | 1 | 1 | | 330 | |
| | 192 | M402 | IPF terminal function | 135, 139 to 142, 145 to 154, 157, 164 to 168, | 1 | 2 ^{*10*12} | | - 330 | |
| | | | selection | 170 to 180, 182, 185, 190 to 196, 198 to 208, | | 9999 ^{*1} | 1 | | |
| ignment | 193 | M403 | OL terminal function selection | 211 to 213, 215, 217 to 220, 226, 228 to 230, 247, 300 to 308, 311 to | 1 | 3 | | 330 | |
| ction ass | 194 | M404 | FU terminal function selection | 313, 315, 317 to 320, 326, 328 to 330, 347, 9999 | 1 | 4 | | 330 | |
| Output terminal function assignment | 195 | M405 | ABC1 terminal function selection | 0 to 5, 7, 8, 10 to 19, 25, 26, 35, 39 to 42, 45 to 54, 57, 64 to 68, 70 to 80, 82, 85, 90, 91, 94 to 96, 98 to 105, 107, 108, 110 to 116, 125, 126, 135, 139 to 142, 145 to 154, 157, 164 to | 1 | 99 | | 330 | |
| | 196 | M406 | ABC2 terminal function selection | 168, 170 to 180, 182, 185, 190, 191, 194 to 196, 198 to 208, 211 to 213, 215, 217 to 220, 226, 228 to 230, 247, 300 to 308, 311 to 313, 315, 317 to 320, 326, 328 to 330, 347, 9999 | 1 | 9999 | | 330 | |
| Multi-speed setting | 232 to 239 | D308 to D315 | Multi-speed setting (speed 8 to speed 15) | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 263 | |
| _ | 240 | E601 | Soft-PWM operation selection | 0, 1 | 1 | 1 | | 218 | |
| - | 241 | M043 | Analog input display unit switchover | 0, 1 | 1 | 0 | | 357 | |
| _ | 242 | T021 | Terminal 1 added compensation amount (terminal 2) | 0% to 100% | 0.1% | 100% | | 353 | |
| - | 243 | T041 | Terminal 1 added compensation amount (terminal 4) | 0% to 100% | 0.1% | 75% | | 353 | |
| | | _ | Cooling fan operation selection | 0, 1, 101 to 105, 1000, 1001, 1101 to 1105 | 1 | 1 | | | |
| _ | 244 | H100 | Cooling fan operation selection | 0, 1, 101 to 105 | 1 | 1 | | 273 | |
| | | H106 | Cooling fan operation selection during the test operation | 0, 1 | 1 | 0 | | | |
| ы | 245 | G203 | Rated slip | 0% to 50%, 9999 | 0.01% | 9999 | | 576 | |
| ensati | 246 | G204 | Slip compensation time constant | 0.01 to 10 s | 0.01 s | 0.5 s | | 576 | |
| Slip compensation | 247 | G205 | Constant output range slip compensation selection | 0, 9999 | 1 | 9999 | | 576 | |

| | | Dr | | | Minimum | Initial | value | Defer | Customer |
|------------------------|--------------------|--------------|--|--|--------------------|---------|-------|------------------|---------------------|
| Function | Pr. | Pr. group | Name | Setting range | setting increments | FM | СА | Refer to page | Customer setting |
| _ | 248 | A006 | Self power management selection | 0 to 2 | 1 | 0 | | 410 | |
| _ | 249 | H101 | Earth (ground) fault detection at start | 0, 1 | 1 | 0 | | 274 | |
| _ | 250 | G106 | Stop selection | 0 to 100 s, 1000 to 1100 s, 8888, 9999 | 0.1 s | 9999 | | 563 | |
| — | 251 | H200 | Output phase loss protection selection | 0, 1 | 1 | 1 | | 276 | |
| ion | 252 | T050 | Override bias | 0% to 200% | 0.1% | 50% | | 353 | |
| Frequency compensation | 253 | T051 | Override gain | 0% to 200% | 0.1% | 150% | | 353 | |
| — | 254 | A007 | Main circuit power OFF waiting time | 1 to 3600 s, 9999 | 1 s | 600 s | | 410 | |
| | 255 | E700 | Life alarm status display | (0 to 255) | 1 | 0 | | 220 | |
| ¥ | 256 ^{*14} | E701 | Inrush current limit circuit life display | (0% to 100%) | 1% | 100% | | 220 | |
| Life check | 257 | E702 | Control circuit capacitor life display | (0% to 100%) | 1% | 100% | | 220 | |
| Lif | 258 ^{*14} | E703 | Main circuit capacitor life display | (0% to 100%) | 1% | 100% | | 220 | |
| | 259 ^{*14} | E704 | Main circuit capacitor life measuring | 0, 1, 11 | 1 | 0 | | 220 | |
| _ | 260 | E602 | PWM frequency automatic switchover | 0, 1 | 1 | 1 | | 218 | |
| | 261 | A730 | Power failure stop selection | 0 to 2, 11, 12, 21, 22 | 1 | 0 | | 478 | |
| top | 262 | A731 | Subtracted frequency at deceleration start | 0 to 20 Hz | 0.01 Hz | 3 Hz | | 478 | |
| failure stop | 263 | A732 | Subtraction starting frequency | 0 to 590 Hz, 9999 | 0.01 Hz | 60 Hz | 50 Hz | 478 | |
| | 264 | A733 | Power-failure deceleration time 1 | 0 to 3600 s | 0.1 s | 5 s | | 478 | |
| Power | 265 | A734 | Power-failure deceleration time 2 Power failure deceleration | 0 to 3600 s, 9999 | 0.1 s | 9999 | | 478 | |
| | 266 | A735 | time switchover frequency | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 478 | |
| — | 267 | T001 | Terminal 4 input selection | 0 to 2 | 1 | 0 | | 349 | |
| — | 268 | M022 | Monitor decimal digits selection | 0, 1, 9999 | 1 | 9999 | | 305 | |
| _ | 269 | E023 | Parameter for manufacturer sett | - | | | | | |
| — | 289 | M431 | Inverter output terminal filter Monitor negative output | 5 to 50 ms, 9999 | 1 ms | 9999 | | 330 | |
| — | 290 | M044 | selection | 0 to 7 | 1 | 0 | | 305, 314 | |
| — | 291 | D100 | Pulse train I/O selection | [FM type] 0, 1, 10, 11, 20, 21, 100 [CA type] 0, 1 | 1 | 0 | | 258, 314 | |
| _ | 294 | A785 | UV avoidance voltage gain | 0% to 200% | 0.1% | 100% | | 478 | |
| _ | 295 | E201 | Frequency change increment amount setting | 0, 0.01, 0.1, 1, 10 | 0.01 | 0 | | 203 | |
| vord | 296 | E410 | Password lock level | 0 to 6, 99, 100 to 106, 199, 9999 | 1 | 9999 | | 208 | |
| Password | 297 | E411 | Password lock/unlock | (0 to 5), 1000 to 9998, 9999 | 1 | 9999 | | 208 | |
| — | 298 | A711 | Frequency search gain | 0 to 32767, 9999 | 1 | 9999 | | 383, 474 | |
| — | 299 | A701 | Rotation direction detection selection at restarting | 0, 1, 9999 | 1 | 9999 | | 466 | |

| | _ | Pr. | | | Minimum | Initial value | Refer | Customer |
|----------------------|---------------------------|---------|---|---|--------------------|---------------------|-------------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM CA | to page | setting |
| | 313 ^{*15} | M410 | DO0 output selection | 0 to 5, 7, 8, 10 to 19, 25, 26, 35, 39 to 42, 45 | 1 | 9999 | 330 | |
| | 314 ^{*15} | M411 | DO1 output selection | to 54, 57, 64 to 66, 68, 70 to 80, 85 to 96, 98 to | 1 | 9999 | 330 | |
| | 315 ^{*15} | M412 | DO2 output selection | 105, 107, 108, 110 to 116, 125, 126, 135, | 1 | 9999 | 330 | |
| | 316 ^{*15} | M413 | DO3 output selection | 139 to 142, 145 to 154, 157, 164 to 166, 168, 170 to 180, 185 to 196, | 1 | 9999 | 330 | |
| | 317 ^{*15} | M414 | DO4 output selection | 198 to 208, 211 to 213, 215, 217 to 220, 226, 228 to 230, 247 to 250, | 1 | 9999 | 330 | |
| PLC | 318 ^{*15} | M415 | DO5 output selection | 300 to 308, 311 to 313, 315, 317 to 320, 326, | 1 | 9999 | 330 | |
| | 319 ^{*15} | M416 | DO6 output selection | 328 to 330, 347 to 350, 9999 | 1 | 9999 | 330 | |
| | 320^{*15} | M420 | RA1 output selection | 0 to 5, 7, 8, 10 to 19, 25, 26, 35, 39 to 42, 45 | 1 | 0 | 330 | |
| | 321 ^{*15} | M421 | RA2 output selection | to 54, 57, 64 to 66, 68, 70 to 80, 85 to 91, 94 to 96, 98, 99, 200 to 208, 211 to 213, 215, 217 to | 1 | 1 | 330 | |
| | 322 ^{*15} | M422 | RA3 output selection | 220, 226, 228 to 230, | 1 | 2 ^{*10*12} | 330 | |
| | 322 | 141-422 | | 247 to 250, 9999 | 1 | 9999 ^{*11} | 550 | |
| | 331 | N030 | RS-485 communication station number | 0 to 31 (0 to 247) | 1 | 0 | 505, 533 | |
| | 332 | N031 | RS-485 communication speed | 3, 6, 12, 24, 48, 96, 192, 384, 576, 768, 1152 | 1 | 96 | 505, 533 | |
| | | _ | RS-485 communication stop bit length / data length | 0, 1, 10, 11 | 1 | 1 | | |
| | 333 | N032 | RS-485 communication data length | 0, 1 | 1 | 0 | 505 | |
| | | N033 | RS-485 communication stop bit length | 0, 1 | 1 | 1 | | |
| ation | 334 | N034 | RS-485 communication parity check selection | 0 to 2 | 1 | 2 | 505 | |
| RS-485 communication | 335 | N035 | RS-485 communication retry count | 0 to 10, 9999 | 1 | 1 | 505 | |
| 5 com | 336 | N036 | RS-485 communication check time interval | 0 to 999.8 s, 9999 | 0.1 s | 0 s | 505 | |
| RS-48 | 337 | N037 | RS-485 communication waiting time setting | 0 to 150 ms, 9999 | 1 ms | 9999 | 505 | |
| | 338 | D010 | Communication operation command source | 0, 1 | 1 | 0 | 251 | |
| | 339 | D011 | Communication speed command source | 0 to 2 | 1 | 0 | 251 | |
| | 340 | D001 | Communication startup mode selection | 0 to 2, 10, 12 | 1 | 0 | 250 | |
| | 341 | N038 | RS-485 communication CR/ LF selection | 0 to 2 | 1 | 1 | 505 | |
| | 342 | N001 | Communication EEPROM write selection | 0, 1 | 1 | 0 | 500 | |
| | 343 | N080 | Communication error count | _ | 1 | 0 | 520 | |
| — | 374 | H800 | Overspeed detection level | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | 302 | |
| input | 384 | D101 | Input pulse division scaling factor | 0 to 250 | 1 | 0 | 258 | |
| Pulse train input | 385 | D110 | Frequency for zero input pulse | 0 to 590 Hz | 0.01 Hz | 0 Hz | 258 | |
| Pulse | 386 | D111 | Frequency for maximum input pulse | 0 to 590 Hz | 0.01 Hz | 60 Hz 50 Hz | 258 | |

| | | Pr. | | | Minimum | Initial | value | Refer | Customer | | | | | | | | |
|-----------------------|--------------------|-------|---|--|---|--------------------|-------|---------------------|----------|------|--|-------------|-----|------|--|------|--|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting | | | | | | | | |
| _ | 390 | N054 | % setting reference frequency | 1 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 533 | | | | | | | | | |
| | 414 | A800 | PLC function operation selection | 0 to 2, 11, 12 | 1 | 0 | | 483 | | | | | | | | | |
| PLC | 415 | A801 | Inverter operation lock mode setting | 0, 1 | 1 | 0 | | 483 | | | | | | | | | |
| | 416 | A802 | Pre-scale function selection | 0 to 5 | 1 | 0 | | 483 | | | | | | | | | |
| | 417 | A803 | Pre-scale setting value | 0 to 32767 | 1 | 1 | | 483 | | | | | | | | | |
| | 450 | C200 | Second applied motor | 0, 1, 3 to 6, 13 to 16, 20, 23, 24, 40, 43, 44, 50, 53, 54, 70, 73, 74, 210, 213, 214, 240, 243, 244, 8090, 8093, 8094, 9090, 9093, 9094, 9999 | 1 | 9999 | | 379 | | | | | | | | | |
| | 453 | C201 | Second motor capacity | 0.4 to 55 kW, 9999 ^{*2} | 0.01 kW ^{*2} | 9999 | | 383, | | | | | | | | | |
| | | 5201 | | 0 to 3600 kW, 9999 ^{*3} | 0.1 kW ^{*3} | 5555 | | 392 | | | | | | | | | |
| | 454 | C202 | Number of second motor poles | 2, 4, 6, 8, 10, 12, 9999 | 1 | 9999 | | 383, 392 | | | | | | | | | |
| | 455 | C225 | Second motor excitation | 0 to 500 A, 9999 ^{*2} | 0.01 A ^{*2} | 9999 | | 383 | | | | | | | | | |
| Ĕ | | | current | 0 to 3600 A, 9999 ^{*3} | 0.1 A ^{*3} | | | | | | | | | | | | |
| Second motor constant | 456 | C204 | Rated second motor voltage | 0 to 1000 V | 0.1 V | 200 V [*] | | 383, 392 | | | | | | | | | |
| notor | 457 | C205 | Rated second motor frequency | 10 to 400 Hz, 9999 | 0.01 Hz | 9999 | | 383, 392 | | | | | | | | | |
| ndr | | | • · · · · · · · · · · · · · · · · · · · | 0 to 50 Ω, 9999 ^{*2} | 0.001 Ω ^{*2} | 9999 | | | | 9999 | | 0000 | | 0000 | | 383, | |
| Secol | 458 | C220 | Second motor constant (R1) | 0 to 400 mΩ, 9999 ^{*3} | 0.01 mΩ ^{*3} | | | | | | | 392, 474 | | | | | |
| | 459 | C221 | Second motor constant (R2) | 0 to 50 Ω, 9999 ^{*2} | 0.001 Ω ^{*2} | 9999 | 9999 | | | | | | 383 | | | | |
| | | | | 0 to 400 mΩ, 9999 ^{*3} | 0.01 mΩ ^{*3} | 5000 | | | | | | | | | | | |
| | 460 | C222 | Second motor constant (L1) / | 0 to 6000 mH, 9999 ^{*2} | 0.1 mH ^{*2} | 9999 | | 383, | | | | | | | | | |
| | | | d-axis inductance (Ld) | 0 to 400 mH, 9999 ^{*3} | 0.01 mH ^{*3} | 2000 | | 392 | | | | | | | | | |
| | 461 | C223 | Second motor constant (L2) / | 0 to 6000 mH, 9999 ^{*2} | 0.1 mH ^{*2} | 9999 | | 9999 | | 9999 | | 383, | | | | | |
| | | | q-axis inductance (Lq) | 0 to 400 mH, 9999 ^{*3} | 0.01 mH ^{*3} | | | 392 | | | | | | | | | |
| | 462 | C224 | Second motor constant (X) | 0% to 100%, 9999 | 0.1% ^{*2} 0.01% ^{*3} | 9999 | | 383 | | | | | | | | | |
| | 463 | C210 | Second motor auto tuning setting/status | 0, 1, 11, 101 | 1 | 0 | | 383, 392, 474 | | | | | | | | | |
| out | 495 | M500 | Remote output selection | 0, 1, 10, 11 | 1 | 0 | | 341 | | | | | | | | | |
| outș | 496 | M501 | Remote output data 1 | 0 to 4095 | 1 | 0 | | 341 | | | | | | | | | |
| Remote output | 497 | M502 | Remote output data 2 | 0 to 4095 | 1 | 0 | | 341 | | | | | | | | | |
| — | 498 | A804 | PLC function flash memory clear | 0, 9696 (0 to 9999) | 1 | 0 | | 483 | | | | | | | | | |
| _ | 502 | N013 | Stop mode selection at communication error | 0 to 4 | 1 | 0 | | 500 | | | | | | | | | |
| JCe | 503 | E710 | Maintenance timer 1 | 0 (1 to 9998) | 1 | 0 | | 224 | | | | | | | | | |
| Maintenance | 504 | E711 | Maintenance timer 1 warning output set time | 0 to 9998, 9999 | 1 | 9999 | | 224 | | | | | | | | | |
| — | 505 | M001 | Speed setting reference | 1 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 303 | | | | | | | | | |
| _ | 506 ^{*14} | E705 | Display estimated main circuit capacitor residual life | (0% to 100%) | 1% | 100% | | 220 | | | | | | | | | |
| - | 507 | E706 | Display/reset ABC1 relay contact life | 0% to 100% | 1% | 100% | | 220 | | | | | | | | | |

| | | Pr. | | | Minimum | Initial valu | e Refer | Customer |
|----------------------------------|--------------------|-------|---|---|-----------------------|--------------------------|-------------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM CA | | setting |
| — | 508 | E707 | Display/reset ABC2 relay contact life | 0% to 100% | 1% | 100% | 220 | |
| — | 514 ^{*14} | H324 | Emergency drive dedicated retry waiting time | 0.1 to 600 s, 9999 | 0.1 s | 9999 | 279 | |
| — | 515 ^{*14} | H322 | Emergency drive dedicated retry count | 1 to 200, 9999 | 1 | 1 | 279 | |
| — | 522 | G105 | Output stop frequency | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | 562 | |
| _ | 523 ^{*14} | H320 | Emergency drive mode selection | 100, 111, 112, 121 to 124, 200, 211, 212, 221 to 224, 300, 311, 312, 321 to 324, 400, 411, 412, 421 to 424, 9999 | 1 | 9999 | 279 | |
| — | 524 ^{*14} | H321 | Emergency drive running speed | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | 279 | |
| _ | 539 | N002 | MODBUS RTU communication check time interval | 0 to 999.8 s, 9999 | 0.1 s | 9999 | 520 | |
| USB | 547 | N040 | USB communication station number | 0 to 31 | 1 | 0 | 547 | |
| э З | 548 | N041 | USB communication check time interval | 0 to 999.8 s, 9999 | 0.1 s | 9999 | 547 | |
| ation | 549 | N000 | Protocol selection | 0, 1, 2 | 1 | 0 | 500, 533 | |
| Communication | 550 | D012 | NET mode operation command source selection | 0, 1, 9999 | 1 | 9999 | 251 | |
| Com | 551 | D013 | PU mode operation command source selection | 1 to 3, 9999 | 1 | 9999 | 251 | |
| — | 552 | H429 | Frequency jump range | 0 to 30 Hz, 9999 | 0.01 Hz | 9999 | 289 | |
| ō | 553 | A603 | PID deviation limit | 0% to 100%, 9999 | 0.1% | 9999 | 419 | |
| PID control | 554 | A604 | PID signal operation selection | 0 to 7, 10 to 17 | 1 | 0 | 419 | |
| D | 555 | E720 | Current average time | 0.1 to 1 s | 0.1 s | 1 s | 225 | |
| rin | 556 | E721 | Data output mask time | 0 to 20 s | 0.1 s | 0 s | 225 | |
| Current average value monitoring | 557 | E722 | Current average value monitor signal output reference current | 0 to 3600 A*3 | 0.01 A ^{*2} | Inverter rate current | d 225 | |
| — | 560 | A712 | Second frequency search gain | 0 to 32767, 9999 | 1 | 9999 | 383, 474 | |
| — | 561 | H020 | PTC thermistor protection level | 0.5 to 30 kΩ, 9999 | 0.01 kΩ | 9999 | 266 | |
| — | 563 | M021 | Energization time carrying- over times | (0 to 65535) | 1 | 0 | 305 | |
| — | 564 | M031 | Operating time carrying-over times | (0 to 65535) | 1 | 0 | 305 | |
| — | 565 | G301 | Second motor excitation current break point | 0 to 400 Hz, 9999 | 0.01 Hz | 9999 | 555 | |
| _ | 566 | G302 | Second motor excitation current low-speed scaling factor | 0% to 300%, 9999 | 0.1% | 9999 | 555 | |

| | | Pr. | | | Minimum | Initial | value | Refer | Customer |
|-----------------------|--------------------|--------------|--|-------------------------------------|--------------------|------------|-------|------------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| Second motor constant | 569 | G942 | Second motor speed control gain | 0% to 200%, 9999 | 0.1% | 9999 | | 180 | |
| Multiple rating | 570 ^{*13} | E301 | Multiple rating setting | 0, 1 | 1 | 1 | 0 | 204 | |
| — | 571 | F103 | Holding time at a start | 0 to 10 s, 9999 | 0.1 s | 9999 | | 238 | |
| — | 573 | A680 T052 | 4 mA input check selection | 1 to 4, 11 to 14, 21 to 24, 9999 | 1 | 9999 | | 369 | |
| — | 574 | C211 | Second motor online auto tuning | 0, 1 | 1 | 0 | | 400 | |
| rol | 575 | A621 | Output interruption detection time | 0 to 3600 s, 9999 | 0.1 s | 1 s | | 419 | |
| PID control | 576 | A622 | Output interruption detection level | 0 to 590 Hz | 0.01 Hz | 0 Hz | | 419 | |
| IId | 577 | A623 | Output interruption cancel level | 900% to 1100% | 0.1% | 1000% | , | 419 | |
| | 578 | A400 | Auxiliary motor operation selection | 0 to 3 | 1 | 0 | | 450 | |
| | 579 | A401 | Motor connection function selection | 0 to 3 | 1 | 0 | | 450 | |
| | 580 | A402 | MC switchover interlock time (multi-pump) | 0 to 100 s | 0.1 s | 1 s | | 450 | |
| | 581 | A403 | Start waiting time (multi- pump) | 0 to 100 s | 0.1 s | 1 s | | 450 | |
| | 582 | A404 | Auxiliary motor connection- time deceleration time | 0 to 3600 s, 9999 | 0.1 s | 1 s | | 450 | |
| Multi-pump function | 583 | A405 | Auxiliary motor disconnection-time acceleration time | 0 to 3600 s, 9999 | 0.1 s | 1 s | | 450 | |
| mp fu | 584 | A406 | Auxiliary motor 1 starting frequency | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 450 | |
| ulti-pu | 585 | A407 | Auxiliary motor 2 starting frequency | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 450 | |
| Ē | 586 | A408 | Auxiliary motor 3 starting frequency | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 450 | |
| | 587 | A409 | Auxiliary motor 1 stopping frequency | 0 to 590 Hz | 0.01 Hz | 0 Hz | | 450 | |
| | 588 | A410 | Auxiliary motor 2 stopping frequency | 0 to 590 Hz | 0.01 Hz | 0 Hz | | 450 | |
| | 589 | A411 | Auxiliary motor 3 stopping frequency | 0 to 590 Hz | 0.01 Hz | 0 Hz | | 450 | |
| | 590 | A412 | Auxiliary motor start detection time | 0 to 3600 s | 0.1 s | 5 s | | 450 | |
| | 591 | A413 | Auxiliary motor stop detection time | 0 to 3600 s | 0.1 s | 5 s | | 450 | |
| | 592 | A300 | Traverse function selection | 0 to 2 | 1 | 0 10% | | 414 414 | |
| se | 593 594 | A301 A302 | Maximum amplitude amount Amplitude compensation | 0% to 25% 0% to 50% | 0.1% 0.1% | 10% 10% | | 414 | |
| Traverse | 595 | A303 | amount during deceleration Amplitude compensation | 0% to 50% | 0.1% | 10% | | 414 | |
| | 596 | A304 | amount during acceleration Amplitude acceleration time | 0.1 to 3600 s | 0.1 s | 5 s | | 414 | |
| | 590 | A304 A305 | Amplitude deceleration time | 0.1 to 3600 s | 0.1 s 0.1 s | 5 s | | 414 | |
| | 557 | A303 | | 0.1 10 0000 3 | 0.13 | 03 | | | |

| | | Pr. | | | Minimum | Initial | value | Refer | Customer |
|---|-----|-------|--|--|--------------------|---|-------|-------------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | СА | to page | setting |
| - | 598 | H102 | Undervoltage level | 175 to 215 VDC ^{*7} /350 to 430 VDC ^{*8} , 9999 | 0.1 V | 9999 | | 275 | |
| — | 599 | T721 | X10 terminal input selection | 0, 1 | 1 | 0 ^{*10*12} 1 ^{*11} | | - 566 | |
| _ | 600 | H001 | First free thermal reduction frequency 1 | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 266 | |
| iermal y | 601 | H002 | First free thermal reduction ratio 1 | 1% to 100% | 1% | 100% | | 266 | |
| ronic the O/L relay | 602 | H003 | First free thermal reduction frequency 2 | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 266 | |
| Electronic thermal O/L relay | 603 | H004 | First free thermal reduction ratio 2 | 1% to 100% | 1% | 100% | | 266 | |
| | 604 | H005 | First free thermal reduction frequency 3 | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 266 | |
| - | 606 | T722 | Power failure stop external signal input selection | 0, 1 | 1 | 1 | | 478 | |
| — | 607 | H006 | Motor permissible load level | 110% to 250% | 1% | 150% | | 266 | |
| - | 608 | H016 | Second motor permissible load level | 110% to 250%, 9999 | 1% | 9999 | | 266 | |
| PID control | 609 | A624 | PID set point/deviation input selection | 1 to 5 | 1 | 2 | | 419 | |
| PID co | 610 | A625 | PID measured value input selection | 1 to 5, 101 to 105 | 1 | 3 | | 419 | |
| — | 611 | F003 | Acceleration time at a restart | 0 to 3600 s, 9999 | 0.1 s | 9999 | | 466, 472 | |
| — | 617 | G080 | Reverse rotation excitation current low-speed scaling factor | 0% to 300%, 9999 | 0.1% | 9999 | | 555 | |
| lo I | 653 | G410 | Speed smoothing control | 0% to 200% | 0.1% | 0% | | 577 | |
| Speed smoothing control | 654 | G411 | Speed smoothing cutoff frequency | 0 to 120 Hz | 0.01 Hz | 20 Hz | | 577 | |
| tion | 655 | M530 | Analog remote output selection | 0, 1, 10, 11 | 1 | 0 | | 343 | |
| oun | 656 | M531 | Analog remote output 1 | 800% to 1200% | 0.1% | 1000% | | 343 | |
| ntf | 657 | M532 | Analog remote output 2 | 800% to 1200% | 0.1% | 1000% | | 343 | |
| utp | 658 | M533 | Analog remote output 3 | 800% to 1200% | 0.1% | 1000% | | 343 | |
| Analog remote output function | 659 | M534 | Analog remote output 4 | 800% to 1200% | 0.1% | 1000% | | 343 | |
| gnetic eration | 660 | G130 | Increased magnetic excitation deceleration operation selection | 0, 1 | 1 | 0 | | 574 | |
| decel | 661 | G131 | Magnetic excitation increase rate | 0% to 40%, 9999 | 0.1% | 9999 | | 574 | |
| Increased magnetic excitation deceleration | 662 | G132 | Increased magnetic excitation current level | 0% to 300% | 0.1% | 100% | | 574 | |
| - | 663 | M060 | Control circuit temperature signal output level | 0°C to 100°C | 1°C | 0°C | | 347 | |
| _ | 665 | G125 | Regeneration avoidance frequency gain | 0% to 200% | 0.1% | 100% | | 572 | |

| | | Pr. | | | Minimum | Initial | value | Refer | Customer |
|---------------------------------|-----|--------------|---|--|-----------------------|--------------|-------|-------------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| — | 668 | A786 | Power failure stop frequency gain | 0% to 200% | 0.1% | 100% | | 478 | |
| _ | 673 | G060 | SF-PR slip amount adjustment operation selection | 2, 4, 6, 9999 | 1 | 9999 | | 559 | |
| - | 674 | G061 | SF-PR slip amount adjustment gain | 0% to 500% | 0.1% | 100% | | 559 | |
| _ | 675 | A805 | User parameter auto storage function selection | 1, 9999 | 1 | 9999 | | 483 | |
| _ | 684 | C000 | Tuning data unit switchover | 0, 1 | 1 | 0 | | 383, 392 | |
| C) | 686 | E712 | Maintenance timer 2 | 0 (1 to 9998) | 1 | 0 | | 224 | |
| Maintenance | 687 | E713 | Maintenance timer 2 warning output set time | 0 to 9998, 9999 | 1 | 9999 | | 224 | |
| inte | 688 | E714 | Maintenance timer 3 | 0 (1 to 9998) | 1 | 0 | | 224 | |
| Ма | 689 | E715 | Maintenance timer 3 warning output set time | 0 to 9998, 9999 | 1 | 9999 | | 224 | |
| _ | 692 | H011 | Second free thermal reduction frequency 1 | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 266 | |
| nerma ay | 693 | H012 | Second free thermal reduction ratio 1 | 1% to 100% | 1% | 100% | | 266 | |
| ronic the O/L relay | 694 | H013 | Second free thermal reduction frequency 2 | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 266 | |
| Electronic thermal O/L relay | 695 | H014 | Second free thermal reduction ratio 2 | 1% to 100% | 1% | 100% | | 266 | |
| | 696 | H015 | Second free thermal reduction frequency 3 | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 266 | |
| — | 699 | T740 | Input terminal filter | 5 to 50 ms, 9999 | 1 ms | 9999 | | 373 | |
| | 702 | C106 | Maximum motor frequency | 0 to 400 Hz, 9999 | 0.01 Hz | 9999 | | 392 | |
| | 706 | C130 | Induced voltage constant (phi f) | 0 to 5000 mV (rad/s), 9999 | 0.1 mV (rad/s) | 9999 | | 392 | |
| | 707 | C107 | Motor inertia (integer) | 10 to 999, 9999 | 1 | 9999 | | 392 | |
| ant | 711 | C131 | Motor Ld decay ratio | 0% to 100%, 9999 | 0.1% | 9999 | | 392 | |
| const | 712 | C132 C182 | Motor Lq decay ratio Starting resistance tuning | 0% to 100%, 9999 0% to 200%, 9999 | 0.1% | 9999 9999 | | 392 392 | |
| Motor constant | 721 | C185 | compensation Starting magnetic pole position detection pulse width | 0 to 6000 µs, 10000 to 16000 µs, 9999 | 1 μs | 9999 | | 392 | |
| | 724 | C108 | Motor inertia (exponent) | 0 to 7, 9999 | 1 | 9999 | | 392 | |
| | 725 | C133 | Motor protection current level | 100% to 500%, 9999 | 0.1% | 9999 | | 392 | |
| 0 | 726 | N050 | Auto Baudrate/Max Master | 0 to 255 | 1 | 255 | | 533 | |
| otoc | 727 | N051 | Max Info Frames | 1 to 255 | 1 | 1 | | 533 | |
| TP pro | 728 | N052 | Device instance number (Upper 3 digits) | 0 to 419 (0 to 418) | 1 | 0 | | 533 | |
| BACnet MS / TP protocol | 729 | N053 | Device instance number (Lower 4 digits) | 0 to 9999 (0 to 4302) | 1 | 0 | | 533 | |

| | | Pr. | | | Minimum | Initial | value | Refer | Customor |
|---------------------|-----|--------------|---|--|--------------------|---------|-------|-------------|---------------------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | СА | to page | Customer setting |
| | 738 | C230 | Second motor induced voltage constant (phi f) | 0 to 5000 mV (rad/s), 9999 | 0.1 mV (rad/s) | 9999 | | 392 | |
| | 739 | C231 | Second motor Ld decay ratio | 0% to 100%, 9999 | 0.1% | 9999 | | 392 | |
| | 740 | C232 | Second motor Lq decay ratio | 0% to 100%, 9999 | 0.1% | 9999 | | 392 | |
| ŧ | 741 | C282 | Second starting resistance tuning compensation | 0% to 200%, 9999 | 0.1% | 9999 | | 392 | |
| Motor constant | 742 | C285 | Second motor magnetic pole detection pulse width | 0 to 6000 μs, 10000 to 16000 μs, 9999 | 1 µs | 9999 | | 392 | |
| otor c | 743 | C206 | Second motor maximum frequency | 0 to 400 Hz, 9999 | 0.01 Hz | 9999 | | 392 | |
| Σ | 744 | C207 | Second motor inertia (integer) | 10 to 999, 9999 | 1 | 9999 | | 392 | |
| | 745 | C208 | Second motor inertia (exponent) | 0 to 7, 9999 | 1 | 9999 | | 392 | |
| | 746 | C233 | Second motor protection current level | 100% to 500%, 9999 | 0.1% | 9999 | | 392 | |
| 753 | | A650 | Second PID action selection | 0, 10, 11, 20, 21, 50, 51, 60, 61, 70, 71, 80, 81, 90, 91, 100, 101, 1000, 1001, 1010, 1011, 2000, 2001, 2010, 2011 | 1 | 0 | | 419 | |
| PID control | 754 | A652 | Second PID control automatic switchover frequency | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | | |
| DIA | 755 | A651 | Second PID action set point | 0% to 100%, 9999 | 0.01% | 9999 | | 419 | |
| | 756 | A653 | Second PID proportional band | 0.1% to 1000%, 9999 | 0.1% | 100% | | 419 | |
| | 757 | A654 | Second PID integral time | 0.1 to 3600 s, 9999 | 0.1 s | 1 s | | 419 | |
| | 758 | A655 | Second PID differential time | 0.01 to 10 s, 9999 | 0.01 s | 9999 | | 419 | |
| | 759 | A600 | PID unit selection | 0 to 43, 9999 | 1 | 9999 | | 442 | |
| | 760 | A616 | Pre-charge fault selection | 0, 1 | 1 | 0 | | 445 | |
| | 761 | A617 | Pre-charge ending level | 0% to 100%, 9999 | 0.1% | 9999 | | 445 | |
| | 762 | A618 | Pre-charge ending time | 0 to 3600 s, 9999 | 0.1 s | 9999 | | 445 | |
| | 763 | A619 | Pre-charge upper detection level | 0% to 100%, 9999 | 0.1% | 9999 | | 445 | |
| rge | 764 | A620 | Pre-charge time limit | 0 to 3600 s, 9999 | 0.1 s | 9999 | | 445 | |
| PID Pre-char | 765 | A656 | Second pre-charge fault selection | 0, 1 | 1 | 0 | | 445 | |
| I O I A | 766 | A657 | Second pre-charge ending level | 0% to 100%, 9999 | 0.1% | 9999 | | 445 | |
| | 767 | A658 | Second pre-charge ending time | 0 to 3600 s, 9999 | 0.1 s | 9999 | | 445 | |
| | 768 | A659 | Second pre-charge upper detection level | 0% to 100%, 9999 | 0.1% | 9999 | | 445 | |
| | 769 | A660 | Second pre-charge time limit | 0 to 3600 s, 9999 | 0.1 s | 9999 | | 445 | |
| ction | 774 | M101 | Operation panel monitor selection 1 | 1 to 3, 5 to 14, 17, 18, | 1 | 9999 | | 305, 533 | |
| ng fun | 775 | M102 | Operation panel monitor selection 2 | 20, 23 to 25, 34, 38, 40 to 45, 50 to 57, 61, 62, | 1 | 9999 | | 305, 533 | |
| Monitoring function | 776 | M103 | Operation panel monitor selection 3 | 64, 67 to 69, 81 to 96, 98, 100, 9999 | 1 | 9999 | | 305, 533 | |
| — | 777 | A681 T053 | 4 mA input fault operation frequency | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 369 | |
| — | 778 | A682 T054 | 4 mA input check filter | 0 to 10 s | 0.01 s | 0 s | | 369 | |
| - | 779 | N014 | Operation frequency during communication error | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 500 | |
| _ | 791 | F070 | Acceleration time in low- speed range | 0 to 3600 s, 9999 | 0.1 s | 9999 | | 228 | |

| | | Pr. | | | Minimum | Initial | value | Refer | Customer | | | | |
|------------------------|--------------------|-------|--|---------------------------------|---|------------------|--------|-------------|----------|------|--|-----|--|
| Function | Pr. | group | Name | Setting range | setting increments | FM | СА | to page | setting | | | | |
| — | 792 | F071 | Deceleration time in low- speed range | 0 to 3600 s, 9999 | 0.1 s | 9999 | | 228 | | | | | |
| - | 799 | M520 | Pulse increment setting for output power | 0.1, 1, 10, 100, 1000 kWh | 0.1 kWh | 1 kWh | | 346 | | | | | |
| — | 800 | G200 | Control method selection | 9, 20, 109, 110 | 1 | 20 | | 177 | | | | | |
| | 820 | G211 | Speed control P gain 1 | 0% to 1000% | 1% | 25% | | 190 | | | | | |
| | 821 | G212 | Speed control integral time 1 | 0 to 20 s | 0.001 s | 0.333 s | 6 | 190 | | | | | |
| | 822 | T003 | Speed setting filter 1 | 0 to 5 s, 9999 | 0.001 s | 9999 | | 355 | | | | | |
| | 824 | G213 | Torque control P gain 1 (current loop proportional gain) | 0% to 500% | 1% | 50% | | 190 | | | | | |
| t | 825 | G214 | Torque control integral time 1 (current loop integral time) | 0 to 500 ms | 0.1 ms | 40 ms | | 190 | | | | | |
| Adjustment | 827 | G216 | Torque detection filter 1 | 0 to 0.1 s | 0.001 s | 0 s | | 193 | | | | | |
| istr | 828 | G224 | Parameter for manufacturer setti | ing. Do not set. | | | 9999 | | | | | | |
| ٨dju | 830 | G311 | Speed control P gain 2 | 0% to 1000%, 9999 | 1% | 9999 | | | | | | | |
| 4 | 831 | G312 | Speed control integral time 2 | 0 to 20 s, 9999 | 0.001 s | 9999 | | 190 | | | | | |
| | 832 | T005 | Speed setting filter 2 | 0 to 5 s, 9999 | 0.001 s | 9999 | | 355 | | | | | |
| | 834 | G313 | Torque control P gain 2 (current loop proportional gain) | 0% to 500%, 9999 | 1% | 9999 | | | | | | | |
| | 835 | G314 | Torque control integral time 2 (current loop integral time) | 0 to 500 ms, 9999 | 0.1 ms | 9999 | | 9999 | | 190 | | | |
| | 837 | G316 | Torque detection filter 2 | 0 to 0.1 s, 9999 | 0.001 s | 9999 | | 9999 | | 9999 | | 193 | |
| _ | 849 | T007 | Analog input offset adjustment | 0% to 200% | 0.1% | 100% | | 355 | | | | | |
| Additional function | 858 | T040 | Terminal 4 function assignment | 0, 4, 9999 | 1 | 0 | | 290, 352 | | | | | |
| nal fu | 859 | C126 | Torque current/Rated PM motor current | 0 to 500 A, 9999 ^{*2} | 0.01 A ^{*2} 0.1 A ^{*3} | 9999 | | 383, 392 | | | | | |
| itio | | | | 0 to 3600 A, 9999 ^{*3} | | | | 002 | | | | | |
| pp | 860 | C226 | Second motor torque current/ | 0 to 500 A, 9999 ^{*2} | 0.01 A ^{*2} | 9999 | | 383, | | | | | |
| ٩ | | | Rated PM motor current | 0 to 3600 A, 9999 ^{*3} | 0.1 A ^{*3} | | | 392 | | | | | |
| | 864 | M470 | Torque detection | 0% to 400% | 0.1% | 150% | | 341 | | | | | |
| Indication | 866 | M042 | Torque monitoring reference | 0% to 400% | 0.1% | 150% | | 314 | | | | | |
| — | 867 | M321 | AM output filter | 0 to 5 s | 0.01 s | 0.01 s | | 319 | | | | | |
| _ | 868 | T010 | Terminal 1 function assignment | 0, 4, 9999 | 1 | 0 | | 290, 352 | | | | | |
| — | 869 | M334 | Current output filter | 0 to 5 s | 0.01 s | — | 0.02 s | 319 | | | | | |
| — | 870 | M440 | Speed detection hysteresis | 0 to 5 Hz | 0.01 Hz | 0 Hz | | 337 | | | | | |
| ctive tion | 872 ^{*14} | H201 | Input phase loss protection selection | 0, 1 | 1 | 0 | | 276 | | | | | |
| Protective function | 874 | H730 | OLT level setting | 0% to 400% | 0.1% | 120% | 110% | 290 | | | | | |
| | 882 | G120 | Regeneration avoidance operation selection | 0 to 2 | 1 | 0 | | 572 | | | | | |
| oidance | 883 | G121 | Regeneration avoidance operation level | 300 to 1200 V | 0.1 V | 380 VE 760 VE | | 572 | | | | | |
| ation av | 884 | G122 | Regeneration avoidance at deceleration detection sensitivity | 0 to 5 | 1 | 0 | | | | | | | |
| Regeneration avoidance | 885 | G123 | Regeneration avoidance compensation frequency limit value | 0 to 590 Hz, 9999 | 0.01 Hz | 6 Hz | | 572 | | | | | |
| | 886 | G124 | Regeneration avoidance voltage gain | 0% to 200% | 0.1% | 100% | | 572 | | | | | |

| | _ | Pr. | | | Minimum | EM CA | value | Refer | Customer |
|--------------------------|----------------------------|-------|--|----------------------------|-----------------------|--------|----------|-------------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| eter | 888 | E420 | Free parameter 1 | 0 to 9999 | 1 | 9999 | | 210 | |
| Free parameter | 889 | E421 | Free parameter 2 | 0 to 9999 | 1 | 9999 | | 210 | |
| — | 890 | H325 | Internal storage device status indication | (0 to 9999) | 1 | 0 | | 287 | |
| | 891 | M023 | Cumulative power monitor digit shifted times | 0 to 4, 9999 | 1 | 9999 | | 305, 324 | |
| | 892 | M200 | Load factor | 30% to 150% | 0.1% | 100% | | 324 | |
| _ | 893 | M201 | Energy saving monitor | 0.1 to 55 kW ^{*2} | 0.01 kW ^{*2} | | r rated | 324 | |
| rinç | | | reference (motor capacity) | 0 to 3600 kW ^{*3} | 0.1 kW ^{*3} | capaci | capacity | | |
| Energy saving monitoring | 894 | M202 | Control selection during commercial power-supply operation | 0 to 3 | 1 | 0 | | 324 | |
| savinç | 895 | M203 | Power saving rate reference value | 0, 1, 9999 | 1 | 9999 | | 324 | |
| rgy | 896 | M204 | Power unit cost | 0 to 500, 9999 | 0.01 | 9999 | | 324 | |
| Enei | 897 | M205 | Power saving monitor average time | 0 to 1000 h, 9999 | 1 h | 9999 | | 324 | |
| | 898 | M206 | Power saving cumulative monitor clear | 0, 1, 10, 9999 | 1 | 9999 | | | |
| | 899 | M207 | Operation time rate (estimated value) | 0% to 100%, 9999 | 0.1% | 9999 | | 324 | |
| | C0 (900) ^{*9} | M310 | FM/CA terminal calibration | — | — | — | | 319 | |
| | C1 (901) ^{*9} | M320 | AM terminal calibration | _ | - | _ | | 319 | |
| | C2 (902) ^{*9} | T200 | Terminal 2 frequency setting bias frequency | 0 to 590 Hz | 0.01 Hz | 0 Hz | | 357 | |
| | C3 (902) ^{*9} | T201 | Terminal 2 frequency setting bias | 0% to 300% | 0.1% | 0% | | 357 | |
| | 125 (903) ^{*9} | T202 | Terminal 2 frequency setting gain frequency | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 357 | |
| 5 | C4 (903) ^{*9} | T203 | Terminal 2 frequency setting gain | 0% to 300% | 0.1% | 100% | | 357 | |
| ramete | C5 (904) ^{*9} | T400 | Terminal 4 frequency setting bias frequency | 0 to 590 Hz | 0.01 Hz | 0 Hz | | 357 | |
| ion pa | C6 (904) ^{*9} | T401 | Terminal 4 frequency setting bias | 0% to 300% | 0.1% | 20% | | 357 | |
| Calibration parameter | 126 (905) ^{*9} | T402 | Terminal 4 frequency setting gain frequency | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 357 | |
| 0 | C7 (905) ^{*9} | T403 | Terminal 4 frequency setting gain | 0% to 300% | 0.1% | 100% | | 357 | |
| | C12 (917) ^{*9} | T100 | Terminal 1 bias frequency (speed) | 0 to 590 Hz | 0.01 Hz | 0 Hz | | 357 | |
| | C13 (917) ^{*9} | T101 | Terminal 1 bias (speed) | 0% to 300% | 0.1% | 0% | | 357 | |
| | C14 (918) ^{*9} | T102 | Terminal 1 gain frequency (speed) | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 357 | |
| | C15 (918) ^{*9} | T103 | Terminal 1 gain (speed) | 0% to 300% | 0.1% | 100% | | 357 | |
| | C16 (919) ^{*9} | T110 | Terminal 1 bias command (torque) | 0% to 400% | 0.1% | 0% | | 363 | |

| | | Pr. | | | Minimum | Initial | value | Refer | Customer |
|-----------------------|----------------------------|-------|---|--|--------------------|---------------------------------------|-------|---------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| | C17 (919) ^{*9} | T111 | Terminal 1 bias (torque) | 0% to 300% | 0.1% | 0% | | 363 | |
| | C18 (920) ^{*9} | T112 | Terminal 1 gain command (torque) | 0% to 400% | 0.1% | 150% | | 363 | |
| | C19 (920) ^{*9} | T113 | Terminal 1 gain (torque) | 0% to 300% | 0.1% | 100% | | 363 | |
| | C8 (930) ^{*9} | M330 | Current output bias signal | 0% to 100% | 0.1% | _ | 0% | 319 | |
| | C9 (930) ^{*9} | M331 | Current output bias current | 0% to 100% | 0.1% | _ | 0% | 319 | |
| Ŀ | C10 (931) ^{*9} | M332 | Current output gain signal | 0% to 100% | 0.1% | _ | 100% | 319 | |
| amete | C11 (931) ^{*9} | M333 | Current output gain current | 0% to 100% | 0.1% | _ | 100% | 319 | |
| Calibration parameter | C38 (932) ^{*9} | T410 | Terminal 4 bias command (torque) | 0% to 400% | 0.1% | 0% | I | 363 | |
| alibrati | C39 (932) ^{*9} | T411 | Terminal 4 bias (torque) | 0% to 300% | 0.1% | 20% | | 363 | |
| ö | C40 (933) ^{*9} | T412 | Terminal 4 gain command (torque) | 0% to 400% | 0.1% | 150% | | 363 | |
| | C41 (933) ^{*9} | T413 | Terminal 4 gain (torque) | 0% to 300% | 0.1% | 100% | 100% | | |
| | C42 (934) ^{*9} | A630 | PID display bias coefficient | 0 to 500, 9999 | 0.01 | 9999 | | 442 | |
| | C43 (934) ^{*9} | A631 | PID display bias analog value | 0% to 300% | 0.1% | 20% | 20% | | |
| | C44 (935) ^{*9} | A632 | PID display gain coefficient | 0 to 500, 9999 | 0.01 | 9999 | | 442 | |
| | C45 (935) ^{*9} | A633 | PID display gain analog value | 0% to 300% | 0.1% | 100% | | 442 | |
| _ | 977 | E302 | Input voltage mode selection | 0 to 2 | 1 | 0 | | 205 | |
| _ | 989 | E490 | Parameter copy alarm release | 10 ^{*2} 100 ^{*3} | 1 | 10 ^{*2} 100 ^{*3} | | 579 | |
| _ | 990 | E104 | PU buzzer control | 0, 1 | 1 | 1 | | 200 | |
| Ы | 991 | E105 | PU contrast adjustment | 0 to 63 | 1 | 58 | | 200 | |
| Monitoring function | 992 | M104 | Operation panel setting dial push monitor selection | 0 to 3, 5 to 14, 17, 18, 20, 23 to 25, 34, 38, 40 to 45, 50 to 57, 61, 62, 64, 67 to 69, 81 to 96, 98, 100 | 1 | 0 | | 305 | |
| - | 997 | H103 | Fault initiation | 0 to 255, 9999 | 1 | 9999 | | 275 | |
| - | 998 | E430 | PM parameter initialization <i>Simple</i> | 0, 12, 14, 112, 114, 8009, 8109, 9009, 9109 ^{*10*11} 0, 8009, 8109, 9009, 9109 ^{*12} | 1 | 0 | | 182 | |
| _ | 999 | E431 | Automatic parameter setting(Simple) | 1, 2, 10 to 13, 20, 21, 9999 | 1 | 9999 | | 211 | |
| _ | 1000 | E108 | Direct setting selection | 0 to 2 | 1 | 0 | | 201 | |
| _ | 1002 | C150 | Lq tuning target current adjustment coefficient | 50% to 150%, 9999 | 0.1% | 9999 | | 392 | |
| × | 1006 | E020 | Clock (year) | 2000 to 2099 | 1 | 2000 | | 195 | |
| Clock | 1007 | E021 | Clock (month, day) | Jan. 1 to Dec. 31 | 1 | 101 | | 195 | |
| Ū | 1008 | E022 | Clock (hour, minute) | 0:00 to 23:59 | 1 | 0 | | 195 | |
| - | 1013 ^{*14} | H323 | Running speed after emergency drive retry reset | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 279 | |

| | _ | Pr. | | | Minimum | Initial value | | Refer | Customer |
|---------------------|------|-------|---|---|-----------------------|---------------|-----|---------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| _ | 1015 | A607 | Integral stop selection at limited frequency | 0 to 2, 10 to 12 | 1 | 0 | | 419 | |
| _ | 1016 | H021 | PTC thermistor protection detection time | 0 to 60 s | 1 s | 0 | | 266 | |
| — | 1018 | M045 | Monitor with sign selection | 0, 1, 9999 | 1 | 9999 | | 305 | |
| | 1020 | A900 | Trace operation selection | 0 to 4 | 1 | 0 | | 486 | |
| | 1021 | A901 | Trace mode selection | 0 to 2 | 1 0 | | 486 | | |
| | 1022 | A902 | Sampling cycle | 0 to 9 | 1 | 2 | | 486 | |
| | 1023 | A903 | Number of analog channels | 1 to 8 | 1 | 4 | | 486 | |
| | 1024 | A904 | Sampling auto start | 0, 1 | 1 | 0 | | 486 | |
| | 1025 | A905 | Trigger mode selection | 0 to 4 | 1 | 0 | | 486 | |
| | 1026 | A906 | Number of sampling before trigger | 0% to 100% | 1% | 90% | | 486 | |
| | 1027 | A910 | Analog source selection (1ch) | | | 201 | | 486 | |
| | 1028 | A911 | Analog source selection (2ch) | | | 202 | | 486 | |
| | 1029 | A912 | Analog source selection (3ch) | 1 to 3, 5 to 14, 17, 18, | | 203 | | 486 | |
| | 1030 | A913 | Analog source selection (4ch) | 20, 23, 24, 34, 40 to 42, 52 to 54, 61, 62, 64, 67 | 1 | 204 | | 486 | |
| | 1031 | A914 | Analog source selection (5ch) | to 69, 81 to 96, 98, 201 to 213, 230 to 232, | 1 | 205 | | 486 | |
| Trace | 1032 | A915 | Analog source selection (6ch) | 237, 238 | | 206 | | 486 | |
| Tra | 1033 | A916 | Analog source selection (7ch) | | | 207 | | 486 | |
| | 1034 | A917 | Analog source selection (8ch) | | | 208 | | 486 | |
| | 1035 | A918 | Analog trigger channel | 1 to 8 | 1 | 1 | | 486 | |
| | 1036 | A919 | Analog trigger operation selection | 0, 1 | 1 | 0 | | 486 | |
| | 1037 | A920 | Analog trigger level | 600 to 1400 | 1 | 1000 | | 486 | |
| | 1038 | A930 | Digital source selection (1ch) | | | 1 | | 486 | |
| | 1039 | A931 | Digital source selection (2ch) | | | 2 | | 486 | |
| | 1040 | A932 | Digital source selection (3ch) | | | 3 | | 486 | |
| | 1041 | A933 | Digital source selection (4ch) | 1 to 255 | 1 | 4 | | 486 | |
| | 1042 | A934 | Digital source selection (5ch) | 1.0200 | ' | 5 | | 486 | |
| | 1043 | A935 | Digital source selection (6ch) | | | 6 | | 486 | |
| | 1044 | A936 | Digital source selection (7ch) | | | 7 | | 486 | |
| | 1045 | A937 | Digital source selection (8ch) | | | 8 | | 486 | |
| | 1046 | A938 | Digital trigger channel | 1 to 8 | 1 | 1 | | 486 | |
| | 1047 | A939 | Digital trigger operation selection | 0, 1 | 1 | 0 | | 486 | |
| — | 1048 | E106 | Display-off waiting time | 0 to 60 min | 1 min | 0 | | 200 | |
| — | 1049 | E110 | USB host reset | 0, 1 | 1 | 0 | | 201 | |
| ы | 1106 | M050 | Torque monitor filter | 0 to 5 s, 9999 | 0.01 s | 9999 | | 305 | |
| ncti | 1107 | M051 | Running speed monitor filter | 0 to 5 s, 9999 | 0.01 s | 9999 | | 305 | |
| Monitoring function | 1108 | M052 | Excitation current monitor filter | 0 to 5 s, 9999 | 0.01 s | 9999 | | 305 | |

| | | Pr. | | | Minimum | Initial | value | Refer | Customer |
|-------------|-----------------|-----------------|---|--|-----------------------|------------------|-------|------------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| | 1132 | A626 | Pre-charge change increment amount | 0% to 100%, 9999 | 0.01% | 9999 | | 445 | |
| | 1133 | A666 | Second pre-charge change increment amount | 0% to 100%, 9999 | 0.01% | 9999 | | 445 | |
| | 1136 | A670 | Second PID display bias coefficient | 0 to 500, 9999 | 0.01 | 9999 | | 442 | |
| | 1137 | A671 | Second PID display bias analog value | 0% to 300% | 0.1% | 20% | | 442 | |
| | 1138 | A672 | Second PID display gain coefficient | 0 to 500, 9999 | 0.01 | 9999 | | 442 | |
| | 1139 | A673 | Second PID display gain analog value | 0% to 300% | 0.1% | 100% | | 442 | |
| ontrol | 1140 | A664 | Second PID set point/ deviation input selection | 1 to 5 | 1 | 2 | | 419 | |
| PID control | 1141 | A665 | Second PID measured value input selection | 1 to 5, 101 to 105 | 1 | 3 | | 419 | |
| | 1142 | A640 | Second PID unit selection | 0 to 43, 9999 | 1 | 9999 | | 419 | |
| | 1143 | A641 | Second PID upper limit | 0% to 100%, 9999 | 0.1% | 9999 | | 419 419 | |
| | 1144 | A642 | Second PID lower limit | 0% to 100%, 9999 | 0.1% | 9999 | 9999 | | |
| | 1145 | A643 | Second PID deviation limit | 0% to 100%, 9999 | 0.1% | 9999 | | 419 | |
| | 1146 | A644 | Second PID signal operation selection | 0 to 7, 10 to 17 | 1 | 0 | | 419 | |
| | 1147 | A661 | Second output interruption detection time | 0 to 3600 s, 9999 | 0.1 s | 1 | 1 | | |
| | 1148 | A662 | Second output interruption detection level | 0 to 590 Hz | 0.01 Hz | 0 Hz | | 419 | |
| | 1149 | A663 | Second output interruption cancel level | 900% to 1100% | 0.1% | 1000% | | 419 | |
| РГС | 1150 to 1199 | A810 to A859 | PLC function user parameters 1 to 50 | 0 to 65535 | 1 | 0 | | 483 | |
| | 1211 | A690 | PID gain tuning timeout time | 1 to 9999 s | 1 s | 100 s | | 437 | |
| | 1212 | A691 | Step manipulated amount | 900% to 1100% | 0.1% | 1000% | | 437 | |
| | 1213 | A692 | Step response sampling cycle | 0.01 to 600 s | 0.01 s | 1 s | | 437 | |
| tuning | 1214 | A693 | Timeout time after the maximum slope | 1 to 9999 s | 1 s | 10 s | | 437 | |
| | 1215 | A694 | Limit cycle output upper limit | 900% to 1100% | 0.1% | 1100% | | 437 | |
| PID gain | 1216 | A695 | Limit cycle output lower limit | 900% to 1100% | 0.1% | 1000% | | 437 | |
| ₽ | 1217 | A696 | Limit cycle hysteresis | 0.1% to 10% | 0.1% | 1% | | 437 | |
| ē. | 1218 | A697 | PID gain tuning setting | 0, 100 to 102, 111, 112, 121, 122, 200 to 202, 211, 212, 221, 222 | 1 | 0 | | 437 | |
| | 1219 | A698 | PID gain tuning start/status | (0), 1, 8, (9, 90 to 96) | 1 | 0 | | 437 | |
| _ | 1300 to 1343 | N500 to N543 | Communication option parameter For details, refer to the Instruction | ers. | | | | | |
| — | 1346 | A457 | PID lower limit operation detection time | 0 to 900 s, 9999 | 1 | 9999 419, 459 | | | |
| - | 1350 to 1359 | N550 to N559 | Communication option parameter For details, refer to the Instruction | | | | | | |

| | | Pr. | | | Minimum | Initial | value | Refer | Customer |
|--------------------------------|------|-------|--|-------------------|------------|---------|-------|---------------------|----------|
| Function | Pr. | group | Name | Setting range | setting | FM | СА | to page | setting |
| | | | Detection time for PID output | | increments | _ | | 459 | |
| | 1361 | A440 | hold | 0 to 900 s | 0.1 s | 5 s | | | |
| | 1362 | A441 | PID output hold range | 0% to 50%, 9999 | 0.1% | 9999 | | 459 | |
| | 1363 | A447 | PID priming time | 0 to 360 s, 9999 | 0.1 s | 9999 | | 459 | |
| | 1364 | A448 | Stirring time during sleep | 0 to 3600 s | 0.1 s | 15 s | | 459 | |
| | 1365 | A449 | Stirring interval time | 0 to 1000 h | 0.1 h | 0 h | | 459 | |
| | 1366 | A627 | Sleep boost level | 0% to 100%, 9999 | 0.01% | 9999 | | 459 | |
| | 1367 | A628 | Sleep boost waiting time | 0 to 360 s | 0.1 s | 0 s | | 459 | |
| | 1368 | A629 | Output interruption cancel time | 0 to 360 s | 0.1 s | 0 s | | 459 | |
| <i>"</i> | 1369 | A446 | Check valve closing completion frequency | 0 to 120 Hz, 9999 | 0.01 Hz | 9999 | | 459 | |
| PID control enhanced functions | 1370 | A442 | Detection time for PID limiting operation | 0 to 900 s | 0.1 s | 0 s | | 419, 450, 459 | |
| nced | 1371 | A443 | PID upper/lower limit pre- warning level range | 0% to 50%, 9999 | 0.1% | 9999 | | 459 | |
| enha | 1372 | A444 | PID measured value control set point change amount | 0% to 50% | 0.01% | 5% | | 459 | |
| ontrol | 1373 | A445 | PID measured value control set point change rate | 0% to 100% | 0.01% | 0% | | 459 | |
| PID c | 1374 | A450 | Auxiliary pressure pump operation starting level | 900% to 1100% | 0.1% | 1000% |) | 459 | |
| | 1375 | A451 | Auxiliary pressure pump operation stopping level | 900% to 1100% | 0.1% | 1000% | 1000% | | |
| | 1376 | A414 | Auxiliary motor stopping level | 0% to 100%, 9999 | 0.1% | 9999 | | 459 | |
| | 1377 | A452 | PID input pressure selection | 1 to 3, 9999 | 1 | 9999 | | 459 | |
| | 1378 | A453 | PID input pressure warning level | 0% to 100% | 0.1% | 20% | | 459 | |
| | 1379 | A454 | PID input pressure fault level | 0% to 100%, 9999 | 0.1% | 9999 | | 459 | |
| | 1380 | A455 | PID input pressure warning set point change amount | 0% to 100% | 0.01% | 5% | | 459 | |
| | 1381 | A456 | PID input pressure fault operation selection | 0, 1 | 1 | 0 | | 459 | |
| — | 1410 | A170 | Starting times lower 4 digits | 0 to 9999 | 1 | 0 | | 413 | |
| — | 1411 | A171 | Starting times upper 4 digits | 0 to 9999 | 1 | 0 | | 413 | |
| — | 1412 | C135 | Motor induced voltage constant (phi f) exponent | 0 to 2, 9999 | 1 | 9999 | | 392 | |
| _ | 1413 | C235 | Second motor induced voltage constant (phi f) exponent | 0 to 2, 9999 | 1 | 9999 | | 392 | |
| | 1460 | A683 | PID multistage set point 1 | 0% to 100%, 9999 | 0.01% | 9999 | | 419 | |
| ing | 1461 | A684 | PID multistage set point 2 | 0% to 100%, 9999 | 0.01% | 9999 | | 419 | |
| PID gain tuning | 1462 | A685 | PID multistage set point 3 | 0% to 100%, 9999 | 0.01% | 9999 | | 419 | |
| ain | 1463 | A686 | PID multistage set point 4 | 0% to 100%, 9999 | 0.01% | 9999 | | 419 | |
| D D | 1464 | A687 | PID multistage set point 5 | 0% to 100%, 9999 | 0.01% | 9999 | | 419 | |
| đ | 1465 | A688 | PID multistage set point 6 | 0% to 100%, 9999 | 0.01% | 9999 | | 419 | |
| | 1466 | A689 | PID multistage set point 7 | 0% to 100%, 9999 | 0.01% | 9999 | | 419 | 1 |

| | | Pr. | | | Minimum | Initial | value | Refer | Customer |
|--------------------------------------|------|-------|---|---------------------------|-----------------------|---------|-------|---------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| | 1469 | A420 | Number of cleaning times monitor | 0 to 255 | 1 | 0 | | 415 | |
| | 1470 | A421 | Number of cleaning times setting | 0 to 255 | 1 | 0 | | 415 | |
| | 1471 | A422 | Cleaning trigger selection | 0 to 15 | 1 | 0 | | 415 | |
| | 1472 | A423 | Cleaning reverse rotation frequency | 0 to 590 Hz | 0.01 Hz | 30 Hz | | 415 | |
| Cleaning | 1473 | A424 | Cleaning reverse rotation operation time | 0 to 3600 s | 0.1 s | 5 s | | 415 | |
| Cle | 1474 | A425 | Cleaning forward rotation frequency | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 415 | |
| | 1475 | A426 | Cleaning forward rotation operation time | 0 to 3600 s, 9999 | 0.1 s | 9999 | | 415 | |
| | 1476 | A427 | Cleaning stop time | 0 to 3600 s | 0.1 s | 5 s | | 415 | |
| | 1477 | A428 | Cleaning acceleration time | 0 to 3600 s, 9999 | 0.1 s | 9999 | | 415 | |
| | 1478 | A429 | Cleaning deceleration time | 0 to 3600 s, 9999 | 0.1 s | 9999 | | 415 | |
| | 1479 | A430 | Cleaning time trigger | 0 to 6000 h | 0.1 h | 0 h | | 415 | |
| | 1480 | H520 | Load characteristics measurement mode | 0, 1 (2 to 5, 81 to 85) | 1 | 0 | | 298 | |
| | 1481 | H521 | Load characteristics load reference 1 | 0% to 400%, 8888, 9999 | 0.1% | 9999 | | 298 | |
| | 1482 | H522 | Load characteristics load reference 2 | 0% to 400%, 8888, 9999 | 0.1% | 9999 | | 298 | |
| E | 1483 | H523 | Load characteristics load reference 3 | 0% to 400%, 8888, 9999 | 0.1% | 9999 | | 298 | |
| etectio | 1484 | H524 | Load characteristics load reference 4 | 0% to 400%, 8888, 9999 | 0.1% | 9999 | | 298 | |
| ault d | 1485 | H525 | Load characteristics load reference 5 | 0% to 400%, 8888, 9999 | 0.1% | 9999 | | 298 | |
| stics f | 1486 | H526 | Load characteristics maximum frequency | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 298 | |
| Load characteristics fault detection | 1487 | H527 | Load characteristics minimum frequency | 0 to 590 Hz | 0.01 Hz | 6 Hz | | 298 | |
| d char | 1488 | H531 | Upper limit warning detection width | 0% to 400%, 9999 | 0.1% | 20% | | 298 | |
| Loa | 1489 | H532 | Lower limit warning detection width | 0% to 400%, 9999 | 0.1% | 20% | | 298 | |
| | 1490 | H533 | Upper limit fault detection width | 0% to 400%, 9999 | 0.1% | 9999 | | 298 | |
| | 1491 | H534 | Lower limit fault detection width | 0% to 400%, 9999 | 0.1% | 9999 | | 298 | |
| | 1492 | H535 | Load status detection signal delay time / load reference measurement waiting time | 0 to 60 s | 0.1 s | 1 s | | 298 | |
| — | 1499 | E415 | Parameter for manufacturer sett | - | | | | | |
| ers | | CLR | Parameter clear | (0), 1 | 1 | 0 | | 578 | |
| nete | ALI | L.CL | All parameter clear | (0), 1 | 1 | 0 | | 578 | |
| Clear parameters | En | .CL | Fault history clear | (0), 1 | 1 | 0 | | 590 | |
| — | Pr. | СРҮ | Parameter copy | (0), 1 to 3 | 1 | 0 | | 579 | |
| — | Pr. | CHG | Initial value change list | — | 1 | 0 | | 586 | |
| _ | | PM | IPM initialization | 0, 12, 14 | 1 | 0 | | 182 | |
| — | AL | ЛО | Automatic parameter setting | — | — | — | | 211 | |
| — | Pr. | MD | Group parameter setting | (0), 1, 2 | 1 | 0 | | 164 | |

- *1 Differs according to the capacity.
 - 6%: FR-F820-00046(0.75K) or lower and FR-F840-00023(0.75K) or lower 4%: FR-F820-00077(1.5K) to FR-F820-00167(3.7K), FR-F840-00038(1.5K) to FR-F840-00083(3.7K) 3%: FR-F820-00250(5.5K), FR-F820-00340(7.5K), FR-F840-00126(5.5K), FR-F840-00170(7.5K) 2%: FR-F820-00490(11K) to FR-F820-01540(37K), FR-F840-00250(11K) to FR-F840-00770(37K) 1.5%: FR-F820-01870(45K), FR-F820-02330(55K), FR-F840-00930(45K), FR-F840-01160(55K) 1%: FR-F820-03160(75K) or higher and FR-F840-01800(75K) or higher
- *2 The setting range or initial value for the FR-F820-02330(55K) or lower and FR-F840-01160(55K) or lower.
- *3 The setting range or initial value for the FR-F820-03160(75K) or higher and FR-F840-01800(75K) or higher.
- *4 The initial value for the FR-F820-00340(7.5K) or lower and FR-F840-00170(7.5K) or lower.
- *5 The initial value for the FR-F820-00490(11K) or higher and FR-F840-00250(11K) or higher.
- *6 Differs according to the capacity.
 4%: FR-F820-00340(7.5K) or lower and FR-F840-00170(7.5K) or lower
 2%: FR-F820-00490(11K) to FR-F820-02330(55K), FR-F840-00250(11K) to FR-F840-01160(55K)
 1%: FR-F820-00490(11K) or birther and FR-F840-01200(75K) or birther
- 1%: FR-F820-03160(75K) or higher and FR-F840-01800(75K) or higher
- *7 The value for the 200 V class.
- *8 The value for the 400 V class.
- *9 The parameter number in parentheses is the one for use with the LCD operation panel and the parameter unit.
- $^{\ast}10~$ The setting range or initial value for the standard model.
- *11 The setting range or initial value for the separated converter type.
- *12 The setting range or initial value for the IP55 compatible model.
- *13 The setting is available for the standard structure model or the separated converter type.
- *14 The setting is available for the standard structure model and the IP55 compatible model.
- *15 The setting is available when the PLC function is enabled.

5.1.2 Use of a function group number for the identification of parameters

A parameter identification number shown on the PU can be switched from a parameter number to a function group number. As parameters are grouped by function and displayed by the group, the related parameters can be set continually at a time.

Changing a parameter identification number to a function group number

| Pr.MD setting | Description |
|---------------|---|
| 0 | The setting of parameter identification number remains the same as the last setting. |
| 1 | The parameter number is used for the identification of parameters, and displayed in numerical order. |
| 2 | The function group number is used for the identification of parameters, and displayed in alphanumeric order. |

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- 2. Selecting the parameter setting mode

Press MODE to choose the parameter setting mode. (The parameter number read previously appears on the 12-segment LCD display.)

3. Selecting a parameter

Press **SET** to confirm the selection. The setting **"[]**" (initial value) will appear.

4. Selecting the use of the function group number

• Selecting a parameter by function group number to change its setting

The following shows the procedure to change the setting of P.H400 (Pr.1) Maximum frequency.

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- **2.** Changing the operation mode

Press $\boxed{\frac{PU}{EXT}}$ to choose the PU operation mode. [PU] indicator turns ON.

3. Selecting the parameter setting mode

Press MODE to choose the parameter setting mode. (The parameter number read previously appears on the 12-segment LCD display.)

4. Enabling the function group selection

Press ESC several times until "

5. Enabling the function group selection

| Turn 😥 until " | " (Protective function parameter 4) appears. Press | SET to confirm the selection. |
|---------------------------------|--|--------------------------------------|
| " /! // " will appear, " | which shows that the operation panel is ready for sele | ection of a number in the group |
| of Protective function paramete | r 4. | |

6. Selecting a parameter

| Turn 🕄 | until " | SET | to display the present set |
|----------|------------------------------------|-----|----------------------------|
| value. " | [(initial value)" appears. | | |

7. Changing the setting value

| Turn | to change the set value t | o " ". Press | SET to confirm the selection. | " " and |
|------|---------------------------|----------------------|-------------------------------|-----------------|
| | | | | |

5.1.3 Parameter list (by function group number)

E: Environment setting parameters

Parameters for the inverter operating environment.

| Pr. | Pr. | Name | Refer |
|-------|-------------------|---|------------|
| group | | | to page |
| E000 | 168 | Parameter for manufacturer setting. Do not set. | |
| E001 | 169 | Parameter for manufacturer setting. De | o not set. |
| E020 | 1006 | Clock (year) | 195 |
| E021 | 1007 | Clock (month, day) | 195 |
| E022 | 1008 | Clock (hour, minute) | 195 |
| E023 | 269 | Parameter for manufacturer setting. Do | o not set. |
| E080 | 168 | Parameter for manufacturer setting. Do | |
| E081 | 169 | Parameter for manufacturer setting. Do | |
| E100 | 75 | Reset selection | 196 |
| E101 | 75 | Disconnected PU detection | 196 |
| E102 | 75 | PU stop selection | 196 |
| E103 | 145 | PU display language selection | 200 |
| E100 | 990 | PU buzzer control | 200 |
| E104 | 991 | PU contrast adjustment | 200 |
| E105 | 1048 | Display-off waiting time | 200 |
| E100 | 75 | Reset limit | 196 |
| | - | | 201 |
| E108 | 1000 | Direct setting selection | |
| E110 | 1049 | USB host reset | 598 |
| E200 | 161 | Frequency setting/key lock operation selection | 202 |
| E201 | 295 | Frequency change increment amount setting | 203 |
| E300 | 30 | Regenerative function selection | 566 |
| E301 | 570 | Multiple rating setting | 204 |
| E302 | 977 | Input voltage mode selection | 205 |
| E400 | 77 | Parameter write selection | 206 |
| E410 | 296 | Password lock level | 208 |
| E411 | 297 | Password lock/unlock | 208 |
| E415 | 1499 | Parameter for manufacturer setting. Do | o not set. |
| E420 | 888 | Free parameter 1 | 210 |
| E421 | 889 | Free parameter 2 | 210 |
| E430 | 998 | PM parameter initialization Simple | 182 |
| E431 | 999 | Automatic parameter setting Simple | 211 |
| E440 | 160 | User group read selection Simple | 215 |
| E441 | 172 | User group registered display/ batch clear | 215 |
| E442 | 173 | User group registration | 215 |
| E443 | 174 | User group clear | 215 |
| E490 | 989 | Parameter copy alarm release | 579 |
| E600 | 72 | PWM frequency selection | 218 |
| E601 | 240 | Soft-PWM operation selection | 218 |
| E602 | 260 | PWM frequency automatic switchover | 218 |
| E700 | 255 | Life alarm status display | 220 |
| E701 | 256 ^{*3} | Inrush current limit circuit life display | 220 |
| E702 | 257 | Control circuit capacitor life display | 220 |
| E703 | 258 ^{*3} | Main circuit capacitor life display | 220 |
| E704 | 259 ^{*3} | Main circuit capacitor life measuring | 220 |

| Pr. group | Pr. | Name | Refer to page |
|--------------|-------------------|--|------------------|
| E705 | 506 ^{*3} | Display estimated main circuit capacitor residual life | 220 |
| E706 | 507 | Display/reset ABC1 relay contact life | 220 |
| E707 | 508 | Display/reset ABC2 relay contact life | 220 |
| E710 | 503 | Maintenance timer 1 | 224 |
| E711 | 504 | Maintenance timer 1 warning output set time | 224 |
| E712 | 686 | Maintenance timer 2 | 224 |
| E713 | 687 | Maintenance timer 2 warning output set time | 224 |
| E714 | 688 | Maintenance timer 3 | 224 |
| E715 | 689 | Maintenance timer 3 warning output set time | 224 |
| E720 | 555 | Current average time | 225 |
| E721 | 556 | Data output mask time | 225 |
| E722 | 557 | Current average value monitor signal output reference current | 225 |

F: Parameters for the settings of the acceleration/deceleration time and the acceleration/deceleration pattern

Parameters for the motor acceleration/deceleration characteristics.

| Pr. | Pr. | Name | Refer |
|-------|-----|---|-------------|
| group | F1. | Name | to page |
| F000 | 20 | Acceleration/deceleration reference frequency | 228 |
| F001 | 21 | Acceleration/deceleration time increments | 228 |
| F002 | 16 | Jog acceleration/deceleration time | 261 |
| F003 | 611 | Acceleration time at a restart | 466, 472 |
| F010 | 7 | Acceleration time Simple | 228 |
| F011 | 8 | Deceleration time Simple | 228 |
| F020 | 44 | Second acceleration/deceleration time | 228 |
| F021 | 45 | Second deceleration time | 228 |
| F022 | 147 | Acceleration/deceleration time switching frequency | 228 |
| F031 | 111 | Check valve deceleration time | 459 |
| F070 | 791 | Acceleration time in low-speed range | 228 |
| F071 | 792 | Deceleration time in low-speed range | 228 |
| F100 | 29 | Acceleration/deceleration pattern selection | 231 |
| F101 | 59 | Remote function selection | 234 |
| F102 | 13 | Starting frequency | 238, 239 |
| F103 | 571 | Holding time at a start | 238 |
| F200 | 140 | Backlash acceleration stopping frequency | 231 |
| F201 | 141 | Backlash acceleration stopping time | 231 |

| Pr. group | Pr. | Name | Refer to page |
|--------------|-----|---|------------------|
| F202 | 142 | Backlash deceleration stopping frequency | 231 |
| F203 | 143 | Backlash deceleration stopping time | 231 |

D: Parameters for the setting of operation command and frequency command

Parameters for setting the command source to the inverter, and the motor driving frequency and torque.

| Pr. group | Pr. | Name | Refer to page |
|-----------------|---------------|--|------------------|
| D000 | 79 | Operation mode selection Simple | 240, 250 |
| D001 | 340 | Communication startup mode selection | 250 |
| D010 | 338 | Communication operation command source | 251 |
| D011 | 339 | Communication speed command source | 251 |
| D012 | 550 | NET mode operation command source selection | 251 |
| D013 | 551 | PU mode operation command source selection | 251 |
| D020 | 78 | Reverse rotation prevention selection | 257 |
| D100 | 291 | Pulse train I/O selection | 258, 314 |
| D101 | 384 | Input pulse division scaling factor | 258 |
| D110 | 385 | Frequency for zero input pulse | 258 |
| D111 | 386 | Frequency for maximum input pulse | 258 |
| D200 | 15 | Jog frequency | 261 |
| D300 | 28 | Multi-speed input compensation selection | 263 |
| D301 | 4 | Multi-speed setting (high speed) | 263 |
| D302 | 5 | Multi-speed setting (middle speed) | 263 |
| D303 | 6 | Multi-speed setting (low speed) | 263 |
| D304 to D307 | 24 to 27 | Multi-speed setting (speed 4 to speed 7) | 263 |
| D308 to D315 | 232 to 239 | Multi-speed setting (speed 8 to speed 15) | 263 |

♦ H: Protective function parameter

Parameters to protect the motor and the inverter.

| Pr. group | Pr. | Name | Refer to page |
|--------------|-----|---|---------------------|
| H000 | 9 | Electronic thermal O/L relaySimple | 266, 383, 392 |
| H001 | 600 | First free thermal reduction frequency 1 | 266 |
| H002 | 601 | First free thermal reduction ratio 1 | 266 |
| H003 | 602 | First free thermal reduction frequency 2 | 266 |
| H004 | 603 | First free thermal reduction ratio 2 | 266 |

| Pr. group | Pr. | Name | Refer to page |
|--------------|--------------------|--|---------------------|
| H005 | 604 | First free thermal reduction frequency 3 | 266 |
| H006 | 607 | Motor permissible load level | 266 |
| H010 | 51 | Second electronic thermal O/L relay | 266, 383, 392 |
| H011 | 692 | Second free thermal reduction frequency 1 | 266 |
| H012 | 693 | Second free thermal reduction ratio 1 | 266 |
| H013 | 694 | Second free thermal reduction frequency 2 | 266 |
| H014 | 695 | Second free thermal reduction ratio 2 | 266 |
| H015 | 696 | Second free thermal reduction frequency 3 | 266 |
| H016 | 608 | Second motor permissible load level | 266 |
| H020 | 561 | PTC thermistor protection level | 266 |
| H021 | 1016 | PTC thermistor protection detection time | 266 |
| H100 | 244 | Cooling fan operation selection | 273 |
| H101 | 249 | Earth (ground) fault detection at start | 274 |
| H102 | 598 | Undervoltage level | 275 |
| H103 | 997 | Fault initiation | 275 |
| H106 | 244 | Cooling fan operation selection during the test operation | 273 |
| H200 | 251 | Output phase loss protection selection | 276 |
| H201 | 872 ^{*3} | Input phase loss protection selection | 276 |
| H300 | 65 | Retry selection | 276 |
| H301 | 67 | Number of retries at fault occurrence | 276 |
| H302 | 68 | Retry waiting time | 276 |
| H303 | 69 | Retry count display erase | 276 |
| H320 | 523 ^{*3} | Emergency drive mode selection | 279 |
| H321 | 524 ^{*3} | Emergency drive running speed | 279 |
| H322 | 515 ^{*3} | Emergency drive dedicated retry count | 279 |
| H323 | 1013 ^{*3} | Running speed after emergency drive retry reset | 279 |
| H324 | 514 ^{*3} | Emergency drive dedicated retry waiting time | 279 |
| H325 | 890 | Internal storage device status indication | 287 |
| H400 | 1 | Maximum frequency Simple | 287 |
| H401 | 2 | Minimum frequency Simple | 287 |
| H402 | 18 | High speed maximum frequency | 287 |
| H420 | 31 | Frequency jump 1A | 289 |
| H421 | 32 | Frequency jump 1B | 289 |
| H422 | 33 | Frequency jump 2A | 289 |
| H423 H424 | 34 35 | Frequency jump 2B Frequency jump 3A | 289 289 |
| H424 | 35 | Frequency jump 38 | 289 |
| H429 | 552 | Frequency jump range | 289 |
| H500 | 22 | Stall prevention operation level | 290 |
| H501 | 156 | Stall prevention operation selection | 290 |

| Pr. | Pr. | Name | Refer |
|-------|------|---|---------|
| group | | | to page |
| H520 | 1480 | Load characteristics measurement mode | 298 |
| H521 | 1481 | Load characteristics load reference 1 | 298 |
| H522 | 1482 | Load characteristics load reference 2 | 298 |
| H523 | 1483 | Load characteristics load reference 3 | 298 |
| H524 | 1484 | Load characteristics load reference 4 | 298 |
| H525 | 1485 | Load characteristics load reference 5 | 298 |
| H526 | 1486 | Load characteristics maximum frequency | 298 |
| H527 | 1487 | Load characteristics minimum frequency | 298 |
| H531 | 1488 | Upper limit warning detection width | 298 |
| H532 | 1489 | Lower limit warning detection width | 298 |
| H533 | 1490 | Upper limit fault detection width | 298 |
| H534 | 1491 | Lower limit fault detection width | 298 |
| H535 | 1492 | Load status detection signal delay time / load reference measurement waiting time | 298 |
| H600 | 48 | Second stall prevention operation level | 290 |
| H601 | 49 | Second stall prevention operation frequency | 290 |
| H610 | 23 | Stall prevention operation level compensation factor at double speed | 290 |
| H611 | 66 | Stall prevention operation reduction starting frequency | 290 |
| H620 | 148 | Stall prevention level at 0 V input | 290 |
| H621 | 149 | Stall prevention level at 10 V input | 290 |
| H631 | 154 | Voltage reduction selection during stall prevention operation | 290 |
| H730 | 874 | OLT level setting | 290 |
| H800 | 374 | Overspeed detection level | 302 |

M: Monitoring and its output signal

Parameters for the settings regarding the monitoring to check the inverter's operating status and the output signals for the monitoring.

| Pr. group | Pr. | Name | Refer to page |
|--------------|-----|--|------------------|
| M000 | 37 | Speed display | 303 |
| M001 | 505 | Speed setting reference | 303 |
| M002 | 144 | Speed setting switchover | 303 |
| M020 | 170 | Watt-hour meter clear | 305 |
| M021 | 563 | Energization time carrying-over times | 305 |
| M022 | 268 | Monitor decimal digits selection | 305 |
| M023 | 891 | Cumulative power monitor digit shifted times | 305, 324 |
| M030 | 171 | Operation hour meter clear | 305 |
| M031 | 564 | Operating time carrying-over times | 305 |
| M040 | 55 | Frequency monitoring reference | 314 |
| M041 | 56 | Current monitoring reference | 314 |

| Pr. group | Pr. | Name | Refer to page |
|--------------|----------------------------|--|------------------|
| M042 | 866 | Torque monitoring reference | 314 |
| M043 | 241 | Analog input display unit switchover | 357 |
| M044 | 290 | Monitor negative output selection | 305, 314 |
| M045 | 1018 | Monitor with sign selection | 305 |
| M050 | 1106 | Torque monitor filter | 305 |
| M051 | 1107 | Running speed monitor filter | 305 |
| M052 | 1108 | Excitation current monitor filter | 305 |
| M060 | 663 | Control circuit temperature signal output level | 347 |
| M100 | 52 | Operation panel main monitor selection | 305, 533 |
| M101 | 774 | Operation panel monitor selection 1 | 305, 533 |
| M102 | 775 | Operation panel monitor selection 2 | 305, 533 |
| M103 | 776 | Operation panel monitor selection 3 | 305, 533 |
| M104 | 992 | Operation panel setting dial push monitor selection | 305 |
| M200 | 892 | Load factor | 324 |
| M201 | 893 | Energy saving monitor reference (motor capacity) | 324 |
| M202 | 894 | Control selection during commercial power-supply operation | 324 |
| M203 | 895 | Power saving rate reference value | 324 |
| M204 | 896 | Power unit cost | 324 |
| M205 | 897 | Power saving monitor average time | 324 |
| M206 | 898 | Power saving cumulative monitor clear | 324 |
| M207 | 899 | Operation time rate (estimated value) | 324 |
| M300 | 54 | FM/CA terminal function selection | 314 |
| M301 | 158 | AM terminal function selection | 314 |
| M310 | C0 (900) ^{*1} | FM/CA terminal calibration | 319 |
| M320 | C1 (901) ^{*1} | AM terminal calibration | 319 |
| M321 | 867 | AM output filter | 319 |
| M330 | C8 (930) ^{*1} | Current output bias signal | 319 |
| M331 | C9 (930) ^{*1} | Current output bias current | 319 |
| M332 | C10 (931) ^{*1} | Current output gain signal | 319 |
| M333 | C11 (931) ^{*1} | Current output gain current | 319 |
| M334 | 869 | Current output filter | 319 |
| M400 | 190 | RUN terminal function selection | 330 |
| M401 | 191 | SU terminal function selection | 330 |
| M402 | 192 | IPF terminal function selection | 330 |
| M403 | 193 | OL terminal function selection | 330 |
| M404 | 194 | FU terminal function selection | 330 |
| M405 | 195 | ABC1 terminal function selection | 330 |
| M406 | 196 | ABC2 terminal function selection | 330 |
| M410 | 313 ^{*4} | DO0 output selection | 330 |
| M411 | 314 ^{*4} | DO1 output selection | 330 |

| group to p M412 315 ⁻⁴ DO2 output selection 330 M413 316 ⁻⁴ DO3 output selection 330 M414 317 ⁻⁴ DO4 output selection 330 M415 318 ⁻⁴ DO5 output selection 330 M416 319 ⁻⁴ DO6 output selection 330 M420 320 ⁻⁴ RA1 output selection 330 M421 321 ⁻⁴ RA2 output selection 330 M422 322 ⁻⁴ RA3 output selection 330 M430 157 OL signal output timer 290 M431 289 Inverter output terminal filter 330 M433 166 Output current detection signal retention time 337 M440 870 Speed detection hysteresis 337 M441 41 Up-to-frequency detection for reverse rotation 337 M442 42 Output frequency detection for reverse rotation 337 M443 43 Output current detection level 339 M461 <th>Pr.</th> <th>Pr.</th> <th>Name</th> <th>Refer</th> | Pr. | Pr. | Name | Refer |
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T: Multi-function input terminal parameters

Parameters for the setting of the input terminals via which commands are given to the inverter.

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| T001 | 267 | Terminal 4 input selection | 349 |
| T002 | 74 | Input filter time constant | 355 |
| T003 | 822 | Speed setting filter 1 | 355 |
| T005 | 832 | Speed setting filter 2 | 355 |
| T007 | 849 | Analog input offset adjustment | 355 |
| T010 | 868 | Terminal 1 function assignment | 290, 352 |
| T021 | 242 | Terminal 1 added compensation amount (terminal 2) | 353 |
| T022 | 125 | Terminal 2 frequency setting gain frequency Simple | 357 |

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| T040 | 858 | Terminal 4 function assignment | 290, 352 |
| T041 | 243 | Terminal 1 added compensation amount (terminal 4) | 353 |
| T042 | 126 | Terminal 4 frequency setting gain frequency Simple | 357 |
| T050 | 252 | Override bias | 353 |
| T051 | 253 | Override gain | 353 |
| T052 | 573 | 4 mA input check selection | 369 |
| T053 | 777 | 4 mA input fault operation frequency | 369 |
| T054 | 778 | 4 mA input check filter | 369 |
| T100 | C12 (917) ^{*1} | Terminal 1 bias frequency (speed) | 357 |
| T101 | C13 (917) ^{*1} | Terminal 1 bias (speed) | 357 |
| T102 | C14 (918) ^{*1} | Terminal 1 gain frequency (speed) | 357 |
| T103 | C15 (918) ^{*1} | Terminal 1 gain (speed) | 357 |
| T110 | C16 (919) ^{*1} | Terminal 1 bias command (torque) | 363 |
| T111 | C17 (919) ^{*1} | Terminal 1 bias (torque) | 363 |
| T112 | C18 (920) ^{*1} | Terminal 1 gain command (torque) | 363 |
| T113 | C19 (920) ^{*1} | Terminal 1 gain (torque) | 363 |
| T200 | C2 (902) ^{*1} | Terminal 2 frequency setting bias frequency | 357 |
| T201 | C3 (902) ^{*1} | Terminal 2 frequency setting bias | 357 |
| T202 | 125 (903) ^{*1} | Terminal 2 frequency setting gain frequency | 357 |
| T203 | C4 (903) ^{*1} | Terminal 2 frequency setting gain | 357 |
| T400 | C5 (904) ^{*1} | Terminal 4 frequency setting bias frequency | 357 |
| T401 | C6 (904) ^{*1} | Terminal 4 frequency setting bias | 357 |
| T402 | 126 (905) ^{*1} | Terminal 4 frequency setting gain frequency | 357 |
| T403 | C7 (905) ^{*1} | Terminal 4 frequency setting gain | 357 |
| T410 | C38 (932) ^{*1} | Terminal 4 bias command (torque) | 363 |
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| T700 | 178 | STF terminal function selection | 373 |
| T701 | 179 | STR terminal function selection | 373 |
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| T703 | 181 | RM terminal function selection | 373 |
| T704 | 182 | RH terminal function selection | 373 |
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| T707 | 185 | JOG terminal function selection | 373 |
| T708 | 186 | CS terminal function selection | 373 |
| T709 | 187 | MRS terminal function selection | 373 |
| T710 | 188 | STOP terminal function selection | 373 |
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| T720 | 17 | MRS input selection | 375 |
| T721 | 599 | X10 terminal input selection | 566 |
| T722 | 606 | Power failure stop external signal input selection | 478 |
| T730 | 155 | RT signal function validity condition selection | 377 |
| T740 | 699 | Input terminal filter | 373 |

♦ C: Motor constant parameters

Parameters for the applied motor setting.

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| C000 | 684 | Tuning data unit switchover | 383, |
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| | | | 379, |
| C100 | 71 | Applied motor | 383, |
| | | | 392 |
| C101 | 80 | Motor capacity | 177, 383. |
| CIUI | 00 | | 303, 392 |
| | | | 177. |
| C102 | 81 | Number of motor poles | 383. |
| - | - | | 392 |
| | | | 266, |
| C103 | 9 | Rated motor current Simple | 383, |
| | | | 392 |
| | | | 177, |
| C104 | 83 | Rated motor voltage | 383, |
| | | | 392 |
| | | | 177, |
| C105 | 84 | Rated motor frequency | 383, 392 |
| C106 | 702 | Maximum mater fraguency | 392 |
| C106 C107 | - | Maximum motor frequency | |
| | 707 | Motor inertia (integer) | 392 |
| C108 | 724 | Motor inertia (exponent) | 392 |
| C110 | 96 | Auto tuning setting/status | 383, 392, |
| CIIU | 90 | Auto tuning setting/status | 392, 474 |
| C111 | 95 | Online auto tuning selection | 400 |
| | | ······· | 383. |
| C120 | 90 | Motor constant (R1) | 392. |
| | | | 474 |
| C121 | 91 | Motor constant (R2) | 383 |
| 0400 | 00 | Motor constant (L1)/d-axis | 383, |
| C122 | 92 | inductance (Ld) | 392 |
| C123 | 93 | Motor constant (L2)/q-axis | 383, |
| 0123 | 33 | inductance (Lq) | 392 |
| C124 | 94 | Motor constant (X) | 383 |
| C125 | 82 | Motor excitation current | 383 |
| C126 | 859 | Torque current/Rated PM motor | 383, |
| | | current | 392 |
| C130 | 706 | Induced voltage constant (phi f) | 392 |
| C131 | 711 | Motor Ld decay ratio | 392 |
| C132 | 712 | Motor Lq decay ratio | 392 |
| C133 | 725 | Motor protection current level | 392 |
| C135 | 1412 | Motor induced voltage constant | 392 |
| | | (phi f) exponent | |

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| C150 | 1002 | Lq tuning target current adjustment coefficient | 392 |
| C182 | 717 | Starting resistance tuning compensation | 392 |
| C185 | 721 | Starting magnetic pole position detection pulse width | 392 |
| C200 | 450 | Second applied motor | 379 |
| C201 | 453 | Second motor capacity | 383, 392 |
| C202 | 454 | Number of second motor poles | 383, 392 |
| C203 | 51 | Rated second motor current | 266, 383, 392 |
| C204 | 456 | Rated second motor voltage | 383, 392 |
| C205 | 457 | Rated second motor frequency | 383, 392 |
| C206 | 743 | Second motor maximum frequency | 392 |
| C207 | 744 | Second motor inertia (integer) | 392 |
| C208 | 745 | Second motor inertia (exponent) | 392 |
| C210 | 463 | Second motor auto tuning setting/ status | 383, 392, 474 |
| C211 | 574 | Second motor online auto tuning | 400 |
| C220 | 458 | Second motor constant (R1) | 383, 392, 474 |
| C221 | 459 | Second motor constant (R2) | 383 |
| C222 | 460 | Second motor constant (L1) / d- axis inductance (Ld) | 383, 392 |
| C223 | 461 | Second motor constant (L2) / q- axis inductance (Lq) | 383, 392 |
| C224 | 462 | Second motor constant (X) | 383 |
| C225 | 455 | Second motor excitation current | 383 |
| C226 | 860 | Second motor torque current/ Rated PM motor current | 383, 392 |
| C230 | 738 | Second motor induced voltage constant (phi f) | 392 |
| C231 | 739 | Second motor Ld decay ratio | 392 |
| C232 | 740 | Second motor Lq decay ratio | 392 |
| C233 | 746 | Second motor protection current level | 392 |
| C235 | 1413 | Second motor induced voltage constant (phi f) exponent | 392 |
| C282 | 741 | Second starting resistance tuning compensation | 392 |
| C285 | 742 | Second motor magnetic pole detection pulse width | 392 |

♦ A: Application parameters

Parameters for the setting of a specific application.

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| A001 | 136 | MC switchover interlock time | 404 |
| A002 | 137 | Start waiting time | 404 |
| A003 | 138 | Bypass selection at a fault | 404 |
| A004 | 139 | Automatic switchover frequency from inverter to bypass operation | 404 |

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| A005 | 159 | Automatic switchover frequency range from bypass to inverter operation | 404 |
| A006 | 248 | Self power management selection | 410 |
| A007 | 254 | Main circuit power OFF waiting time | 410 |
| A170 | 1410 | Starting times lower 4 digits | 413 |
| A171 | 1411 | Starting times upper 4 digits | 413 |
| A300 | 592 | Traverse function selection | 414 |
| A301 | 593 | Maximum amplitude amount | 414 |
| A302 | 594 | Amplitude compensation amount during deceleration | 414 |
| A303 | 595 | Amplitude compensation amount during acceleration | 414 |
| A304 | 596 | Amplitude acceleration time | 414 |
| A305 | 597 | Amplitude deceleration time | 414 |
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| A401 | 579 | Motor connection function selection | 450 |
| A402 | 580 | MC switchover interlock time (multi-pump) | 450 |
| A403 | 581 | Start waiting time (multi-pump) | 450 |
| A404 | 582 | Auxiliary motor connection-time deceleration time | 450 |
| A405 | 583 | Auxiliary motor disconnection- time acceleration time | 450 |
| A406 | 584 | Auxiliary motor 1 starting frequency | 450 |
| A407 | 585 | Auxiliary motor 2 starting frequency | 450 |
| A408 | 586 | Auxiliary motor 3 starting frequency | 450 |
| A409 | 587 | Auxiliary motor 1 stopping frequency | 450 |
| A410 | 588 | Auxiliary motor 2 stopping frequency | 450 |
| A411 | 589 | Auxiliary motor 3 stopping frequency | 450 |
| A412 | 590 | Auxiliary motor start detection time | 450 |
| A413 | 591 | Auxiliary motor stop detection time | 450 |
| A414 | 1376 | Auxiliary motor stopping level | 450 |
| A420 | 1469 | Number of cleaning times monitor | 415 |
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| A422 | 1471 | Cleaning trigger selection | 415 |
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| A424 | 1473 | Cleaning reverse rotation operation time | 415 |
| A425 | 1474 | Cleaning forward rotation frequency | 415 |
| A426 | 1475 | Cleaning forward rotation operation time | 415 |
| A427 | 1476 | Cleaning stop time | 415 |
| A428 | 1477 | Cleaning acceleration time | 415 |
| A429 | 1478 | Cleaning deceleration time | 415 |
| A430 | 1479 | Cleaning time trigger | 415 |
| A440 | 1361 | Detection time for PID output hold | 459 |
| A441 | 1362 | PID output hold range | 459 |
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| A443 | 1371 | PID upper/lower limit pre-warning level range | 459 |
| A444 | 1372 | PID measured value control set point change amount | 459 |
| A445 | 1373 | PID measured value control set point change rate | 459 |
| A446 | 1369 | Check valve closing completion frequency | 459 |
| A447 | 1363 | PID priming time | 459 |
| A448 | 1364 | Stirring time during sleep | 459 |
| A449 | 1365 | Stirring interval time | 459 |
| A450 | 1374 | Auxiliary pressure pump operation starting level | 459 |
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| A452 | 1377 | PID input pressure selection | 459 |
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| A603 | 553 | PID deviation limit | 419 |
| A604 | 554 | PID signal operation selection | 419 |
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| A658 | 767 | Second pre-charge ending time | 445 |
| A659 | 768 | Second pre-charge upper detection level | 445 |
| A660 | 769 | Second pre-charge time limit | 445 |
| A661 | 1147 | Second output interruption detection time | 419 |
| A662 | 1148 | Second output interruption detection level | 419 |
| A663 | 1149 | Second output interruption cancel level | 419 |
| A664 | 1140 | Second PID set point/deviation input selection | 419 |
| A665 | 1141 | Second PID measured value input selection | 419 |
| A666 | 1133 | Second pre-charge change increment amount | 445 |
| A670 | 1136 | Second PID display bias coefficient | 442 |
| A671 | 1137 | Second PID display bias analog value | 442 |
| A672 | 1138 | Second PID display gain coefficient | 442 |
| A673 | 1139 | Second PID display gain analog value | 442 |
| A680 | 573 | 4 mA input check selection | 369 |
| A681 | 777 | 4 mA input fault operation frequency | 369 |
| A682 | 778 | 4 mA input check filter | 369 |
| A683 | 1460 | PID multistage set point 1 | 419 |
| A684 | 1461 | PID multistage set point 2 | 419 |
| A685 | 1462 | PID multistage set point 3 | 419 |
| A686 | 1463 | PID multistage set point 4 | 419 |
| A687 | 1464 | PID multistage set point 5 | 419 |
| A688 | 1465 | PID multistage set point 6 | 419 |
| A689 | 1466 | PID multistage set point 7 | 419 |
| A690 A691 | 1211 1212 | PID gain tuning timeout time Step manipulated amount | 437 437 |
| A691 A692 | 1212 | Step response sampling cycle | 437 |
| | | Timeout time after the maximum | |
| A693 | 1214 | slope | 437 |

| Pr. group | Pr. | Name | Refer to page |
|-----------------|-----------------|---|------------------|
| A694 | 1215 | Limit cycle output upper limit | 437 |
| A695 | 1216 | Limit cycle output lower limit | 437 |
| A696 | 1217 | Limit cycle hysteresis | 437 |
| A697 | 1218 | PID gain tuning setting | 437 |
| A698 | 1219 | PID gain tuning start/status | 437 |
| | | Automatic restart after | 466. |
| A700 | 162 | instantaneous power failure | 472, |
| | | selection | 474 |
| A701 | 299 | Rotation direction detection selection at restarting | 466 |
| A702 | 57 | Restart coasting time | 466, 472 |
| A703 | 58 | Restart cushion time | 466 |
| A704 | 163 | First cushion time for restart | 466 |
| A705 | 164 | First cushion voltage for restart | 466 |
| A710 | 165 | Stall prevention operation level for restart | 466 |
| A711 | 298 | Frequency search gain | 383, 474 |
| A712 | 560 | Second frequency search gain | 474 |
| A730 | 261 | Power failure stop selection | 478 |
| A731 | 262 | Subtracted frequency at deceleration start | 478 |
| A732 | 263 | Subtraction starting frequency | 478 |
| A733 | 264 | Power-failure deceleration time 1 | 478 |
| A734 | 265 | Power-failure deceleration time 2 | 478 |
| A735 | 266 | Power failure deceleration time switchover frequency | 478 |
| A785 | 294 | UV avoidance voltage gain | 478 |
| A786 | 668 | Power failure stop frequency gain | 478 |
| A800 | 414 | PLC function operation selection | 483 |
| A801 | 415 | Inverter operation lock mode setting | 483 |
| A802 | 416 | Pre-scale function selection | 483 |
| A803 | 417 | Pre-scale setting value | 483 |
| A804 | 498 | PLC function flash memory clear | 483 |
| A805 | 675 | User parameter auto storage function selection | 483 |
| A810 to A859 | 1150 to 1199 | PLC function user parameters 1 to 50 | 483 |
| A900 | 1020 | Trace operation selection | 486 |
| A901 | 1021 | Trace mode selection | 486 |
| A902 | 1022 | Sampling cycle | 486 |
| A903 | 1023 | Number of analog channels | 486 |
| A904 | 1024 | Sampling auto start | 486 |
| A905 | 1025 | Trigger mode selection | 486 |
| A906 | 1026 | Number of sampling before trigger | 486 |
| A910 | 1027 | Analog source selection (1ch) | 486 |
| A911 | 1028 | Analog source selection (2ch) | 486 |
| A912 | 1029 | Analog source selection (3ch) | 486 |
| A913 | 1030 | Analog source selection (4ch) | 486 |
| A914 | 1031 | Analog source selection (5ch) | 486 |
| A915 | 1032 | Analog source selection (6ch) | 486 |
| A916 | 1033 | Analog source selection (7ch) | 486 |
| A917 | 1034 | Analog source selection (8ch) | 486 |
| A918 | 1035 | Analog trigger channel | 486 |
| A919 | 1036 | Analog trigger operation selection | 486 |
| A920 | 1037 | Analog trigger level | 486 |
| A930 | 1038 | Digital source selection (1ch) | 486 |
| A931 | 1039 | Digital source selection (2ch) | 486 |

| Pr. group | Pr. | Name | Refer to page |
|--------------|------|-------------------------------------|------------------|
| A932 | 1040 | Digital source selection (3ch) | 486 |
| A933 | 1041 | Digital source selection (4ch) | 486 |
| A934 | 1042 | Digital source selection (5ch) | 486 |
| A935 | 1043 | Digital source selection (6ch) | 486 |
| A936 | 1044 | Digital source selection (7ch) | 486 |
| A937 | 1045 | Digital source selection (8ch) | 486 |
| A938 | 1046 | Digital trigger channel | 486 |
| A939 | 1047 | Digital trigger operation selection | 486 |

N: Communication operation parameters

Parameters for the setting of communication operation such as the communication specifications or operating characteristics.

| Pr. | | News | Refer |
|-------|-----|---|-------------|
| group | Pr. | Name | to page |
| N000 | 549 | Protocol selection | 500, 533 |
| N001 | 342 | Communication EEPROM write selection | 500 |
| N002 | 539 | MODBUS RTU communication check time interval | 520 |
| N013 | 502 | Stop mode selection at communication error | 500 |
| N014 | 779 | Operation frequency during communication error | 500 |
| N020 | 117 | PU communication station number | 505 |
| N021 | 118 | PU communication speed | 505 |
| N022 | 119 | PU communication data length | 505 |
| N023 | 119 | PU communication stop bit length | 505 |
| N024 | 120 | PU communication parity check | 505 |
| N025 | 121 | PU communication retry count | 505 |
| N026 | 122 | PU communication check time interval | 505 |
| N027 | 123 | PU communication waiting time setting | 505 |
| N028 | 124 | PU communication CR/LF selection | 505 |
| N030 | 331 | RS-485 communication station number | 505, 533 |
| N031 | 332 | RS-485 communication speed | 505, 533 |
| N032 | 333 | RS-485 communication data length | 505 |
| N033 | 333 | RS-485 communication stop bit length | 505 |
| N034 | 334 | RS-485 communication parity check selection | 505 |
| N035 | 335 | RS-485 communication retry count | 505 |
| N036 | 336 | RS-485 communication check time interval | 505 |
| N037 | 337 | RS-485 communication waiting time setting | 505 |
| N038 | 341 | RS-485 communication CR/LF selection | 505 |
| N040 | 547 | USB communication station number | 547 |
| N041 | 548 | USB communication check time interval | 547 |
| N050 | 726 | Auto Baudrate/Max Master | 533 |

| Pr. group | Pr. | Name | Refer to page |
|-------------------------------------|-------------------------------------|--|------------------|
| N051 | 727 | Max Info Frames | 533 |
| N052 | 728 | Device instance number (Upper 3 digits) | 533 |
| N053 | 729 | Device instance number (Lower 4 digits) | 533 |
| N054 | 390 | % setting reference frequency | 533 |
| N080 | 343 | Communication error count | 520 |
| N500 to N543, N550 to N559 | 1300 to 1343, 1350 to 1359 | Communication option parameters. For details, refer to the Instruction Manual of the option. | |

♦ G: Control parameters

Parameters for motor control.

| Pr. group | Pr. | Name | Refer to page |
|--------------|------------------|---|------------------|
| G000 | 0 | Torque boost | 551 |
| G001 | 3 | Base frequency Simple | 552 |
| G001 G002 | 3 19 | Base frequency Simple Base frequency voltage | 552 |
| G002 G003 | 19 | Load pattern selection | 552 554 |
| G003 G010 | 46 | Second torque boost | 554 551 |
| G010 G011 | 40 47 | Second V/F (base frequency) | 552 |
| G011 G030 | 60 | Energy saving control selection | 557 |
| G030 G040 | 100 | V/F1 (first frequency) | 558 |
| G040 G041 | 100 | V/F1 (first frequency voltage) | 558 |
| G041 | 102 | V/F2 (second frequency) | 558 |
| G042 | 102 | V/F2 (second frequency voltage) | 558 |
| G044 | 104 | V/F3 (third frequency) | 558 |
| G045 | 105 | V/F3 (third frequency voltage) | 558 |
| G046 | 106 | V/F4 (fourth frequency) | 558 |
| G047 | 107 | V/F4 (fourth frequency voltage) | 558 |
| G048 | 107 | V/F5 (fifth frequency) | 558 |
| G049 | 109 | V/F5 (fifth frequency voltage) | 558 |
| G060 | 673 | SF-PR slip amount adjustment operation selection | 559 |
| G061 | 674 | SF-PR slip amount adjustment gain | 559 |
| G080 | 617 | Reverse rotation excitation current low-speed scaling factor | 555 |
| G100 | 10 | DC injection brake operation frequency | 560 |
| G101 | 11 | DC injection brake operation time | 560 |
| G105 | 522 | Output stop frequency | 562 |
| G106 | 250 | Stop selection | 563 |
| G107 | 70 ^{*2} | Parameter for manufacturer setting. D | o not set. |
| G110 | 12 | DC injection brake operation voltage | 560 |
| G120 | 882 | Regeneration avoidance operation selection | 572 |
| G121 | 883 | Regeneration avoidance operation level | 572 |
| G122 | 884 | Regeneration avoidance at deceleration detection sensitivity | 572 |
| G123 | 885 | Regeneration avoidance compensation frequency limit value | 572 |
| G124 | 886 | Regeneration avoidance voltage gain | 572 |
| G125 | 665 | Regeneration avoidance frequency gain | 572 |

5

| Pr. group | Pr. | Name | Refer to page |
|--------------|-----|--|------------------|
| G130 | 660 | Increased magnetic excitation deceleration operation selection | 574 |
| G131 | 661 | Magnetic excitation increase rate | 574 |
| G132 | 662 | Increased magnetic excitation current level | 574 |
| G200 | 800 | Control method selection | 177 |
| G201 | 85 | Excitation current break point | 555 |
| G202 | 86 | Excitation current low-speed scaling factor | 555 |
| G203 | 245 | Rated slip | 576 |
| G204 | 246 | Slip compensation time constant | 576 |
| G205 | 247 | Constant output range slip compensation selection | 576 |
| G211 | 820 | Speed control P gain 1 | 190 |
| G212 | 821 | Speed control integral time 1 | 190 |
| G213 | 824 | Torque control P gain 1 (current loop proportional gain) | 190 |
| G214 | 825 | Torque control integral time 1 (current loop integral time) | 190 |
| G216 | 827 | Torque detection filter 1 | 193 |
| G224 | 828 | Parameter for manufacturer setting. D | o not set. |
| G301 | 565 | Second motor excitation current break point | 555 |

| Pr. group | Pr. | Name | Refer to page |
|--------------|-----|--|------------------|
| G302 | 566 | Second motor excitation current low-speed scaling factor | 555 |
| G311 | 830 | Speed control P gain 2 | 190 |
| G312 | 831 | Speed control integral time 2 | 190 |
| G313 | 834 | Torque control P gain 2 (current loop proportional gain) | 190 |
| G314 | 835 | Torque control integral time 2 (current loop integral time) | 190 |
| G316 | 837 | Torque detection filter 2 | 193 |
| G410 | 653 | Speed smoothing control | 577 |
| G411 | 654 | Speed smoothing cutoff frequency | 577 |
| G932 | 89 | Speed control gain (Advanced magnetic flux vector) | 180 |
| G942 | 569 | Second motor speed control gain | 180 |

*1 The parameter number in parentheses is the one for use with the LCD operation panel and the parameter unit.

*2 The setting is available for the standard model or the separated converter type.

*3 The setting is available for the standard model or the IP55 compatible model.

*4 The setting is available when the PLC function is enabled.

V/F control (initial setting), Advanced magnetic flux vector control, and PM motor control are available with this inverter.

♦ V/F control

The inverter controls the output frequency (F) and the output voltage (V) so that the ratio of frequency to voltage (V/F) is kept constant when the frequency is changed.

Advanced magnetic flux vector control

The inverter performs vector calculation and divide its output current into the excitation current and the torque current. The inverter compensates the frequency and the voltage to output a current that meets the load torque to the motor, which improves the motor torque at low speed. The output frequency is further compensated (slip compensation) to bring the actual motor speed closer to the commanded speed. This control method is useful when the load fluctuates are severe.

• NOTE

Advanced magnetic flux vector control requires the following conditions.

If these conditions are not satisfied, select V/F control. Otherwise, malfunctions such as insufficient torque, uneven rotation may occur.

• For the motor capacity, the rated motor current should be equal to or less than the rated inverter current. (It must be 0.4 kW or higher.)

If a motor with substantially low rated current compared with the inverter rated current, however, is used, speed and torque accuracies may deteriorate due to torque ripples, etc. Set the rated motor current to about 40% or higher of the inverter rated current.

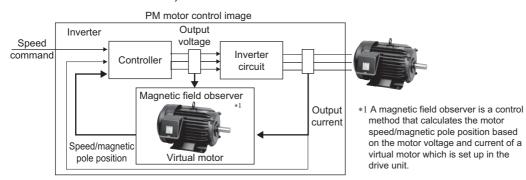
· The motor described in the following table is used.

| Motor | Condition | |
|--|--|--|
| Mitsubishi Electric standard motor (SF-JR) | | |
| Mitsubishi Electric high-efficiency motor (SF-HR) | The offline cute tuning is not required | |
| Mitsubishi Electric constant-torque motor (SF-JRCA 4P / SF-HRCA) | The offline auto tuning is not required. | |
| Mitsubishi Electric high-performance energy-saving motor (SF-PR) | | |
| Other motor (Mitsubishi motor SF-TH, etc. or other manufacturer's motor) | The offline auto tuning is required. | |

- Single-motor operation (one motor to one inverter) is performed.
- The wiring length from inverter to motor is 30 m or less. (When the wiring length exceeds 30 m, perform offline auto tuning with the wiring in place.)
- A sine wave filter (MT-BSL/BSC) is not used.

PM motor control

- The inverter enables highly efficient motor control and highly accurate motor speed control of a PM (permanent magnet embedded) motor, which is more efficient than an induction motor.
- A speed detector such as an encoder is not required as the inverter estimates the motor speed by the calculation from the inverter output voltage and current. The inverter drives the PM motor with the least required current for a load in order to achieve the highest motor efficiency.
- When using an IPM motor MM-EFS or MM-THE4, simply performing the motor parameter initialization (PM parameter initialization or IPM initialization) enables PM motor control.



- The PM motor control requires the following conditions.
- The motor described in the following table is used.

| Motor | Condition |
|---|--|
| Mitsubishi Electric IPM motor (MM-EFS or MM-THE4) | The offline auto tuning is not required. |
| IPM motor (other than MM-EFS or MM-THE4), SPM motor | The offline auto tuning is required. |

• For the motor capacity, the rated motor current should be equal to or less than the rated inverter current. (It must be 0.4 kW or higher.)

If a motor with substantially low rated current compared with the inverter rated current, however, is used, speed and torque accuracies may deteriorate due to torque ripples, etc. Set the rated motor current to about 40% or higher of the inverter rated current.

- · Single-motor operation (one motor to one inverter) is performed.
- The wiring length from the inverter to the motor is 100 m or less. (Refer to page 57.) (When the wiring length from the inverter to the IPM motor MM-EFS or MM-THE4 exceeds 30 m, perform offline auto tuning.)
- A surge voltage suppression filter (FR-ASF/FR-BMF) or sine wave filter (MT-BSL/BSC) is not used.

5.2.1 Changing the control method and mode

Set the control method.

V/F control, Advanced magnetic flux vector control, and PM motor control are the control methods available for selection. When using an IPM motor MM-EFS or MM-THE4, simply performing the motor parameter initialization (PM parameter initialization) enables PM motor control.

• The PM motor test operation can be performed by setting **Pr.800 Control method selection**.

| Pr. | Name | Initial value | Setting range | Description | |
|--------------|----------------------|-------------------------|--|--|----------------------------|
| 71 C100 | Applied motor | 0 | 0 to 6, 13 to 16, 20, 23, 24, 40, 43, 44, 50, 53, 54, 70, 73, 74, 210, 213, 214, 240, 243, 244, 8090, 8093, 8094, 9090, 9093, 9094 | By selecting a standard motor or constant-torque motor, the | |
| 80 C101 | Motor capacity | 9999 | 0.4 to 55 kW ^{*1} 0 to 3600 kW ^{*2} | Set the applied motor capacity. | |
| 0101 | | | 9999 | | |
| 81 | Number of motor 9999 | | 2, 4, 6, 8, 10, 12 | Set the number of motor poles. | |
| C102 | poles | 9999 | 9999 | V/F control | |
| 83 C104 | Rated motor voltage | 200/400 V ^{*3} | 0 to 1000 V | Set the rated motor voltage (V). | |
| 84 | Rated motor | 9999 | 10 to 400 Hz | Set the rated motor frequency (Hz). | |
| C105 | frequency | 9999 | 9999 | The setting value of Pr.3 Base frequer | ncy is used. ^{*4} |
| | | | 9 | PM motor test operation (Motor is not driven even if it is connected.) | |
| 800 | Control method | | 20 | Normal operation (Motor can be driven | .) |
| 6200 G200 | selection | 20 20 | 109 | PM motor test operation (Motor is not driven even if it is connected.) | Fast-response operation |
| | | | 110 | Normal operation (Motor can be driven.) | |

*1 For the FR-F820-02330(55K) or lower and FR-F840-01160(55K) or lower.

- *2 For the FR-F820-03160(75K) or higher and FR-F840-01800(75K) or higher.
- *3 The initial value differs according to the inverter's voltage class (200/400 V class).

*4 When the IPM motor MM-EFS or MM-THE4 is selected in **Pr.71 Applied motor**, the rated frequency of the MM-EFS or MM-THE4 is used. When a PM motor other than the MM-EFS or MM-THE4 is selected in **Pr.71**, 75 Hz (for the motor capacity of 15 kW or lower) or 100 Hz (for 18.5 kW or higher) is used.

Setting the motor capacity and the number of motor poles (Pr.80, Pr.81)

- Motor specifications (the motor capacity and the number of motor poles) must be set to select Advanced magnetic flux vector control or PM motor control.
- Set the motor capacity (kW) in Pr.80 Motor capacity and set the number of motor poles in Pr.81 Number of motor poles.

Setting the number of motor poles in Pr.81 automatically changes the setting of Pr.144 Speed setting switchover. (Refer to page 303.)

Selecting the fast-response operation (Pr.800 = "109 or 110")

Setting Pr.800 = "109 to 110" selects the fast-response operation. The fast-response operation is available during PM motor control.

| | Speed response | | | | |
|------------------|--|---|--|--|--|
| Control method | Fast-response operation Pr.800 = "109 or 110" | Normal-response operation Pr.800 = "9 or 20" | | | |
| PM motor control | 130 Hz at maximum | 50 Hz at maximum | | | |

NOTE

• Refer to page 218 for the carrier frequency during fast-response operation.

• The inverter overload trip (E.THT) is more likely to occur when fast-response operation is set.

⁻ NOTE

PM motor test operation (Pr.800 = "9")

• A test operation for speed control is available without connecting a motor to the inverter.

The speed calculation changes to track the speed command, and such speed changes can be checked on the operation panel or by outputting it as analog signals to terminal FM/CA or AM.

- NOTE

• Since current is not detected and voltage is not output, monitors related to current and voltage such as output current and output voltage, etc. and output signals do not function.

I/O signal status during the test operation

· During the test operation, the following signals are disabled.

■ Input terminal function selection (Pr.178 to Pr.189)

- V/F switchover (X18) signal
- Start-time tuning start external input (X28) signal

■ Output terminal function selection (Pr.190 to Pr.196)

- Electronic thermal O/L relay pre-alarm (THP) signal
- Start time tuning completion (Y39) signal

Parameters referred to

Pr.178 to Pr.189 (Input terminal function selection) Pr.178 to Pr.196 (Output terminal function selection) page 330

Status of the monitoring during the test operation

- o: Enabled
- ×: Disabled (0 is displayed at any time.)
- Δ : A cumulative total before the test operation is displayed.
- -: Not available

| Monitor item | Monitoring on DU/PU | Output via terminal FM/CA/AM | Monitor item | Monitoring on DU/PU | Output via terminal FM/CA/AM |
|--|------------------------|------------------------------------|---------------------------------|------------------------|------------------------------------|
| Output frequency | 0 | 0 | PID deviation | 0 | °*3 |
| Fault indication | 0 | — | Input terminal status | 0 | — |
| Frequency setting value | 0 | 0 | Output terminal status | 0 | — |
| Motor speed | 0 | 0 | Option input terminal status | 0 | — |
| Converter output voltage | 0 | 0 | Option output terminal status | 0 | — |
| Electronic thermal O/L relay load factor | ×*2 | ×*2 | Motor thermal load factor | o ^{*4} | ° ^{*4} |
| Output current peak value | x*2 | x*2 | Inverter thermal load factor | o ^{*4} | ° ^{*4} |
| Converter output voltage peak value | 0 | 0 | PTC thermistor value | 0 | — |
| Load meter | 0 | 0 | PID measured value 2 | 0 | 0 |
| Cumulative energization time | 0 | — | PID input pressure value | 0 | 0 |
| Reference voltage output | — | 0 | Remote output 1 | 0 | 0 |
| Actual operation time | 0 | — | Remote output 2 | 0 | 0 |
| Cumulative energy | Δ | — | Remote output 3 | 0 | 0 |
| Trace status | 0 | × | Remote output 4 | 0 | 0 |
| Station number (RS-485 terminals) | 0 | — | PID manipulated variable | 0 | °*3 |
| Station number (PU connector) | 0 | — | Second PID set point | 0 | 0 |
| Station number (CC-Link) | 0 | — | Second PID measured value | 0 | 0 |
| Energy saving effect | 0 | 0 | Second PID deviation | 0 | ° ^{*3} |
| Cumulative energy saving | Δ | — | Second PID measured value 2 | 0 | 0 |
| PID set point | 0 | 0 | Second PID manipulated variable | 0 | ° _{*3} |
| PID measured value | 0 | 0 | Gecond Fib manipulated valiable | Ŭ | 0 - |

*1 The monitoring-enabled items differ depending on the output interface (operation panel, parameter unit, terminal FM/CA, or terminal AM). For the details, refer to page 314.

*2 When the inverter operation is switched to the test operation, the indication is changed to 0. When PM motor control is selected again after the test operation, the output current peak value and the electronic thermal relay load factor from the last operation are displayed.

*3 The output is enabled via terminal AM only.

*4 When the inverter operation is switched to the test operation, the accumulated thermal value is reduced because the output current is considered as 0.

Parameters referred to

Pr.52 Operation panel main monitor selection 🖙 page 305 Pr.158 AM terminal function selection 🖙 page 314

Changing the control method with external terminals (RT signal, X18 signal)

- Control method (V/F control or Advanced magnetic flux vector control) can be switched using external terminals.
 The control method can be switched using either the Second function selection (RT) signal or the V/F switchover (X18) signal.
- When using the RT signal, set the second motor in **Pr.450 Second applied motor**. Turning ON the RT signal enables the second function, enabling the switchover of the control method.
- When using the X18 signal, turning ON the X18 signal switches the presently-selected control method (Advanced magnetic flux vector control) to the V/F control. Use this method to switch the control method for one motor. At this time, the second functions including the electronic thermal O/L relay characteristic are not changed. (To switch the second functions, use the RT signal.)

To input the X18 signal, set "18" in any parameter from **Pr.178 to Pr.189 (Input terminal function selection)** to assign the function to the terminal.

| First motor control method | Second motor control method (RT signal-ON) | Pr.450 setting | Pr.453, Pr.454 settings |
|---|---|-----------------|-------------------------|
| | V/F control | 9999 | — |
| V/F control | V/F control | — | 9999 ^{*2} |
| | Advanced magnetic flux vector control | Induction motor | Other than 9999 |
| | PM motor control | IPM/SPM motor | |
| | Same control as the first motor ^{*1} | 9999 | — |
| Advanced magnetic flux vector control ^{*1} | V/F control | — | 9999 ^{*2} |
| PM motor control | Advanced magnetic flux vector control | Induction motor | Other than 9999 |
| | PM motor control | IPM/SPM motor | |

*1 V/F control is set by turning ON the X18 signal. If the X18 signal is unassigned, the RT signal performs the same function; Turning ON the RT signal selects V/F control.

*2 V/F control is set when Pr.453 or Pr.454 is set to "9999". When Pr.450 is set to the IPM motor MM-EFS or MM-THE4, PM motor control is enabled even if Pr.453 ≠ "9999" and Pr.454 = "9999".

- NOTE

- The RT signal is assigned to the terminal RT in the initial status. Set "3" in one of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the RT signal to another terminal.
- The RT signal is the Second function selection signal. The RT signal also enables other second functions. (Refer to page 377.)
- The control method could be changed by external terminals (RT signal, X18 signal) while the inverter is stopped. If a signal is switched during the operation, the control method changes after the inverter stops.

Parameters referred to

Pr.178 to Pr.189 (Input terminal function selection) 🖙 page 373 Pr.450 Second applied motor 🖙 page 379

5.2.2 Selecting the Advanced magnetic flux vector control

Magnetic flux

Point P

To use the Advanced magnetic flux vector control, set the motor capacity, the number of motor poles, and the motor type using **Pr.80** and **Pr.81**.

Advanced magnetic flux vector control

Operating procedure

- **1.** Perform secure wiring. (Refer to page 45.)
- **2.** Make the motor setting (**Pr.71**).

| Motor | | Pr.71 setting ^{*1} | Remarks |
|---|--------------------------|-----------------------------|--|
| | SF-JR | 0 (initial value) (3, 4) | |
| Mitsubishi Electric standard motor | SF-JR 4P 1.5 kW or lower | 20 | |
| Mitsubishi Electric high-efficiency motor | SF-HR | 40 | |
| | Others | 0 (3) | Offline auto tuning is required. ^{*2} |
| | SF-JRCA 4P | 1 | |
| Mitsubishi Electric constant-torque motor | SF-HRCA | 50 | |
| | Other (SF-JRC, etc.) | 1 (13) | Offline auto tuning is required. ^{*2} |
| Mitsubishi Electric high-performance energy-saving motor | SF-PR | 70 | |
| Other manufacturer's standard motor | — | 0 (3) | Offline auto tuning is required. ^{*2} |
| Other manufacturer's constant-torque motor | _ | 1 (13) | Offline auto tuning is required. ^{*2} |

*1 For the other setting values of **Pr.71**, refer to page 379.

- *2 For offline auto tuning, refer to page 383.
- **3.** Set the motor overheat protection (**Pr.9**). (Refer to page 266.)
- **4.** Set the motor capacity and number of motor poles (**Pr.80**, **Pr.81**). (Refer to page 177.) V/F control is performed when the setting is "9999" (initial value).
- 5. Set the rated motor voltage and frequency (**Pr.83**, **Pr.84**). (Refer to page 383.)
- **6.** Set the operation command. (Refer to page 240.) Select the start command and speed command.
- **7.** Perform the test operation.

As required

- Perform the offline auto tuning (Pr.96). (Refer to page 383.)
- Select the online auto tuning (Pr.95). (Refer to page 400.)

- NOTE

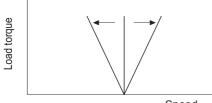
- Under this control, rotations are more likely to be uneven than under V/F control. (This control method is not suitable for grinder, wrapping machine, etc., which require even rotation at a low speed.)
- For the FR-F820-02330(55K) or lower and the FR-F840-01160(55K) or lower, the operation with a surge voltage suppression filter (FR-ASF-H/FR-BMF-H) installed between the inverter and the motor may reduce the output torque.
- The optional sine wave filter (MT-BSL/BSC) cannot be used between the inverter and the motor.
- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Keeping the motor speed constant when the load fluctuates (speed control gain)

| Pr. | Name | Initial value | Setting range | Description | | |
|-------------|---|------------------|------------------|--|--|---|
| 89 G932 | Speed control gain (Advanced magnetic flux | · U% | | 0% to 200% operation under Advanced magnetic flux vector control. T | | Makes adjustments to keep the motor speed constant during variable load operation under Advanced magnetic flux vector control. The reference value is 100%. |
| vector) | | | 9999 | The gain set by Pr.71 . (The gain set in accordance with the motor.) | | |
| 569 G942 | Second motor speed control gain | 9999 | 0% to 200% | Makes adjustments to keep the second motor speed constant during variable load operation under Advanced magnetic flux vector control. The reference value is 100%. | | |
| | Ũ | | 9999 | The gain set by Pr.450 . (The gain set in accordance with the motor.) | | |

• Use **Pr.89** to keep the motor speed constant during variable load operation.

(This parameter is useful to adjust the motor speed.)



Speed

Driving two motors under Advanced magnetic flux vector control

- Turning ON the Second function selection (RT) signal enables the second motor operation.
- Set a second motor in **Pr.450 Second applied motor**. (In the initial setting, "9999" (no second applied motor) is selected. Refer to page 379.)

| Function | RT signal-ON (second motor) | RT signal-OFF (first motor) |
|--|-----------------------------|-----------------------------|
| Applied motor | Pr.450 | Pr.71 |
| Motor capacity | Pr.453 | Pr.80 |
| Number of motor poles | Pr.454 | Pr.81 |
| Speed control gain (Advanced magnetic flux vector) | Pr.569 | Pr.89 |

NOTE

- The RT signal is the Second function selection signal. The RT signal also enables other second functions. (Refer to page 377.)
 The RT signal is assigned to terminal RT in the initial status. Set "3" in one of Pr.178 to Pr.189 (Input terminal function selection) to assign the RT signal to another terminal.
- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.71, Pr.450 Applied motor and page 379 Pr.800 Control method selection and page 177

5.2.3 Selecting the PM motor control

PM

Setting for the PM motor control by selecting IPM initialization on the operation panel

("

Point P

The parameters required to drive an IPM motor MM-EFS or MM-THE4 are automatically set by batch. (Refer to page 185.)
[PM] indicator on the operation panel (FR-DU08) is turned ON when the PM motor control is set.

The following shows the procedure to perform the motor parameter initialization (change the parameter settings to the appropriate settings for an IPM motor MM-EFS (1500 r/min specification) or MM-THE4) by selecting IPM initialization on the operation panel.

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- **2.** Changing the operation mode

Press U to choose the PU operation mode.

[PU] indicator turns ON.

3. Selecting the parameter setting mode

Press MODE to choose the parameter setting mode. [PRM] indicator is ON.

4. Selecting IPM initialization

Turn 🕄 until " | 📮 🎢 " (IPM initialization) appears.

5. Displaying the set value

Press SET to read the present set value.

"[]" (initial value) appears.

6. Changing the setting value

| Turn 🔛 | to change the value to " | { <i>⊒</i> ' ", and press | SET | to confirm it |
|--------|--------------------------|---------------------------|-----|---------------|
| | to change the value to | n, and piess | JLI | |

"

| Setting | Description |
|------------------|--|
| 0 | Parameter settings for an induction motor |
| 12 ^{*1} | Parameter setting (in rotations per minute) for the IPM motor MM-EFS (1500 r/min specification) or MM-THE4 |
| 14 ^{*1} | Parameter setting (in rotations per minute) for the IPM motor MM-EFS (3000 r/min specification) |

*1 The setting is available for the standard structure model or the separated converter type.

- If the motor parameter initialization is performed by using IPM initialization for the use of a PM motor, the setting of **Pr.998 PM** parameter initialization is also changed automatically.
- To set a speed by adjusting frequencies or to monitor it, use Pr.998. (Refer to page 183.)
- When Pr.998 = "112 or 114", IPM initialization setting is displayed as "12 or 14".

Motor parameter initialization for PM motor control (Pr.998)

- Use PM parameter initialization to set the parameters required for driving an IPM motor MM-EFS or MM-THE4.
- The offline auto tuning enables the operation with an IPM motor other than the MM-EFS or MM-THE4 and with SPM motors.
- Two methods of the motor parameter initialization are available for the use of MM-EFS or MM-THE4 motor; using Pr.998

PM parameter initialization, and using IPM initialization (

| Pr. | Name | Initial value | Setting range | Descri | ption |
|-----|---|------------------|--|--|---|
| | | | 0 | Parameter setting (in frequencies) for an induction motor | The setting of the motor parameters is changed to the setting required to drive an induction motor. |
| | | | 12 ^{*1} | Parameter setting (in rotations per minute) for the IPM motor MM-EFS (1500 r/min specification) or MM-THE4 | |
| | 998 PM parameter E430 initialization 0 | | 14 ^{*1} | Parameter setting (in rotations per minute) for the IPM motor MM-EFS (3000 r/min specification) | The setting of the motor parameters is changed to the setting required to drive an |
| | | | 112 ^{*1} | Parameter setting (in frequencies) for the IPM motor MM-EFS (1500 r/min specification) or MM-THE4 | IPM motor. |
| | | • | Parameter setting (in frequencies) for the IPM motor MM-EFS (3000 r/min specification) | | |
| | | | 8009 | Parameter setting (in rotations per minute) for an IPM motor other than the MM-EFS or MM-THE4 (after tuning) | The setting of the motor parameters is changed to the setting required to drive an IPM motor. (Set Pr.71 Applied motor |
| | | | 8109 | Parameter setting (in frequencies) for an IPM motor other than the MM-EFS or MM-THE4 (after tuning) | and perform offline auto tuning in advance. (Refer to page 392.)) |
| | | | 9009 | Parameter setting (in rotations per minute) for an SPM motor (after tuning) | The setting of the motor parameters is changed to the setting required to drive an |
| | | | 9109 | Parameter setting (in frequencies) for an SPM motor (after tuning) | SPM motor. (Set Pr.71 Applied motor and perform offline auto tuning in advance. (Refer to page 392.)) |

*1 The setting is available for the standard structure model or the separated converter type.

- To use a motor capacity that is one rank lower than the inverter capacity, set Pr.80 Motor capacity before performing PM parameter initialization.
- When "12, 14, 8009, or 9009" is set in **Pr.998**, the motor speed which was set/monitored in frequencies is set/monitored in motor rotations per minute. To set/monitor in frequencies, set "112, 114, 8109, or 9109" in **Pr.998**.
- To change the setting of motor parameters for PM motor control to the setting required to drive an induction motor, set "0" in **Pr.998**.
- When using an IPM motor other than the MM-EFS or MM-THE4 or an SPM motor, set "8009, 8109, 9009, or 9109" in **Pr.998**.



- Make sure to set **Pr.998** before setting other parameters. If the **Pr.998** setting is changed after setting other parameters, some of those parameters are initialized too. (Refer to page 185 for the parameters that are initialized.)
- To change back to the parameter settings required to drive an induction motor, perform Parameter clear or All parameter clear.
- Whenever the setting of **Pr.998 PM parameter initialization** is changed from "12, 14, 8009, or 9009" (setting/monitoring in rotations per minute) to "112, 114, 8109, 9109" (setting/monitoring in frequencies), and vice versa, the motor parameters are changed.

The purpose of this parameter is not to change the setting/monitoring unit. Use **Pr.144 Speed setting switchover** just to change the unit between rotations per minute and frequencies. Using **Pr.144** enables switching the unit between rotations per minute and frequencies without initializing the setting of the motor parameters.

Example) Changing the **Pr.144** setting between "6" and "106" switches the setting/monitoring unit between frequencies and rotations per minute.

- For an inverter out of the capacity range of the IPM motor MM-EFS or MM-THE4, the settings "12, 14, 112, and 114" are disabled. (Refer to page 641 and page 644 for the capacity of the MM-EFS or MM-THE4.)
- **PM parameter initialization (Pr.998)** is used for change of parameter settings for use of a PM motor as the first motor. When a PM motor is used as the second motor, the motor parameters for the second motor must be set individually.

◆ List of the target parameters for the motor parameter initialization

- The setting of the parameters in the following table is changed to the setting for PM motor control by performing the motor parameter initialization using IPM initialization or **Pr.998 PM parameter initialization**. The changed settings differ according to the specification (capacity) of the PM motor used.
- Performing Parameter clear or All parameter clear resets these parameter settings to the settings required to drive an induction motor.

| | | | | | | Setting | | | | • | - 44 1 |
|--------------|---|---|--------------------|---|-------------------|--|--------------------------------------|---------------------|---|---|--------------------------------|
| Pr. | Name | | ction otor | | | etting in r minute) | PM | motor (s frequen | setting in increments | | etting ements |
| г. | Name | 0 (initia FM | l value) CA | 12 | 14 | 8009 9009 | 112 | 114 | 8109 9109 | 12, 14, 8009, 9009 | 0, 112, 114, 8109, 9109, |
| 1 | Maximum frequency | 120 Hz ^{*1} 60 Hz ^{*2} | | Maximum motor rotations per minute | | Maximum motor rotations per minute ^{*6} | Maximu motor frequen | | Maximum motor frequency ^{*6} | | 0.01 Hz |
| 4 | Multi-speed setting (high speed) | 60 Hz | 50 Hz | Rated n rotation minute | | Pr.84 | Rated r frequen | | Pr.84 | 1 r/min | 0.01 Hz |
| 9 | Electronic thermal O/L relay | Inverter current | rated | Rated n current [*] | | _ | Rated r | | _ | 0.01 A ^{**} | |
| 13 | Starting frequency | 0.5 Hz | | Minimur rotation minute | | Pr.84 × 10% | Minimu frequen | | Pr.84 × 10% | 1 r/min | 0.01 Hz |
| 15 | Jog frequency | 5 Hz | | Minimur rotation minute | | Pr.84 × 10% | Minimu frequen | | Pr.84 × 10% | 1 r/min | 0.01 Hz |
| 18 | High speed maximum frequency | 120 Hz [*] 60 Hz ^{*2} | 1 | Maximu motor ro per min | otations | _ | Maximum motor frequency | | _ | 1 r/min | 0.01 Hz |
| 20 | Acceleration/deceleration reference frequency | 60 Hz | 50 Hz | Rated motor | | Pr.84 | Rated motor frequency | | Pr.84 | 1 r/min | 0.01 Hz |
| 22 | Stall prevention operation level | 120% ^{*5} | 110% ^{*5} | Short-tii | me moto | torque | | | | 0.1% | |
| 37 | Speed display | 0 | | 0 | | | | | | 1 | |
| 55 | Frequency monitoring reference | 60 Hz | 50 Hz | Rated n rotation minute | | Pr.84 | Rated r frequen | | Pr.84 | 1 r/min | 0.01 Hz |
| 56 | Current monitoring reference | Inverter current | rated | Rated n current [*] | | Pr.859 | Rated motor current ^{*8} | | Pr.859 | 0.01 A ^{*1} 0.1 A ^{*2} | |
| 71 | Applied motor | 0 | | 210 ^{*3} | 240 ^{*3} | — | 210 ^{*3} | 240 ^{*3} | — | 1 | |
| 80 | Motor capacity | 9999 | Inverter | | _ | Inverter capacity | | _ | 0.01 kW 0.1 kW [*] | | |
| 81 | Number of motor poles | 9999 | | Number motor p | | — | Number of motor poles ^{*4} | | _ | 1 | |
| 84 | Rated motor frequency | 9999 | | Rated n rotation minute ^{*/} | s per | _ | Rated r frequen | | _ | 1 r/min | 0.01 Hz |
| 125 (903) | Terminal 2 frequency setting gain frequency | 60 Hz | 50 Hz | Rated n rotation minute | | Pr.84 | Rated r frequen | | Pr.84 | 1 r/min | 0.01 Hz |
| 126 (905) | Terminal 4 frequency setting gain frequency | 60 Hz | 50 Hz | Rated n rotation minute | s per | Pr.84 | Rated r frequen | | Pr.84 | 1 r/min | 0.01 Hz |
| 144 | Speed setting switchover | 4 | | Number of motor poles + 100 | | Pr.81 +100 | Number motor p | | Pr.81 | 1 | |
| 240 | Soft-PWM operation selection | 1 | | 0 | | | | | | 1 | |

| | | | | | | Setting | | | | | atting | | |
|--------------|---|-----------|---------------|--|---|----------------------------|--|--|---|----------------------|--|---------|---------|
| Pr. | Name | | ction otor | | • | setting in r minute) | PM | motor (s frequen | etting in cies) | | etting ements | | |
| Ρ1. | name | 0 (initia | l value) | 40 | | 8009 | 440 | 114 | 8109 | 12, 14, | 0, 112, | | |
| | | FM | CA | 12 14 | | 9009 | 112 | | 9109 | 8009, 9009 | 114, 8109, 9109, | | |
| 263 | Subtraction starting frequency | 60 Hz | 50 Hz | | Rated motor rotations per Pr.84 ninute | | Rated motor frequency Pr.84 | | Pr.84 | 1 r/min | 0.01 Hz | | |
| 266 | Power failure deceleration time switchover frequency | 60 Hz | 50 Hz | Rated m rotations minute | | Pr.84 | Rated motor frequency | | Pr.84 | 1 r/min | 0.01 Hz | | |
| 374 | Overspeed detection level | 9999 | | Motor rotations per minute at overspeed detection level | | per minute at overspeed | | Maximum motor rotations per minute + 10 Hz ^{*6*7} | Motor frequency at overspeed detection level | | Maximum motor frequency + 10 Hz ^{*6} | 1 r/min | 0.01 Hz |
| 390 | % setting reference frequency | 60 Hz | 50 Hz | Rated motor rotations per minute | | Pr.84 | Rated n frequen | | Pr.84 | 1 r/min | 0.01 Hz | | |
| 505 | Speed setting reference | 60 Hz | 50 Hz | Rated m | | Pr.84 | Rated n frequen | | Pr.84 | 0.01 Hz | | | |
| 557 | Current average value | Inverter | rated | Rated m | notor | D= 950 | Rated n | notor | D= 950 | 0.01 A ^{*1} | | | |
| 557 | monitor signal output reference current | current | | current | 8 | Pr.859 | current ^{*8} | | Pr.859 | 0.1 A ^{*2} | | | |
| 870 | Speed detection hysteresis | 0 Hz | 0 Hz | | Motor rotations per minute at speed detection hysteresis | | Motor frequen speedd hystere: | etection | 0.5 Hz | 1 r/min | 0.01 Hz | | |
| 885 | Regeneration avoidance compensation frequency limit value | 6 Hz | | Minimum rotations per minute | | Pr.84 × 10% | Minimu frequen | | Pr.84 × 10% | 1 r/min | 0.01 Hz | | |
| 893 | Energy saving monitor | Inverter | | Motor c | apacity (| Pr.80) | | | | 0.01 kV | 1 kW ^{*1} | | |
| | reference (motor capacity) | capacity | , | 0.1 kW ^{*2} | | | 2 | | | | | | |
| C14 (918) | Terminal 1 gain frequency (speed) | 60 Hz | 50 Hz | Rated m rotations minute | | Pr.84 | Rated n frequen | | Pr.84 | 1 r/min | 0.01 Hz | | |

—: Not changed

*1 Initial value for the FR-F820-02330(55K) or lower and FR-F840-01160(55K) or lower.

*2 Initial value for the FR-F820-03160(75K) or higher and FR-F840-01800(75K) or higher.

*3 When Pr.71 Applied motor = "213, 214, 243, 244, 8093, 8094, 9093, or 9094", the Pr.71 setting is not changed.

*4 When a value other than "9999" is set, the set value is not changed.

*5 110% for SLD rating and 120% for LD rating (Refer to **Pr.570 Multiple rating setting** on page 204.)

- *6 Use **Pr.702 Maximum motor frequency** to set the maximum motor frequency or rotations per minute. When **Pr.702** ="9999 (initial value)", the setting of **Pr.84 Rated motor frequency** is used as the maximum motor frequency or rotations per minute.
- *7 The setting value is converted from frequency to rotations per minute. (It differs according to the number of motor poles.)

*8 Refer to page 641 for the rated motor current of MM-EFS/MM-THE4.

NOTE

• When the motor parameter initialization is performed with the setting in units of rotations per minute (**Pr.998** = "12, 14, 8009, or 9009"), the parameters not listed in the table and the monitor items are also set and displayed in rotations per minute.

■ IPM motor specification list

Overspeed detection level frequency (rotations per

per minute)

minute)

| Item | MM-EFS 1500 r/min spec. (15 kW or lower) | MM-EFS 1500 r/min spec. (18.5 to 55 kW)) | MM-THE4 (75 to 160 kW) |
|---|---|---|------------------------|
| Rated motor frequency (rotations per minute) | 75 Hz (1500 r/min) | 100 Hz (1500 r/min) | 75 Hz (1500 r/min) |
| Maximum motor frequency (rotations per minute) | 112.5 Hz (2250 r/min) | 150 Hz (2250 r/min) | 90 Hz (1800 r/min) |
| Number of motor poles | 6 | 8 | 6 |
| Short-time motor torque | 110% for SLD rating, 120% | for LD rating | · |
| Minimum frequency (rotations per minute) | 7.5 Hz (150 r/min) | 10 Hz (150 r/min) | 7.5 Hz (150 r/min) |
| Speed detection hysteresis frequency (rotations per minute) | 0.5 Hz (10 r/min) | 0.5 Hz (8 r/min) | 0.5 Hz (10 r/min) |
| Overspeed detection level frequency (rotations per minute) | 122.5 Hz (2450 r/min) | 160 Hz (2400 r/min) | 100 Hz (2000 r/min) |
| Item | MM-EFS 3000 r/min spec. (15 kW or lower) | | |
| Rated motor frequency (rotations per minute) | 150 Hz (3000 r/min) | | |
| Maximum motor frequency (rotations per minute) | 200 Hz (4000 r/min) | | |
| Number of motor poles | 6 | | |
| Short-time motor torque | 110% for SLD rating, 120% for LD rating | | |
| Minimum frequency (rotations per minute) | 15 Hz (300 r/min) |] | |
| Speed detection hysteresis frequency (rotations per minute) | 0.5 Hz (10 r/min) | | |

210 Hz (4200 r/min)

5.3 Speed control under PM motor control

| Purpose | Parameter to set | | | | | |
|---|-------------------------------|---------------------------------------|--|-----|--|--|
| To adjust the gain for PM motor control | Speed control gain adjustment | P.G211 to P.G214, P.G311 to P.G314 | Pr.820, Pr.821, Pr.824, Pr.825, Pr.830, Pr.831, Pr.834, Pr.835 | 190 | | |
| To stabilize torque feedback signal | Torque detection filter | P.G216, P.G316 | Pr.827, Pr.837 | 193 | | |

Speed control performs control so that the speed command and the actual motor rotation speed match.

5.3.1 Setting procedure of PM motor control

PM

This inverter is set for a general-purpose motor in the initial setting. Follow the following procedure to change the setting for the PM motor control.

Driving the IPM motor MM-EFS or MM-THE4 (standard structure models)

Operating procedure

1. Performing the motor parameter initialization (Refer to page 182.)

Set "12, 14, 112, or 114" in **Pr.998 PM parameter initialization**, or select " PM" (IPM initialization) and set "12 or 14" on the operation panel.

| Setting | Description |
|---------|--|
| 12 | Parameter setting (in rotations per minute) for the IPM motor MM-EFS (1500 r/min specification) or MM-THE4 |
| 112 | Parameter setting (in frequencies) for the IPM motor MM-EFS (1500 r/min specification) or MM-THE4 |
| 14 | Parameter setting (in rotations per minute) for the IPM motor MM-EFS (3000 r/min specification) |
| 114 | Parameter setting (in frequencies) for the IPM motor MM-EFS (3000 r/min specification) |

- **2.** Parameter setting (acceleration/deceleration time, multi-speed setting, etc.) Set parameters such as the acceleration/deceleration time and multi-speed setting as required.
- **3.** Operation command setting (Refer to page 240.) Select the start command and speed command.
- **4.** Perform the test operation.

When using the MM-EFS or MM-THE4, perform offline auto tuning for a PM motor as required. (Refer to page 392)

Driving a PM motor other than the MM-EFS or MM-THE4

Operating procedure

- Motor settings (Pr.9, Pr.71, Pr.80, Pr.81, Pr.83, and Pr.84) (Refer to page 379, page 392.) Set "8093 (IPM motor other than MM-EFS or MM-THE4) or 9093 (SPM motor)" in Pr.71 Applied motor. Set Pr.9 Rated motor current, Pr.80 Motor capacity, Pr.81 Number of motor poles, Pr.83 Rated motor voltage, and Pr.84 Rated motor frequency according to the motor specifications.
- Performing the offline auto tuning for a PM motor (Pr.96) (Refer to page 392.)
 Set "1" (offline auto tuning without rotating motor (for other than MM-EFS or MM-THE4)) in Pr.96, and perform tuning.
- 3. Initial setting for the PM motor control using Pr.998 (Refer to page 183.) When the setting for the PM motor is selected in Pr.998 PM parameter initialization, the settings for PM motor control is enabled. [PM] on the operation panel (FR-DU08) turns ON when PM parameter initialization is set.

| Setting | Description |
|---------|---|
| 8009 | Parameter setting (in rotations per minute) for an IPM motor other than the MM-EFS or MM-THE4 |
| 8109 | Parameter setting (in frequencies) for an IPM motor other than the MM-EFS or MM-THE4 |
| 9009 | Parameter settings (in rotations per minute) for an SPM motor |
| 9109 | Parameter settings (in frequencies) for an SPM motor |

- **4.** Parameter setting (acceleration/deceleration time, multi-speed setting, etc.) Set parameters such as the acceleration/deceleration time and multi-speed setting as required.
- **5.** Operation command setting (Refer to page 240.) Select the start command and speed command.
- **6.** Perform the test operation.

NOTE

- To change to the PM motor control, perform PM parameter initialization at first. If the parameter initialization is performed after setting other parameters, some of those parameters are initialized too. (Refer to page 185 for the parameters that are initialized.)
- Constant-speed operation cannot be performed in the low-speed range of 150 r/min or less.
- During PM motor control, the RUN signal is output about 100 ms after turning ON the start command (STF/STR). The delay is due to the magnetic pole detection.
- During PM motor control, the function of the automatic restart after instantaneous power failure works only when an IPM motor MM-EFS or MM-THE4 is connected.

When a regeneration unit is used, the frequency search may not be available if the rotation speed is about 10% higher than the rated speed.

5.3.2 Performing high-accuracy, fast-response control (gain adjustment for PM motor control)

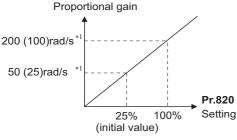
PM

Manual gain adjustment is useful for achieving optimum machine performance or improving unfavorable conditions, such as vibration and acoustic noise during operation with high load inertia or gear backlash.

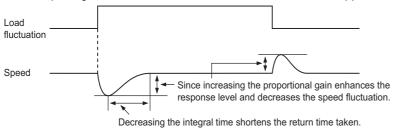
| Pr. | Name | Initial value | Setting range | Description |
|-------------|--|------------------|------------------|---|
| 820 G211 | Speed control P gain 1 | 25% | 0% to 1000% | The proportional gain during speed control is set. (Setting this parameter higher improves the trackability for speed command changes. It also reduces the speed fluctuation caused by external disturbance.) |
| 821 G212 | Speed control integral time 1 | 0.333 s | 0 to 20 s | The integral time during speed control is set. (Setting this parameter lower shortens the return time to the original speed when the speed fluctuates due to external disturbance.) |
| 824 G213 | Torque control P gain 1 (current loop proportional gain) | 50% | 0% to 500% | The proportional gain of the current controller is set. |
| 825 G214 | Torque control integral time 1 (current loop integral time) | 40 ms | 0 to 500 ms | The integral time of the current controller is set. |
| 830 | Speed control P gain 2 | 9999 | 0% to 1000% | Second function of Pr.820 (enabled when the RT signal is ON) |
| G311 | Speed control F gain 2 | 9999 | 9999 | The Pr.820 setting is applied to the operation. |
| 831 | Speed control integral time 2 | 9999 | 0 to 20 s | Second function of Pr.821 (enabled when the RT signal is ON) |
| G312 | Speed control integral time 2 | 3333 | 9999 | The Pr.821 setting is applied to the operation. |
| 834 | Torque control P gain 2 (current | 9999 | 0% to 500% | Second function of Pr.824 (enabled when the RT signal is ON) |
| G313 | loop proportional gain) | 2222 | 9999 | The Pr.824 setting is applied to the operation. |
| 835 | Torque control integral time 2 | 9999 | 0 to 500 ms | Second function of Pr.825 (enabled when the RT signal is ON) |
| G314 | (current loop integral time) | 9999 | 9999 | The Pr.825 setting is applied to the operation. |

Adjusting the speed control gain manually

- The speed control gain can be adjusted for the conditions such as abnormal machine vibration, acoustic noise, slow response, and overshoot.
- Setting 25% (initial value) in **Pr.820 Speed control P gain 1** is equivalent to 50 rad/s (speed response of a single motor). (Equivalent to the half the rad/s value with the FR-F820-03160(75K) or higher and FR-F840-01800(75K) or higher.) Setting this parameter higher speeds up the response, but setting this too high causes vibration and acoustic noise.
- Setting **Pr.821 Speed control integral time 1** lower shortens the return time to the original speed during speed fluctuation, but setting it too low causes overshoot.



- *1 The value in parentheses is applicable with the FR-F820-03160(75K) or higher and FR-F840-01800(75K) or higher.
- Actual speed gain is calculated as follows when load inertia is applied.



```
Actual speed gain = Speed gain of a single motor \times \frac{JM}{JM+JL}
```

JM: Motor inertia JL: Load inertia converted as the motor axis inertia

Adjustment procedure

- 1. Change the **Pr.820** setting while checking the conditions.
- 2. If it cannot be adjusted well, change **Pr.821** setting, and perform step **1** again.

| No. | Movement / condition | Adjustment method | | | | |
|-----|--|-------------------|--|--|--|--|
| | | | et Pr.820 and Pr.821 higher. | | | |
| 1 | Load inertia is too high. | Pr.820 | If acceleration is slow, raise the setting by 10% and then set the value to 80% to 90% of the setting immediately before vibration/noise starts occurring. | | | |
| | | Pr.821 | If overshoots occur, set about 80% to 90% of the maximum value without overshooting while increasing the setting value by twice. | | | |
| | | Set Pr.82 |) lower and Pr.821 higher. | | | |
| 2 | Vibration or acoustic 2 noise are generated from machines. | P | | Set about 80% to 90% of the maximum value without any vibration/noise while decreasing the setting value by 10%. | | |
| | | Pr.821 | If overshoots occur, set about 80% to 90% of the maximum value without overshooting while increasing the setting value by twice. | | | |
| | | Set Pr.82 |) higher. | | | |
| 3 | 3 Response is slow. | | If acceleration is slow, set about 80% to 90% of the maximum value without any vibration/ acoustic noise while increasing the setting value by 5%. | | | |
| | Return time (response | Set Pr.82 | l lower. | | | |
| 4 | 4 time) is long. Set about 80 | | t 80% to 90% of the maximum value without overshooting or unstable movements while ng the setting value of Pr.821 by half. | | | |
| | Overshoots or unstable | Set Pr.82 | 1 higher. | | | |
| 5 | 5 Overshoots or unstable movements occur. | | Set about 80% to 90% of the maximum value without overshooting or unstable movements while increasing the setting value of Pr.821 by double. | | | |

NOTE

• Pr.830 Speed control P gain 2 and Pr.831 Speed control integral time 2 are enabled when terminal RT is ON. In this case, replace them for Pr.820 and Pr.821 in the description above.

Gain adjustment of current controllers for the d axis and the q axis

- Use **Pr.824 Torque control P gain 1 (current loop proportional gain)** to adjust the proportional gain of current controllers for the d axis and the q axis. The 100% gain is equivalent to 1000 rad/s. Setting this parameter higher improves the trackability for current command changes. It also reduces the current fluctuation caused by external disturbances.
- Use **Pr.825 Torque control integral time 1 (current loop integral time)** to set the integral time of current controllers for the d axis and the q axis. If the setting value is small, it produces current fluctuation against external disturbances, decreasing time until it returns to original current value.

- NOTE

• Pr.834 Torque control P gain 2 (current loop proportional gain) and Pr.835 Torque control integral time 2 (current loop integral time) are enabled when terminal RT is ON. In this case, replace them for Pr.824 and Pr.825 in the description above.

5.3.3 Troubleshooting in the speed control

PM

| No. | Condition | Possible cause | Countermeasure |
|-----|---|---|--|
| 1 | Motor does not run at the correct speed. (Command speed and | Speed command from the controller is different from the actual speed. The speed command is affected by noise. | Check that the speed command sent from the controller is correct. (Take EMC measures.) Set Pr.72 PWM frequency selection lower. |
| | actual speed differ.) | The command speed and the speed recognized by the inverter are different. | Adjust the bias and gain of the speed command again in Pr.125, Pr.126, C2 to C7, and C12 to C15. |
| 2 | The speed does not accelerate to the | Torque shortage. Stall prevention function is activated. | Raise the stall prevention operation level. (Refer to page 290.) Increase the capacity. |
| | command speed. | Only P (proportional) control is performed. | Speed deviation occurs under P (proportional) control when the load is heavy. Select PI control. |
| | | Speed command varies. | Check that the speed command sent from the controller is correct. (Take EMC measures.) Set Pr.72 lower. Set Pr.822 Speed setting filter 1 higher. (Refer to page 355.) |
| 3 | Motor speed fluctuates. | Torque shortage. | Raise the stall prevention operation level. (Refer to page 290.) |
| | | Speed control gain is not suitable for the machine. (Resonance occurs.) | Adjust Pr.820 Speed control P gain 1 and Pr.821 Speed control integral time 1. |
| | l lumtin n (uibnetien en | Speed control gain is too high. | Set Pr.820 lower and Pr.821 higher. |
| 4 | Hunting (vibration or acoustic noise) occurs in the motor or the machine. | Torque control gain is too high. | Set Pr.824 Torque control P gain 1 (current loop proportional gain) lower. |
| | | Motor wiring is incorrect. | Check the wiring. |
| | Acceleration/ | Torque shortage. | Raise the stall prevention operation level. (Refer to page 290.) |
| 5 | deceleration time is different from the setting. | Load inertia is too high. | Set acceleration/deceleration time suitable for the load. |
| | Machine movement is | Speed control gain is not suitable for the machine. | • Adjust Pr.820 and Pr.821 . |
| 6 | unstable. | Response is slow because of the inverter's acceleration/ deceleration time setting. | Set the optimum acceleration/deceleration time. |
| 7 | Rotation ripple occurs during the low-speed | High carrier frequency is affecting the motor rotation. | Set Pr.72 lower. |
| | operation. | Speed control gain is too low. | Set Pr.820 higher. |

Parameters referred to

Pr.3 Base frequency, Pr.19 Base frequency voltage 37 page 552

Pr.35 base frequency, Pr.19 base frequency voltage is page 352 Pr.72 PWM frequency selection is page 218 Pr.80 Motor capacity, Pr.81 Number of motor poles is page 177 Pr.125 Terminal 2 frequency setting gain frequency, Pr.126 Terminal 4 frequency setting gain frequency is page 357 Pr.822 Speed setting filter 1 is page 355

5.3.4 Torque detection filter

PM

Set the time constant of primary delay filter torque feedback signal.

Speed loop response is reduced. Under ordinary circumstances, therefore, use the initial value as it is.

| Pr. | Name | Initial value | Setting range | Description |
|------|----------------------------------|------------------|------------------|---|
| 827 | 827 Torgue detection filter 1 | | 0 | Without filter |
| G216 | | 0 s | 0.001 to 0.1 s | Set the time constant of primary delay filter torque feedback signal. |
| 837 | 837 Torgue detection filter 2 | | 0 to 0.1 s | Second function of Pr.827 (enabled when the RT signal is ON) |
| G316 | rorque delection inter 2 | 9999 | 9999 | Same as Pr.827 setting |

Stabilizing torque detection (Pr.827, Pr.837)

Current loop response is reduced. Under ordinary circumstances, therefore, use the initial value as it is.
 If there is torque ripple due to high frequency disturbance, adjust until speed stabilizes by gradually raising the setting.
 Speed is oppositely destabilized if the setting value is too large.

Employing multiple primary delay filters

• Use **Pr.833** and **Pr.837** if changing filter according to application. **Pr.837** is enabled when the Second function selection (RT) signal is turned ON.

• NOTE

- The RT signal is a second function selection signal which also enables other second functions. (Refer to page 377.)
- The RT signal is assigned to the terminal RT in the initial status. Set "3" in one of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the RT signal to another terminal.

5.4 (E) Environment setting parameters

| Purpose | Par | Parameter to set | | | |
|---|---|-----------------------------|---------------------------------------|-----|--|
| To set the time | Real time clock function | P.E020 to P.E022 | Pr.1006 to Pr.1008 | 195 | |
| To set a limit for the reset function. To shut off output if the operation panel disconnects. To force deceleration to a stop on the operation panel. | Reset selection/ disconnected PU detection/PU stop selection/reset limit | P.E100 to P.E102, P.E107 | Pr.75 | 196 | |
| To select the display language of the parameter unit | PU display language selection | P.E103 | Pr.145 | 200 | |
| To control the buzzer of the parameter unit and operation panel | PU buzzer control | P.E104 | Pr.990 | 200 | |
| To adjust the LCD contrast of the parameter unit | PU contrast adjustment | P.E105 | Pr.991 | 200 | |
| To turn OFF the operation panel when not using it for a certain period of time | Display-off setting | P.E106 | Pr.1048 | 200 | |
| To switch the monitor display of the operation panel to the PID set point setting screen by simply turning the setting dial | Direct setting | P.E108 | Pr.1000 | 201 | |
| To use the USB memory | USB host reset | P.E110 | Pr.1049 | 201 | |
| To use the setting dial of the operation panel like a potentiometer to set the frequency. To disable the operation panel. | Operation panel operation selection | P.E200 | Pr.161 | 202 | |
| To change the frequency change increments which changes when using the setting dial of the operation panel | Frequency change increment amount setting | P.E201 | Pr.295 | 203 | |
| To use the regeneration unit to increase the motor braking torque | Regenerative brake selection | P.E300 | Pr.30 | 566 | |
| To change the overload current rating specification | Multiple rating setting | P.E301 | Pr.570 | 204 | |
| To input a voltage between 480 V and 500 V | Input voltage mode selection | P.E302 | Pr.977 | 205 | |
| To prevent parameter rewriting | Parameter write disable selection | P.E400 | Pr.77 | 206 | |
| To restrict parameters with a password | Password | P.E410, P.E411 | Pr.296, Pr.297 | 208 | |
| To use parameters freely | Free parameter | P.E420, P.E421 | Pr.888, Pr.889 | 210 | |
| To change parameter settings for an IPM motor as a batch | PM parameter initialization | P.E430 | Pr.998 | 183 | |
| To set multiple parameters by batch | Automatic parameter setting | P.E431 | Pr.999 | 211 | |
| To display the required parameters | Applicable parameter display and user group function | P.E440 to P.E443 | Pr.160, Pr.172 to Pr.174 | 215 | |
| To release the parameter copy warning (CP) | Parameter copy alarm release | P.E490 | Pr.989 | 579 | |
| To reduce the motor noise and EMI | PWM carrier frequency changing | P.E600 to P.E602 | Pr.72, Pr.240, Pr.260 | 218 | |
| | Inverter parts life display | P.E700 to P.E707 | Pr.255 to Pr.259, Pr.506 to Pr.508 | 220 | |
| To understand the maintenance time of inverter parts and peripheral devices | Maintenance output function | P.E710 to P.E715 | Pr.503 to Pr.504, Pr.686 to Pr.689 | 224 | |
| | Current average value monitor signal | P.E720 to P.E722 | Pr.555 to Pr.557 | 225 | |

5.4.1 Real time clock function

The time can be set. The time can only be updated while the inverter power is ON.

The real time clock function is enabled using an optional LCD operation panel (FR-LU08).

| Pr. | Name | Initial value | Setting range | Description |
|--------------|-------------------------|--------------------|--|--|
| 1006 E020 | Clock (year) | 2000 (year) | 2000 to 2099 | Set the year. |
| 1007 E021 | Clock (month, day) | 101 (January 1) | 101 to 131, 201 to 228 (229), 301 to 331, 401 to 430, 501 to 531, 601 to 630, 701 to 731, 801 to 831, 901 to 930, 1001 to 1031, 1101 to 1130, 1201 to 1231 | Set the month and day. 1000's and 100's digits: Month (1 (January) to 12 (December)). 10's and 1's digits: Day (1 to the last day of the month (28, 29, 30, or 31)). For December 31, set "1231". |
| 1008 E022 | Clock (hour, minute) | 0 (00:00) | 0 to 59, 100 to 159, 200 to 259, 300 to 359, 400 to 459, 500 to 559, 600 to 659, 700 to 759, 800 to 859, 900 to 959, 1000 to 1059, 1100 to 1159, 1200 to 1259, 1300 to 1359, 1400 to 1459, 1500 to 1559, 1600 to 1659, 1700 to 1759, 1800 to 1859, 1900 to 1959, 2000 to 2059, 2100 to 2159, 2200 to 2259, 2300 to 2359 | Set the hour and minute using the 24-hour clock. 1000's and 100's digits: 0 to 23 hours, 10's and 1's digits: 0 to 59 minutes. For 23:59, set "2359". |

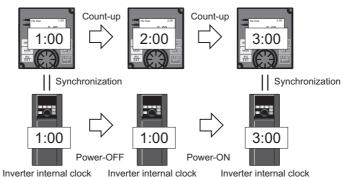
Simple clock function

• When the current year, month, day, hour and minute are set in the parameters above, the inverter internal clock starts ticking. The set date and time can be checked by reading the parameters.

- NOTE

- The time data of the internal clock is saved in the inverter's EEPROM every 10 minutes.
- The clock does not run while the control circuit power is OFF. The clock needs to be set every time after turning ON the inverter power. Prepare separate power supply, such as an external 24 V power supply, to supply power continuously to the control circuit for the simple clock function.
- However, if the power to the main circuit of the inverter is turned ON with the control circuit power already ON, the clock data is reset to the data stored in EEPROM because the Inverter reset is performed whenever the power is supplied to the main circuit of the inverter in the initial setting. To prevent the clock from resetting, set Pr.30 Regenerative function selection. (Refer to page 566.)
- The set time is used for functions such as the Fault history.

Real time clock function



- When the FR-LU08 is connected to the inverter, the internal clock of the inverter can be synchronized with the clock in the FR-LU08 (Real time clock function). The FR-LU08 with battery (CR1216) backup can keep its clock function running even if the main power of the inverter is turned OFF. (The inverter internal clock stops running when the inverter power is turned OFF.)
- To adjust the clock in the FR-LU08, set Pr.1006 to Pr.1008 on the FR-LU08.

- Time synchronization between the inverter internal clock and the clock in the FR-LU08 is performed every one minute.
- If the FR-LU08 clock is reset due to dead battery for example, the data in the inverter internal clock is used.

5.4.2 Reset selection / disconnected PU detection / PU stop selection

The acceptance of reset command, the inverter operation in the event of detection of the PU (operation panel / parameter unit) disconnected, and the acceptance of stop command from the PU (PU stop function) can be selected using Pr.E100 (Reset selection), Pr.E101 (Disconnected PU detection), and Pr.E102 (PU stop selection), respectively, or using Pr.75 alone.

| Pr. | Name | Initial value | Setting range | Description | |
|---|-------------------|------------------|---|---|--|
| 75 Reset selection/ disconnected PU detection/PU stop | | 14 | 0 to 3, 14 to 17, 1000 to 1003, 1014 to 1017 ^{*1} 0 to 3, 14 to 17, 100 to 103, 114 to 117, 1000 to | In the initial setting, the reset command input is always enabled, the inverter operation continues even when PU is disconnected, and the operation can be stopped on the PU. | |
| | selection | | 1003, 1014 to 1017, 1100 to 1103, 1114 to 1117 ^{*2} | | |
| | | | 0 | Reset input is always enabled. | |
| E100 | Reset selection | 0 | 1 | Reset input is enabled only when the protective function is activated. | |
| EIUU | | | 2 | Reset input is enabled only when the start signal is OFF. | |
| | | | 3 | Reset input is enabled when the protective function is activated and the start signal is OFF. | |
| E101 | Disconnected PU | | 0 | Operation continues even when the PU is disconnected. | |
| EIVI | detection | tection | 1 | The inverter output is shut off when the PU is disconnected. | |
| E102 | - | | 0 | The inverter decelerates to a stop when the STOP key on the PU is pressed in PU operation mode. (The PU stop function is disabled.) | |
| E 102 | PU stop selection | 1 | 1 | The inverter decelerates to a stop when the STOP key on the PU is pressed in any operation mode of the PU, external, or Network. (The PU stop function is enabled.) | |
| E407 | Decet limit | 0 | 0 | Reset limit is disabled. | |
| E107 | Reset limit | 0 | 1*2 | Reset limit is enabled. | |

The parameters above do not return to their initial values even if Parameter clear/All parameter clear is executed.

*1 The setting range of the FR-F820-02330(55K) or lower and the FR-F840-01160(55K) or lower

*2 The setting range of the FR-F820-03160(75K) or higher and the FR-F840-01800(75K) or higher

| Pr.75 setting | Reset input | Operation after PU disconnection is detected | PU stop function | Reset limit function |
|-----------------------|--|--|------------------|-----------------------|
| 0 | Always enabled. | Operation continues. | Disabled | Disabled |
| 1 | When the protective function is activated. | Operation continues. | Disabled | Disabled |
| 2 | Always enabled. | Inverter output shutoff. | Disabled | Disabled |
| 3 | When the protective function is activated. | Inverter output shutoff. | Disabled | Disabled |
| 14 (initial value) | Always enabled. | Operation continues. | Enabled | Disabled |
| 15 | When the protective function is activated. | Operation continues. | Enabled | Disabled |
| 16 | Always enabled. | Inverter output shutoff. | Enabled | Disabled |
| 17 | When the protective function is activated. | Inverter output shutoff. | Enabled | Disabled |
| 100 | Always enabled. | Operation continues. | Disabled | Enabled ^{*3} |
| 101 | When the protective function is activated. | Operation continues. | Disabled | Enabled ^{*3} |
| 102 | Always enabled. | Inverter output shutoff. | Disabled | Enabled ^{*3} |
| 103 | When the protective function is activated. | Inverter output shutoff. | Disabled | Enabled ^{*3} |
| 114 | Always enabled. | Operation continues. | Enabled | Disabled |
| 115 | When the protective function is activated. | Operation continues. | Enabled | Disabled |
| 116 | Always enabled. | Inverter output shutoff. | Enabled | Disabled |
| 117 | When the protective function is activated. | Inverter output shutoff. | Enabled | Disabled |
| 1000 | When the start signal is OFF. | Operation continues. | Disabled | Disabled |
| 1001 | When the protective function is activated and the start signal is OFF. | Operation continues. | Disabled | Disabled |
| 1002 | When the start signal is OFF. | Inverter output shutoff. | Disabled | Disabled |
| 1003 | When the protective function is activated and the start signal is OFF. | Inverter output shutoff. | Disabled | Disabled |
| 1014 | When the start signal is OFF. | Operation continues. | Enabled | Disabled |
| 1015 | When the protective function is activated and the start signal is OFF. | Operation continues. | Enabled | Disabled |
| 1016 | When the start signal is OFF. | Inverter output shutoff. | Enabled | Disabled |
| 1017 | When the protective function is activated and the start signal is OFF. | Inverter output shutoff. | Enabled | Disabled |
| 1100 | When the start signal is OFF. | Operation continues. | Disabled | Enabled ^{*3} |
| 1101 | When the protective function is activated and the start signal is OFF. | Operation continues. | Disabled | Enabled ^{*3} |
| 1102 | When the start signal is OFF. | Inverter output shutoff. | Disabled | Enabled ^{*3} |
| 1103 | When the protective function is activated and the start signal is OFF. | Inverter output shutoff. | Disabled | Enabled ^{*3} |
| 1114 | When the start signal is OFF. | Operation continues. | Enabled | Enabled ^{*3} |
| 1115 | When the protective function is activated and the start signal is OFF. | Operation continues. | Enabled | Enabled ^{*3} |
| 1116 | When the start signal is OFF. | Inverter output shutoff. | Enabled | Enabled ^{*3} |
| 1117 | When the protective function is activated and the start signal is OFF. | Inverter output shutoff. | Enabled | Enabled ^{*3} |

*3 The setting is available for the FR-F820-03160(75K) or higher and FR-F840-01800(75K) or higher.

Reset selection (P.E100)

- While **P.E100** = "1", or **Pr.75** = "1, 3, 15, 17, 101, 103, 115, or 117", the reset command input is enabled (using the RES signal or through communication) only when the protective function is activated.
- While **P.E100** = "2" or **Pr.75** = "1000, 1002, 1014, 1016, 1100, 1102, 1114, or 1116", the reset command input is enabled (using the RES signal or through communication) only when the start signal is OFF.
- While **P.E100** = "3" or **Pr.75** = "1001, 1003, 1015, 1017, 1101, 1103, 1115, or 1117", the reset command input is enabled (using the RES signal or through communication) only when the protective function is activated with the start signal OFF.



- When the RES signal is input during operation, the motor coasts since the inverter being reset shuts off the output. Also, the cumulative value of the electronic thermal relay is cleared.
- When "reset input always enabled" is selected, the reset key on the PU is enabled only when the protective function is activated.
- The following table shows applicable start commands. (When both the STF and STR signals are ON, the start signal status is OFF.)

| Start signal input interface | Applicable start signal |
|------------------------------|--|
| External terminal | X13, X28, JOGF, JOGR, STF, or STR |
| PU | Forward/reverse rotation command given by pressing the FWD/REV key |
| Communication | X13, X28, STF, or STR |

• During emergency drive operation, reset input is always enabled regardless of the reset selection setting.

Disconnected PU detection (P.E101)

When the inverter detects that the PU (FR-DU08/FR-PU07) is disconnected from the inverter for 1 second or more while
 P.E101 or Pr.75 is set to shut off the inverter output upon disconnection of the PU, the PU disconnection ("E.PUE") indication is displayed and the inverter output is shut off.

NOTE

- When the PU has been disconnected before power-ON, the output is not shut off.
- To restart the inverter operation, confirm that the PU is connected before reset.
- When the inverter detects that the PU is disconnected during PU JOG operation while **P.E101** or **Pr.75** is set to continue the inverter operation even when the PU is disconnected, the inverter decelerates the motor to a stop.
- During RS-485 communication operation via the PU connector, the Reset selection function and the PU stop selection function are enabled but the Disconnected PU detection function is disabled. (The communication is checked according to Pr.122 PU communication check time interval.)

◆ PU stop selection (P.E102)

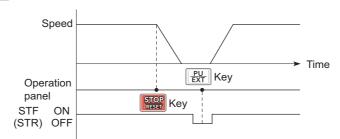
- When the PU stop function is enabled, the motor can be decelerated to a stop by pressing on the PU in either the PU, External, or Network operation mode.
- The table below describes situations in which the PU stop function is activated. The indication "

PU, and the operation cannot be restarted while the indication remains on. However, the Fault signal is not output.

| Operation mode | Operation |
|---|---|
| External External/PU combined 1 Network | STOP RESET on the PU is pressed during operation. |
| PU operation mode | on the PU is pressed while the inverter is operated by a command source other than the PU. (The command interface/source is selected by setting Pr.551 PU mode operation command source selection .) |

How to restart the inverter which has been stopped in the External operation mode by using an the PU ("PS" (PU stop) warning reset method)

- For the operation panel (FR-DU08)
 - **1.** After completion of deceleration stop, turn OFF the STF and STR signals.
 - Press PU three times ("PU is cleared)
 when Pr.79 Operation mode selection = "0 (initial value) or 6".
 When Pr.79 = "2, 3, or 7", the PU stop warning can be cleared with one keystroke.
- · For the parameter unit (FR-PU07)
 - 1. After completion of deceleration stop, turn OFF the STF or STR signal.
 - 2. Press EXT (" - " is cleared)



Stop/restart example for External operation

The inverter can be restarted by performing the reset operation (by turning OFF and ON the power or inputting the RES signal).

- NOTE

• Even when **Pr.250 Stop selection** ≠ "9999" is set and coasting stop is selected, using the PU stop function in the External operation mode does not provide coasting stop but deceleration stop.

Reset limit (P.E107)

- Setting P.E107 = "1" or Pr.75 = any of "100 to 103, 114 to 117, 1100 to 1103, or 1114 to 1117" will make the inverter to refuse any reset operation (RES signal input, etc.) for 3 minutes after the first activation of an electronic thermal O/L relay or protective function (E.THM, E.THT, E.OC[]).
- The reset limit function is available with the FR-F820-03160(75K) or higher and the FR-F840-01800(75K) or higher.

NOTE

- · Resetting the inverter power (turning OFF the control power) clears the accumulated thermal value.
- When the retry function is set enabled (Pr.67 Number of retries at fault occurrence ≠ "0"), the reset limit function is disabled.

• Do not perform a reset while a start signal is being input. Doing so will cause a sudden start of the motor, which is dangerous.

A Parameters referred to

Pr.67 Number of retries at fault occurrence ☞ page 276 Pr.79 Operation mode selection ☞ page 240 Pr.250 Stop selection ☞ page 563 Pr.551 PU mode operation command source selection ☞ page 251

5.4.3 PU display language selection

You can switch the display language of the parameter unit (FR-PU07) to another.

| Pr. | Name | Initial value | Setting range | Description |
|------|----------------------------------|---------------|---------------|-------------|
| | | _ | 0 | Japanese |
| | | | 1 | English |
| | PU display language selection | | 2 | German |
| 145 | | | 3 | French |
| E103 | | | 4 | Spanish |
| | | | 5 | Italian |
| | | | 6 | Swedish |
| | | | 7 | Finnish |

5.4.4 Buzzer control

The PU (operation panel or parameter unit) key sound and buzzer can be turned ON/OFF.

| Pr. | Name | Initial value | Setting range | Description |
|------------------------|-------------------------|---------------|---------------|-------------------------------------|
| 990 | 990 Bill buzzer control | 1 | 0 | Turns the key sound and buzzer OFF. |
| E104 PU buzzer control | | 1 | 1 | Turns the key sound and buzzer ON. |

- NOTE

· When the buzzer is set to ON, a warning sound will be audible when a fault occurs.

5.4.5 PU contrast adjustment

Contrast of the LCD display on the LCD operation panel (FR-LU08) or the parameter unit (FR-PU07) can be adjusted. Decreasing the setting value lowers the contrast.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|------------------------|---------------|---------------|------------------------------|
| 991 E105 | PU contrast adjustment | 58 | 0 to 63 | 0: Low $ ightarrow$ 63: High |

This parameter can be selected from among simple mode parameters only when the LCD operation panel (FR-LU08) or the parameter unit (FR-PU07) is connected to the inverter.

5.4.6 Display-off setting

The LED display of the operation panel (FR-DU08) can be turned OFF when the operation panel has not been used for a certain period of time.

| Pr. | Name | Initial value | Setting range | Description |
|------|--------------------------|---------------|-------------------|--|
| 1048 | Display-off waiting time | | 0 | Display-off setting is disabled. |
| E106 | | 0 | 1 to 60 (minutes) | Set time until the LED of the operation panel is turned OFF. |

- When the operation panel has not been operated for the time set in Pr.1048, the display-off setting is activated and the LED display turns OFF.
- In the display-off state, the [MON] indicator blinks slowly.
- The time interval counting for display-off is reset at removal/reinstallation of the operation panel, power-ON/OFF of the inverter, or the Inverter reset.
- The triggers for display-on are as follows:
 - Operation of the operation panel,
 - Occurrence of a warning, alarm, or fault,
 - Removal/reinstallation of the operation panel, power-ON/OFF of the inverter, or the Inverter reset,
 - Connection/disconnection at the USB A connector.

• NOTE

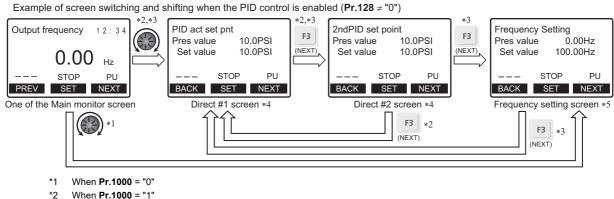
• The [P.RUN] indicator is ON even if the operation panel is in the display-off state (while the PLC function is enabled).

5.4.7 Direct setting

The PID set point setting screen (direct setting screen) can be displayed first on the LCD operation panel (FR-LU08) according to the parameter setting.

| Pr. | Name | Initial value | Setting range | Description |
|-------------------------------|---------------------------|---------------|---------------|---|
| | | | 0 | Displays the Frequency setting screen. |
| 1000 Direct setting selection | Direct setting selection | 0 | 1 | Displays the direct setting screen (for set point setting). |
| E108 | B Breet Setting Selection | | 2 | Displays the direct setting screen (for set point setting) |
| | | | - | and the frequency setting screen. |

- This function is useful for setting the PID set point on the LCD operation panel.
- The monitor display can be switched from the main monitor screen to the set point setting screen for the PID action simply by turning (3), according to the setting of **Pr.1000 Direct setting selection**. On each setting screen, turn (3) to input
 - a setting value, and press [F2] to confirm the setting.



- *3 When **Pr.1000** = "2"
- *4 Not displayed when PID control is disabled (**Pr.128** = "0").
- *5 Indication of "NEXT" is not displayed when **Pr.1000** = "0".
- To switch back the monitor display from the Extended direct screen or the Frequency setting screen to the Main monitor

screen, press [BACK]

Parameters referred to

Pr.128 PID action selection 🖙 page 419

5.4.8 Resetting USB host errors

When a USB device is connected to the USB connector (connector A), the USB host error can be canceled without performing the Inverter reset.

| Pr. | Name | Initial value | Setting range | Description |
|------|----------------|---------------|---------------|----------------------|
| 1049 | USB host reset | 0 | 0 | Read only |
| E110 | | 0 | 1 | Resets the USB host. |

- Parameter copy (refer to page 579) or the trace function (refer to page 486) is available when a USB device (such as a USB memory) is connected to the USB connector (connector A).
- When a device such as a USB charger is connected to the USB connector and an excessive current (500 mA or higher) flows, USB host error "
- When the UF warning appears, the USB error can be canceled by removing the USB device and setting **Pr.1049** = "1". (The UF warning can also be canceled by resetting the inverter power or resetting with the RES signal.)

5.4.9 Easy frequency setting (Volume-knob-like setting) and key lock function selection

The frequency can be easily set with the setting dial on the operation panel (FR-DU08) like a volume knob. The key operation of the operation panel can be disabled.

| Pr. | Name | Initial value | Setting range | Descripti | on |
|------|--------------------------------|---------------|---------------|--|-------------------|
| | | 0 | 0 | Normal frequency setting | Key lock function |
| 161 | 161 Frequency setting/key lock | | 1 | Easy frequency setting (Volume-knob-like setting) | disabled. |
| E200 | operation selection | | 10 | Normal frequency setting | Key lock function |
| | | | 11 | Easy frequency setting (Volume-knob-like setting) | enabled. |

Setting the frequency by turning the setting dial like a volume knob

• The frequency can be set by simply turning the setting dial on the operation panel (FR-DU08) during operation (Volume-

knob-like setting). SET needs not to be pressed. (For details on the operation method, refer to page 124.)

- NOTE

- If the display changes from blinking "60.00" to "0.00", the setting value of **Pr.161** may not be "1".
- The newly-set frequency is be saved as the set frequency in EEPROM after 10 seconds.
- When setting the frequency by turning the setting dial, the frequency goes up to the set value of **Pr.1 Maximum frequency**. Be aware of what frequency **Pr.1** is set to, and adjust the setting of **Pr.1** according to the application.

Disabling the setting dial and keys on the operation panel (by holding down the MODE key for 2 seconds)

- The setting dial and keys on the operation panel (FR-DU08) can be disabled to prevent parameter changes, unexpected starts or frequency changes.
- Set **Pr.161** to "10 or 11" and then press MODE for 2 seconds to disable setting dial and keys.
- To enable the setting dial and keys again, press MODE for 2 seconds.

- NOTE

- Even if setting dial and keys are disabled, the monitor indicator and signal are enabled.
- The PU stop warning cannot be reset by using keys while the key lock function is enabled.

Parameters referred to Pr.1 Maximum frequency page 287

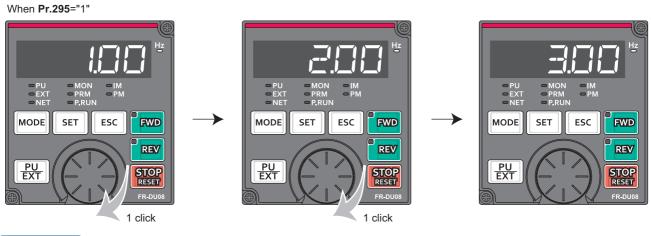
5.4.10 Frequency change increment amount setting

When setting the set frequency with the setting dial of the operation panel (FR-DU08), the frequency changes in 0.01 Hz increments in the initial status. Setting this parameter to increase the frequency increment amount that changes when the setting dial is rotated can improve usability.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|--|---------------|---------------|--|
| | | | 0 | Function disabled |
| 005 | F | | 0.01 | |
| 295 E201 | Frequency change increment amount setting | 0 | 0.10 | The minimum change width when the set frequency is |
| 201 | | | 1.00 | changed with the setting dial can be set. |
| | | | 10.00 | |

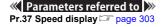
Basic operation

When Pr.295 ≠ "0", the minimum increment when the set frequency is changed with the setting dial can be set.
 For example, when Pr.295 = 1.00 Hz, one click (one dial gauge) of the setting dial changes the frequency in increments of 1.00 Hz, such as 1.00 Hz → 2.00 Hz → 3.00 Hz.



NOTE

- When machine speed display is selected in **Pr.37 Speed display**, the minimum increments of change are determined by **Pr.295** as well. Note that the setting value may differ as speed setting changes the set machine speed and converts it to the speed display again.
- For Pr.295, the increments are not displayed.
- The **Pr.295** setting is enabled only for the changes to the set frequency. It does not apply to the settings of other parameters related to frequency.
- When 10 is set, the frequency setting changes in 10 Hz increments. Be cautious of excessive speed (in potentiometer mode).



5.4.11 Multiple rating setting

Two rating types of different rated current and permissible load can be selected. The optimal inverter rating can be chosen in accordance with the application, enabling equipment size to be reduced. (The setting is available for the standard structure model or the separated converter type.)

| Pr. | Name | Initial | value | Setting range | Description (overload current rating, surrounding air temperature) | | |
|------|-------------------------------------|----------------|-------|---|--|---|--|
| F1. | Name | FM | CA | Setting range | Description (overload current rating, surrounding an temperature) | | |
| 570 | 570 Multiple rating E301 setting | ultiple rating | | rating 1 0 | | 0 | SLD rating. 110% for 60 seconds, 120% for 3 seconds (inverse-time characteristics) at surrounding air temperature of 40°C. |
| E301 | | etting 1 | 1 | LD rating. 120% for 60 seconds, 150% for 3 seconds (inverse-time characteristics) at surrounding air temperature of 50°C. | | | |

Changing the parameter initial values and setting ranges

• When the **Pr.570** setting is changed, initial values of the following parameters will be changed according to each rating by performing an inverter reset and All parameter clear.

| Pr. | Nama | Pr.570 | setting | Refer to |
|-----|---|---------------------------------|---------------------------------------|----------|
| Pr. | Name | 0 | 1 | Refer to |
| 9 | Electronic thermal O/L relay | SLD rated current ^{*1} | LD rated current ^{*1} | 266 |
| 22 | Stall prevention operation level | 110% | 120% | 290 |
| 48 | Second stall prevention operation level | 110% | 120% | 290 |
| 56 | Current monitoring reference | SLD rated current ^{*1} | LD rated current ^{*1} | 314 |
| 148 | Stall prevention level at 0 V input | 110% | 120% | 290 |
| 149 | Stall prevention level at 10 V input | 120% | 150% | 290 |
| 150 | Output current detection level | 110% | 120% | 339 |
| 165 | Stall prevention operation level for restart | 110% | 120% | 466 |
| 557 | Current average value monitor signal output reference current | SLD rated current ^{*1} | LD rated current ^{*1} | 225 |
| 874 | OLT level setting | 110% | 120% | 290 |
| 893 | Energy saving monitor reference (motor capacity) | SLD rated motor capacity*1 | LD rated motor capacity ^{*1} | 324 |

*1 The rated current and motor capacity differ depending on the inverter capacity. Refer to the inverter rated specifications (page 638).

ΜΟΤΕ

• When **Pr.570** = "0" (SLD rating), carrier frequency automatic reduction is enabled regardless of the setting in **Pr.260 PWM** frequency automatic switchover.

• Setting Pr.570 is not available for the IP55 compatible model. The LD rating is applied.

Parameters referred to

Pr.260 PWM frequency automatic switchover is page 218

5.4.12 Using a power supply exceeding 480 VAC

To input a voltage between 480 VAC and 500 VAC to the 400 V class inverter, change the voltage protection level.

| Pr. | Name | Initial value | Setting range | Description |
|------|--|---------------|------------------|---------------------------------------|
| 077 | | | 0 | 400 V class voltage protection level |
| - | 977 Input voltage mode E302 selection | mode 0 | | 500 V class voltage protection level |
| 2302 | | | 2 | For manufacturer setting. Do not set. |

To use a voltage between 480 VAC and 500 VAC, set Pr.977 Input voltage mode selection = "1". The setting is applied
after a reset.

- Setting Pr.977 = "1" changes the voltage protection level to the one for the 500 V class.
- The increased magnetic excitation deceleration operation level is 740 V. Use Pr.660 Increased magnetic excitation deceleration operation selection to select the increased magnetic excitation deceleration.)

- To check availability of stand-alone options when the input voltage is between 480 and 500 VAC, refer to the Instruction Manual or catalog of each option for details of the ratings.
- Changing the Pr.977 setting does not affect the voltage level to activate the regenerative overvoltage trip (E.OV1 to E.OV3).
- · Changing the Pr.977 setting does not affect the voltage level set in Pr.883 Regeneration avoidance operation level.
- The setting of **Pr.977** is invalid for the 200 V class inverter.

Parameters referred to

Pr.660 Increased magnetic excitation deceleration operation selection Figure 574

5.4.13 Parameter write selection

Whether to enable the writing to various parameters or not can be selected. Use this function to prevent parameter values from being rewritten by misoperation.

| Pr. | Name | Initial value | Setting range | Description |
|----------------------------|--------------------------------|---------------|---------------|--|
| | | | 0 | Parameter write is enabled only during stop. |
| 77 Baramotor write selecti | Parameter write selection | 0 | 1 | Parameter writing is disabled. |
| E400 | E400 Parameter write selection | 0 | 2 | Parameter writing is enabled in any operation mode regardless of the operation status. |

• **Pr.77** can be set at any time regardless of the operation mode or operation status. (Setting through communication is unavailable.)

Parameter write enabled only during stop (Pr.77 = "0 (initial value)")

- Parameters can be written only during a stop in the PU operation mode.
- The following parameters can always be written regardless of the operation mode or operation status.

| Pr. | Name | Pr. | Name |
|-------------------|---|-------------------|---|
| 4 to 6 | (Multi-speed setting high-speed, middle-speed, low-speed) | 555 to 557 | (Current average value monitoring) |
| 22 | Stall prevention operation level | 656 to 659 | (Analog remote output) |
| 24 to 27 | (Multi-speed setting speed 4 to speed 7) | 663 | Control circuit temperature signal output level |
| 52 | Operation panel main monitor selection | 675 | User parameter auto storage function selection |
| 54 | FM/CA terminal function selection | 755 to 758 | (Second PID control) |
| 55 | Frequency monitoring reference | 759 | PID unit selection |
| 56 | Current monitoring reference | 774 to 776 | (PU/DU monitor selection) |
| 72 ^{*1} | PWM frequency selection | 866 | Torque monitoring reference |
| 75 | Reset selection/Disconnected PU detection/PU stop selection | 888, 889 | (Free parameter) |
| 77 | Parameter write selection | 891 to 899 | (Energy saving monitoring) |
| 79 ^{*2} | Operation mode selection | C0 (900) | FM/CA terminal calibration |
| 129 | PID proportional band | C1(901) | AM terminal calibration |
| 130 | PID integral time | C8 (930) | Current output bias signal |
| 133 | PID action set point | C9 (930) | Current output bias current |
| 134 | PID differential time | C10 (931) | Current output gain signal |
| 158 | AM terminal function selection | C11 (931) | Current output gain current |
| 160 | User group read selection | 990 | PU buzzer control |
| 232 to 239 | (Multi-speed setting speed 8 to speed 15) | 991 | PU contrast adjustment |
| 240 ^{*1} | Soft-PWM operation selection | 992 | Operation panel setting dial push monitor selection |
| 241 | Analog input display unit switchover | 997 | Fault initiation |
| 268 | Monitor decimal digits selection | 998 ^{*2} | PM parameter initialization |
| 290 | Monitor negative output selection | 999 ^{*2} | Automatic parameter setting |
| 295 | Frequency change increment amount setting | 1000 | Direct setting selection |
| 296, 297 | (Password setting) | 1006 | Clock (year) |
| 306 | Analog output signal selection | 1007 | Clock (month, day) |
| 310 | Analog meter voltage output selection | 1008 | Clock (hour, minute) |
| 340 ^{*2} | Communication startup mode selection | 1019 | Analog meter voltage negative output selection |
| 345, 346 | (DeviceNet communication) | 1048 | Display-off waiting time |
| 416, 417 | (PLC) | 1142 | Second PID unit selection |
| 434, 435 | (CC-Link communication) | 1150 to 1199 | (PLC function user parameters) |
| 496, 497 | (Remote output) | 1211 to 1219 | (PID gain tuning) |
| 498 | PLC function flash memory clear | 1460 to 1466 | (PID multistage set point 1 to 7) |
| 550 ^{*2} | NET mode operation command source selection | 1490 to 1405 | (Lood operatoriation fourt detection) |
| 551 ^{*2} | PU mode operation command source selection | 1480 to 1485 | (Load characteristics fault detection) |

*1 Writing during operation is enabled in PU operation mode, but disabled in External operation mode.

*2 Writing during operation is disabled. To change the parameter setting value, stop the operation.

Parameter write disabled (Pr.77 = "1")

- Parameter write, Parameter clear, and All parameter clear are disabled. (Parameter read is enabled.)
- The following parameters can be written even if **Pr.77** = "1".

| Pr. | Name |
|-----|--|
| 22 | Stall prevention operation level |
| 75 | Reset selection/Disconnected PU detection/PU stop selection |
| 77 | Parameter write selection |
| 79 | Operation mode selection ^{*1} |
| 160 | User group read selection |
| 296 | Password lock level |

| 297 | Password lock/unlock |
|------------|---------------------------|
| 345, 346 | (DeviceNet communication) |
| 496, 497 | (Remote output) |
| 656 to 659 | (Analog remote output) |
| 997 | Fault initiation |

*1 Writing during operation is disabled. To change the parameter setting value, stop the operation.

Parameter write enabled during operation (Pr.77 = "2")

- These parameters can always be written.
- The following parameters cannot be written during operation even if **Pr.77** = "2". To change the parameter setting value, stop the operation.

| Pr. | Name | |
|------------|--|--|
| 23 | Stall prevention operation level compensation factor at double speed | |
| 48 | Second stall prevention operation level | |
| 49 | Second stall prevention operation frequency | |
| 60 | Energy saving control selection | |
| 66 | Stall prevention operation reduction starting frequency | |
| 71 | Applied motor | |
| 79 | Operation mode selection | |
| 80 | Motor capacity | |
| 81 | Number of motor poles | |
| 82 | Motor excitation current | |
| 83 | Rated motor voltage | |
| 84 | Rated motor frequency | |
| 90 to 94 | (Motor constant) | |
| 95 | Online auto tuning selection | |
| 96 | Auto tuning setting/status | |
| 135 to 139 | (Electronic bypass sequence parameter) | |
| 178 to 196 | (Input and output terminal function selection) | |
| 248 | Self power management selection | |
| 254 | Main circuit power OFF waiting time | |
| 261 | Power failure stop selection | |
| 289 | Inverter output terminal filter | |
| 291 | Pulse train I/O selection | |
| 298 | Frequency search gain | |
| 313 to 322 | (Extended output terminal function selection) | |
| 329 | Digital input unit selection | |
| 414 | PLC function operation selection | |
| 415 | Inverter operation lock mode setting | |
| 418 | Extension output terminal filter | |
| 450 | Second applied motor | |
| 453 | Second motor capacity | |
| 454 | Number of second motor poles | |

| Pr. | Name | | |
|--|--|--|--|
| 455 | Second motor excitation current | | |
| 456 | Rated second motor voltage | | |
| 457 | Rated second motor frequency | | |
| 458 to 462 | (Second motor constant) | | |
| 463 | Second motor auto tuning setting/status | | |
| 507, 508 | (Display/reset ABC relay contact life) | | |
| 541 | Frequency command sign selection | | |
| 560 | Second frequency search gain | | |
| 561 | PTC thermistor protection level | | |
| 570 | Multiple rating setting | | |
| 574 | Second motor online auto tuning | | |
| 578 | Auxiliary motor operation selection | | |
| 579 | Motor connection function selection | | |
| 598 | Undervoltage level | | |
| 606 | Power failure stop external signal input selection | | |
| 660 to 662 | Increased magnetic excitation deceleration | | |
| 673 | SF-PR slip amount adjustment operation selection | | |
| 699 | Input terminal filter | | |
| 702 | Maximum motor frequency | | |
| 706, 707, 711, 712, 717, 721, 724, 725, 1412 | (PM motor tuning) | | |
| 738 to 746, 1413 | (Second PM motor tuning) | | |
| 800 | Control method selection | | |
| 858 | Terminal 4 function assignment | | |
| 859 | Torque current/Rated PM motor current | | |
| 860 | Second motor torque current/Rated PM motor current | | |
| 868 | Terminal 1 function assignment | | |
| 977 | Input voltage mode selection | | |
| 998 | PM parameter initialization | | |
| 999 | Automatic parameter setting | | |
| 1002 | Lq tuning target current adjustment coefficient | | |

5.4.14 Password

Registering a 4-digit password can restrict access to parameters (reading/writing).

| Pr. | Name | Initial value | Setting range | Description |
|-------------|----------------------|----------------------------------|------------------------|---|
| 296 E410 | Password lock level | 0 to 6, 99, 100 9999 106, 199 | | Password protection enabled. Setting the access (reading/writing) restriction level to parameters locked with a password enables writing to Pr.297 . |
| | | | 9999 | No password protection |
| | Password lock/unlock | 9999 | 1000 to 9998 | Input a 4-digit password to lock parameters, or input the valid password to unlock the locked parameters. |
| 297 E411 | | | (0 to 5) ^{*1} | Number of failed password attempts (read only, displayed after any of "100 to 106, or 199" is set in Pr.296 and a password to lock parameters is input). |
| | | | 9999 ^{*1} | No password protection |

These parameters can be set when **Pr.160 User group read selection** = "0". However, when **Pr.296** \neq 9999 (Password protection enabled), **Pr.297** can always be set, regardless of the setting in **Pr.160**.

*1 Although "0 or 9999" can be input in **Pr.297**, the value is invalid. (The display cannot be changed.)

Parameter reading/writing restriction level (Pr.296)

• The access (reading/writing) restriction level to parameters in the PU operation mode or NET operation mode can be selected with **Pr.296**.

| | Access to parameters in the PU operation mode ^{*3} | | Acces | Access to parameters in the NET operation mode ^{*4} | | | |
|----------------------|---|--|--|--|--------------------------|---------------------|--|
| Pr.296 setting | | | via RS-485 terminals / using PLC function ^{*7} | | via communication option | | |
| | Read ^{*1} | Write ^{*2} | Read | Write ^{*2} | Read | Write ^{*2} | |
| 9999 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 0, 100 ^{*6} | × | × | × | × | × | × | |
| 1, 101 | 0 | × | 0 | × | 0 | × | |
| 2, 102 | 0 | × | 0 | 0 | 0 | 0 | |
| 3, 103 | 0 | 0 | 0 | × | 0 | × | |
| 4, 104 | × | × | × | × | 0 | × | |
| 5, 105 | × | × | 0 | 0 | 0 | 0 | |
| 6, 106 | 0 | 0 | × | × | 0 | × | |
| 99, 199 | | Only the parameters registered in the user group can be read/written (For the parameters not registered in the user group, the restriction level when "4 or 104" is set applies.). ^{*5} | | | | | |

o: Enabled, ×: Disabled

- *1 If the parameter reading is restricted by the setting of **Pr.160 User group read selection**, those parameters cannot be read even when "o" is indicated.
- *2 If the parameter writing is restricted by the setting of **Pr.77 Parameter write selection**, those parameters cannot be written even when "o" is indicated.
- *3 Access from the command source in the PU operation mode (the operation panel (FR-DU08) or the parameter unit in the initial setting) is restricted. (For the PU operation mode command source selection, refer to page 251.)

*4 Access from the command source in the Network operation mode (the RS-485 terminals or a communication option in the initial setting) is restricted. (For the NET operation mode command source selection, refer to page 251.)

- *5 Read/write is enabled only for the simple mode parameters registered in the user group when **Pr.160** = "9999". **Pr.296** and **Pr.297** can be read or written regardless of whether they are registered to the user group.
- *6 If a communication option is installed, the Option fault (E.OPT) occurs, and the inverter output shuts off. (Refer to page 605.)
- *7 The PLC function user parameters (Pr.1150 to Pr.1199) can be written and read by the PLC function regardless of the Pr.296 setting.

Locking parameters with a password (Pr.296, Pr.297)

- · The procedure of locking parameters with a password is as follows.
 - 1. Set the parameter reading/writing restriction level to enable the password protection. (Set a value other than "9999" in **Pr.296**.)

| Pr.296 setting | Allowable number of failed password attempts | Pr.297 readout |
|---------------------------------|--|---|
| 0 to 6 or 99 | Unlimited | Always 0 |
| 100 to 106 or 199 ^{*1} | Limited to 5 times | Number of failed password attempts (0 to 5) |

*1 If an invalid password is input 5 times while any of "100 to 106, or 199" is set in **Pr.296**, the password is locked up afterward (the locked parameters cannot be unlocked even with the valid password). All parameter clear is required to reset the password. (After All parameter clear is performed, the parameters are returned to their initial values.)

2. Write a four-digit number (1000 to 9998) to **Pr.297** as a password (writing is disabled when **Pr.296** = "9999"). After a password is set, parameters are locked and access (reading/writing) to the parameters is limited at the level set in **Pr.296** until the valid password is input to unlock the locked parameters.

NOTE

- After a password is set, the Pr.297 readout is always any of "0 to 5".
- " | _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ appears when a password-protected parameter is attempted to be read/written.
- Even if a password is set, the parameters which are written by the inverter, such as parameters related to the life check of inverter parts, are overwritten as needed.
- Even if a password is set, **Pr.991 PU contrast adjustment** can be read/written when the parameter unit (FR-PU07) is connected.

Unlocking the locked parameters (Pr.296, Pr.297)

- · There are two ways to unlock the locked parameters.
- Enter the password in Pr.297. When a valid password is input, the locked parameters can be unlocked. When an invalid password is input, an error indication appears and the parameters cannot be unlocked. If an invalid password is input 5 times while any of "100 to 106, or 199" is set in Pr.296, the locked parameters cannot be unlocked afterward even with the valid password (the password is locked up).
- · Perform All parameter clear.

- NOTE

- If the password is forgotten, it can be reset by performing All parameter clear, but the other parameters are also reset.
- All parameter clear cannot be performed during the inverter operation.
- When using FR Configurator2 in the PU operation mode, do not set "0, 4, 5, 99, 100, 104, 105, or 199" (parameter read is disabled) in **Pr.296**. Doing so may cause abnormal operation.
- The means to reset the password varies according to how the reset command is sent (from the PU, through RS-485 communication, or via a communication option).

o: Password reset enabled, ×: Password reset disabled

| | PU (operation panel or parameter unit) | RS-485 communication | Communication option | |
|---------------------|---|-------------------------|----------------------|--|
| All parameter clear | 0 | 0 | 0 | |
| Parameter clear | × | × | 0 | |

For the information how to perform Parameter clear or All parameter clear with the parameter unit or via a communication option, refer to the Instruction Manual of the parameter unit or the option. (For the operation panel (FR-DU08), refer to page 578. For RS-485 communication using the Mitsubishi inverter protocol, refer to page 507. For RS-485 communication using the MODBUS-RTU communication protocol, refer to page 520.)

Access to parameters according to the password status

| Parameter | | • | disabled / Parameters cked | Parameters locked | Password locked up |
|--------------------------------|---------------------|-------------------------------------|-------------------------------------|--|---|
| | | Pr.296 = "9999", Pr.297 = "9999" | Pr.296 ≠ "9999", Pr.297 = "9999" | Pr.296 ≠ "9999", Pr.297 = "0 to 4" (read value) | Pr.296 = "100 to 106, 199" Pr.297 = "5" (read value) |
| Pr.296 | Read | ° ^{*1} | 0 | 0 | 0 |
| P1.290 | Write | o ^{*1} | o ^{*1} | × | × |
| D= 207 | Read | o ^{*1} | 0 | 0 | 0 |
| Pr.297 | Write | × | 0 | 0 | °*3 |
| Pr.CLR (Parame | write ter clear) | 0 | 0 | ×*4 | ×*4 |
| ALL.C A (All para clear) | | 0 | 0 | °*2 | o*2 |
| Pr.CPY (Parame | write eter copy) | 0 | 0 | × | × |

o: Enabled, ×: Disabled

*1 Reading/writing is disabled if reading is restricted by the Pr.160 setting. (Reading is available in the Network operation mode regardless of the Pr.160 setting.)

- *2 All parameter clear cannot be performed during the operation.
- *3 Inputting a password is possible but the locked-up password cannot be unlocked or reset even with the valid password.
- *4 Parameter clear can be performed only via a communication option.

NOTE

- When "4, 5, 104, or 105" is set in Pr.296 and a password is set, Pr.15 Jog frequency is not listed on the parameter unit (FR-PU07).
- · When a password has been set and parameters are locked, Parameter copy cannot be performed using the operation panel, parameter unit, or a USB memory device .

Parameters referred to

Pr.77 Parameter write selection ^[C] page 206 Pr.160 User group read selection ^[C] page 215 Pr.550 NET mode operation command source selection ^[C] page 251

Pr.551 PU mode operation command source selection F page 251

5.4.15 **Free parameter**

Any number within the setting range of 0 to 9999 can be input.

For example, these numbers can be used:

- · As a unit number when multiple units are used.
- · As a pattern number for each operation application when multiple units are used.
- · As the year and month of introduction or inspection.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|------------------|---------------|---------------|---|
| 888 E420 | Free parameter 1 | 9999 | 0 to 9999 | Any value can be input. The settings are retained even if the inverter power is turned |
| 889 E421 | Free parameter 2 | 9999 | 0 to 9999 | OFF. |

NOTE

· Pr.888 and Pr.889 do not influence the operation of the inverter.

5.4.16 Setting multiple parameters by batch

The setting of particular parameters is changed by batch, such as communication parameters for connection with the Mitsubishi Electric human machine interface (GOT), the parameters for the rated frequency (50/60 Hz) setting, or the parameters for acceleration/deceleration time increment.

Multiple parameters are changed automatically. Users do not have to consider each parameter number (automatic parameter setting).

| Pr. | Name | Initial value | Setting range | Description | | |
|----------------|-----------------------------|--------------------|------------------|---------------------------------------|--|--|
| | | | 1 | Standard PID display setting | | |
| | | | 2 | Extended PID display setting | | |
| | | | 10 | GOT initial setting (PU connector) | "Controller Type" in GOT: | |
| | Automatic parameter setting | 9999 ^{*1} | 11 | GOT initial setting (RS-485 terminal) | FREQROL 500/700/800, SENSORLESS SERVO | |
| 999 E431 | | | 12 | GOT initial setting (PU connector) | "Controller Type" in GOT: | |
| 2431 | | | 13 | GOT initial setting (RS-485 terminal) | FREQROL 800 (Automatic Negotiation) | |
| | | | 20 | 50 Hz rated frequency | | |
| | | | 21 | 60 Hz rated frequency | | |
| 9999 No action | | | | | | |

*1 The read value is always "9999".

Automatic parameter setting (Pr.999)

• Select which parameters to automatically set from the following table, and set them in **Pr.999**. Multiple parameter settings are changed automatically. Refer to page 212 for the list of parameters that are changed automatically.

| Pr.999 setting | | Description | Operation in the automatic parameter setting mode |
|-------------------|--|--|---|
| 1 | Sets the standar | d monitor indicator setting of PID control. | " \square (PID) \rightarrow " \square " (PID) \rightarrow Write "1". |
| 2 | Automatically se | ts the monitor indicator for PID control. | " \square (PID) \rightarrow " \square " (PID) \rightarrow Write "2". |
| 10 | connection with | ts the communication parameters for the GOT PU connector ("Controller Type" in GOT: 700/800, SENSORLESS SERVO) | " \square (GOT) \rightarrow " \square " (GOT) \rightarrow Write |
| 11 | connection with | ts the communication parameters for the GOT RS-485 terminals ("Controller Type" in GOT: 700/800, SENSORLESS SERVO) | _ |
| 12 | connection with | ts the communication parameters for the GOT a PU connector ("Controller Type" in GOT: (Automatic Negotiation)) | " \square (GOT) \rightarrow " \square " (GOT) \rightarrow Write "2". |
| 13 | Automatically sets the communication parameters for the GOT connection with RS-485 terminals ("Controller Type" in GOT: FREQROL 800 (Automatic Negotiation)) | | _ |
| 20 | 50 Hz rated frequency | Sets the related parameters of the rated frequency according to the power supply | " \square (AUTO) \rightarrow " \square (F50) \rightarrow Write "1". |
| 21 | 60 Hz rated frequency | frequency | - |

• If the automatic setting is performed with **Pr.999** or the automatic parameter setting mode, the settings including the changed parameter settings (changed from the initial setting) will be automatically changed. Before performing the automatic setting, confirm that changing the parameters will not cause any problem.

PID monitor indicator setting (Pr.999 = "1 or 2")

| Pr. | Name | Initial value | Pr.999 = "1" | Pr.999 = "2" | Refer to page |
|-----------|-------------------------------------|---------------|--------------|---------------------------|---------------|
| 759 | PID unit selection 9999 | | 9999 | 4 | 442 |
| 1142 | Second PID unit selection | 9999 | 9999 | 4 | 442 |
| 774 | Operation panel monitor selection 1 | 9999 | 9999 | 52 | |
| 775 | Operation panel monitor selection 2 | 9999 | 9999 | 53 | 305 |
| 776 | Operation panel monitor selection 3 | 9999 | 9999 | 54 | |
| C42 (934) | PID display bias coefficient | 9999 | 9999 | 0 | |
| C44 (935) | PID display gain coefficient | 9999 | 9999 | 100 | 442 |
| 1136 | Second PID display bias coefficient | 9999 | 9999 | 0 | 442 |
| 1138 | Second PID display gain coefficient | 9999 | 9999 | 100 | |
| — | 3-line monitor setting | — | Invalid | Enabled ^{*1*2*3} | — |
| — | Direct setting | — | Invalid | Enabled ^{*3} | — |
| — | Dedicated parameter list function | — | Invalid | Enabled ^{*3} | — |

*1 Enabled when the FR-LU08 (-01) is used.

*2 Enabled when the FR-PU07 is used.

*3 Enabled when the FR-PU07-01 is used.

■ 3-line monitor setting

On the operation panel or parameter unit, the 3-line monitor is used as the first monitor.

■ Direct setting

Pressing the [FUNC] key on the FR-PU07-01 displays the direct setting screen. The PID action set point can be directly set regardless of the operation mode or **Pr.77 Parameter write selection** setting.

Pressing the [FUNC] key on the direct setting screen displays the function menu.

| Direct setting | Parameter to be set |
|------------------|------------------------------------|
| Direct setting 1 | Pr.133 PID action set point |
| Direct setting 2 | Pr.755 Second PID action set point |

Dedicated parameter list function

Pressing the [PrSET] key of the FR-PU07-01 displays the dedicated parameter list. Parameters that need to be set first for the PID extended display setting are listed.

| Dedicated parameter list | Parameter to be set |
|--------------------------|--------------------------------------|
| No.1 | Pr.999 Automatic parameter setting |
| No.2 | Pr.934 PID display bias coefficient |
| No.3 | Pr.935 PID display bias analog value |

- The display of parameters other than the above may be changed due to changes in C42 or C44. Set the PID monitor indicator before changing the settings of other parameters.
- To use the direct setting on the LCD operation panel, set Pr.1000 Direct setting selection. (Refer to page 201.)

♦ GOT initial setting (PU connector) (Pr.999 = "10, 12")

| Pr. | Name | Initial value | Pr.999 = "10" | Pr.999 = "12" | Refer to page |
|-----|--|---------------|---------------|-----------------|---------------|
| 79 | Operation mode selection | 0 | 1 | 1 | 240 |
| 118 | PU communication speed | 192 | 192 | 1152 | |
| 119 | PU communication stop bit length / data length | 1 | 10 | 0 | |
| 120 | PU communication parity check | 2 | 1 | 1 | |
| 121 | PU communication retry count | 1 | 9999 | 9999 | 505 |
| 122 | PU communication check time interval | 9999 | 9999 | 9999 | |
| 123 | PU communication waiting time setting | 9999 | 0 ms | 0 ms | |
| 124 | PU communication CR/LF selection | 1 | 1 | 1 | |
| 340 | Communication startup mode selection | 0 | 0 | 0 | 250 |
| 414 | PLC function operation selection | 0 | — | 2 ^{*1} | 483 |

*1 The setting is changed when **Pr.414** = "0" (initial setting).

Initial setting with the GOT2000 series

- When "FREQROL 500/700/800, SENSORLESS SERVO" is selected for "Controller Type" in the GOT setting, set Pr.999
 = "10" to configure the GOT initial setting.
- When "FREQROL 800 (Automatic Negotiation)" is selected for "Controller Type" in the GOT setting, the GOT automatic connection can be used. When "FREQROL 800 (Automatic Negotiation)" is selected for "Controller Type" in the GOT setting and the GOT automatic connection is not used, set Pr.999 = "12" to configure the GOT initial setting. (Refer to page 548.)

■ Initial setting with the GOT1000 series

• Set Pr.999 = "10" to configure the GOT initial setting.

NOTE

- · Always perform an inverter reset after the initial setting.
- For details on connection with GOT, refer to the Instruction Manual of GOT.

♦ GOT initial setting (RS-485 terminals) (Pr.999 = "11, 13")

| Pr. | Name | Initial value | Pr.999 = "11" | Pr.999 = "13" | Refer to page |
|-----|--|---------------|---------------|-----------------|---------------|
| 79 | Operation mode selection | 0 | 0 | 0 | 240 |
| 332 | RS-485 communication speed | 96 | 192 | 1152 | |
| 333 | RS-485 communication stop bit length / data length | | 10 | 0 | |
| 334 | RS-485 communication parity check selection | 2 | 1 | 1 | 505 |
| 335 | RS-485 communication retry count | 1 | 9999 | 9999 | |
| 336 | RS-485 communication check time interval | 0 s | 9999 | 9999 | |
| 337 | RS-485 communication waiting time setting | 9999 | 0 ms | 0 ms | |
| 340 | Communication startup mode selection | 0 | 1 | 1 | 250 |
| 341 | RS-485 communication CR/LF selection | 1 | 1 | 1 | 505 |
| 414 | PLC function operation selection | 0 | — | 2 ^{*1} | 483 |
| 549 | Protocol selection | 0 | 0 | 0 | 520 |

*1 The setting is changed when **Pr.414** = "0" (initial setting).

■ Initial setting with the GOT2000 series

- When "FREQROL 500/700/800, SENSORLESS SERVO" is selected for "Controller Type" in the GOT setting, set **Pr.999** = "11" to configure the GOT initial setting.
- When "FREQROL 800 (Automatic Negotiation)" is selected for "Controller Type" in the GOT setting, the GOT automatic connection can be used. When "FREQROL 800 (Automatic Negotiation)" is selected for "Controller Type" in the GOT setting and the GOT automatic connection is not used, set Pr.999 = "13" to configure the GOT initial setting. (Refer to page 548.)

Initial setting with the GOT1000 series

• Set **Pr.999** = "11" to configure the GOT initial setting.

NOTE

- Always perform an inverter reset after the initial setting.
- For details on connection with GOT, refer to the Instruction Manual of GOT.

◆ Rated frequency (Pr.999 = "20" (50 Hz) or "21" (60 Hz))

| D., | Nama | Initial value | | D= 000 - "04" | D= 000 - 1001 | Defendence | |
|-----------|---|-----------------|-------|---------------|---------------|---------------|--|
| Pr. | Name | FM type CA type | | Pr.999 = "21" | Pr.999 = "20" | Refer to page | |
| 3 | Base frequency | 60 Hz | 50 Hz | 60 Hz | 50 Hz | 552 | |
| 4 | Multi-speed setting (high speed) | 60 Hz | 50 Hz | 60 Hz | 50 Hz | 263 | |
| 20 | Acceleration/deceleration reference frequency | 60 Hz | 50 Hz | 60 Hz | 50 Hz | 228 | |
| 37 | Speed display | 0 | | 0 | | 303 | |
| 55 | Frequency monitoring reference | 60 Hz | 50 Hz | 60 Hz | 50 Hz | 314 | |
| 66 | Stall prevention operation reduction starting frequency | | 50 Hz | 60 Hz | 50 Hz | 290 | |
| 125 (903) | Terminal 2 frequency setting gain frequency | | 50 Hz | 60 Hz | 50 Hz | 357 | |
| 126 (905) | Terminal 4 frequency setting gain frequency | 60 Hz | 50 Hz | 60 Hz | 50 Hz | 307 | |
| 263 | Subtraction starting frequency | 60 Hz | 50 Hz | 60 Hz | 50 Hz | | |
| 266 | Power failure deceleration time switchover frequency | 60 Hz | 50 Hz | 60 Hz | 50 Hz | 478 | |
| 386 | Frequency for maximum input pulse | 60 Hz | 50 Hz | 60 Hz | 50 Hz | 258 | |
| 390 | % setting reference frequency | 60 Hz | 50 Hz | 60 Hz | 50 Hz | 533 | |
| 505 | Speed setting reference | 60 Hz | 50 Hz | 60 Hz | 50 Hz | 303 | |
| 584 | Auxiliary motor 1 starting frequency | 60 Hz | 50 Hz | 60 Hz | 50 Hz | | |
| 585 | Auxiliary motor 2 starting frequency | 60 Hz | 50 Hz | 60 Hz | 50 Hz | 450 | |
| 586 | Auxiliary motor 3 starting frequency | 60 Hz | 50 Hz | 60 Hz | 50 Hz |] | |
| C14 (918) | Terminal 1 gain frequency (speed) | 60 Hz | 50 Hz | 60 Hz | 50 Hz | 357 | |
| 1013 | Running speed after emergency drive retry reset | 60 Hz | 50 Hz | 60 Hz | 50 Hz | 279 | |

5.4.17 Extended parameter display and user group function

This function restricts the parameters that are read by the operation panel and parameter unit.

| Pr. Name | | Initial value | | Setting range | Description |
|-------------|---------------------------------------|--------------------|----|-----------------|---|
| F1. | Name | FM | CA | Setting range | Description |
| 460 | 160 User group read E440 selection | 9999 | 0 | 9999 | Only simple mode parameters are displayed. |
| | | | | 0 | Displays simple mode and extended parameters. |
| 2440 | | | | 1 | Only parameters registered in user groups are displayed. |
| 172 E441 | User group registered | 0 | | (0 to 16) | Displays the number of parameters that are registered in the user groups. (Read-only) |
| 6441 | E441 display/batch clear | | | 9999 | Batch clear of user group registrations |
| 173 E442 | User group registration | 9999 ^{*1} | | 0 to 1999, 9999 | Sets the parameter number to register for the user group. |
| 174 E443 | User group clear | 9999 ^{*1} | | 0 to 1999, 9999 | Sets the parameter number to clear from the user group. |

*1 The read value is always "9999".

Display of simple mode parameters and extended parameters (Pr.160)

- When **Pr.160** = "9999", only the simple mode parameters are displayed on the operation panel (FR-DU08) and parameter unit (FR-PU07). (For the simple mode parameters, refer to the parameter list on page 140.)
- With the initial value (Pr.160 = "0", simple mode parameters and extended parameters can be displayed.

| NOTE |
|------|
| NOTE |
| |

- When a plug-in option in installed on the inverter, the option parameters can also be read.
- Every parameter can be read regardless of the **Pr.160** setting when reading parameters via a communication option.
- When reading the parameters using the RS-485 terminals, all parameters can be read regardless of the **Pr.160** setting by setting **Pr.550 NET mode operation command source selection** and **Pr.551 PU mode operation command source selection**.

| Pr.551 | Pr.550 | Pr.160 enabled/disabled | |
|---|--------------------------------|--|--|
| 1 (RS-485) | — | Enabled | |
| | 0 (Communication option) | Enabled | |
| 2 (PU), 3 (USB), 9999 (Automatic determination) (initial value) | 1 (RS-485) | Disabled (All can be read) | |
| | 9999 (Automatic determination) | With communication option: Enabled | |
| | (initial value) | Without communication option: Disabled (All can be read) | |

When the LCD operation panel (FR-LU08) or the parameter unit (FR-PU07) is installed, Pr.15 Jog frequency, Pr.16 Jog acceleration/deceleration time, C42 (Pr.934) PID display bias coefficient, C43 (Pr.934) PID display bias analog value, C44 (Pr.935) PID display gain coefficient, C45 (Pr.935) PID display gain analog value, Pr.991 PU contrast adjustment, Pr.1136 Second PID display bias coefficient, Pr.1137 Second PID display bias analog value, Pr.1138 Second PID display gain coefficient, and Pr.1139 Second PID display gain analog value are displayed as simple mode parameters.

User group function (Pr.160, Pr.172 to Pr.174)

- The user group function is a function for displaying only the parameters required for a setting.
- A maximum of 16 parameters from any of the parameters can be registered in a user group. When Pr.160 = "1", reading/ writing is enabled only for the parameters registered in user groups. (Parameters not registered in user groups can no longer be read.)
- To register a parameter in a user group, set the parameter number in Pr.173.
- To clear a parameter from a user group, set the parameter number in **Pr.174**. To batch clear all the registered parameters, set **Pr.172** = "9999".

Registering a parameter in a user group (Pr.173)

• To register **Pr.3** in a user group

Operating procedure

 Power ON Make sure the motor is stopped.
 Changing the operation mode Press PU EXT to choose the PU operation mode. [PU] indicator turns ON.
 Selecting the parameter setting mode Press MODE to choose the parameter setting mode. (The parameter number read previously appears)
 Selecting a parameter Turn Su until "P. (¬∃" (Pr.173) appears.
 Parameter read Press SET. "GGGG" appears.

6. Parameter registration

Turn 🚱 until " 🚽 " (**Pr.3**) appears. Press SET to register the parameter.

"P, P and " \exists " are displayed alternately.

To continue adding parameters, repeat steps 5 and 6.

Clearing a parameter from a user group (Pr.174)

• To delete **Pr.3** from a user group.

Operating procedure

| 1. | Power ON |
|----|---|
| | Make sure the motor is stopped. |
| 2. | Changing the operation mode |
| | Press $\boxed{\frac{PU}{EXT}}$ to choose the PU operation mode. [PU] indicator turns ON. |
| 3. | Selecting the parameter setting mode |
| | Press MODE to choose the parameter setting mode. (The parameter number read previously appears) |
| 4. | Selecting a parameter |
| | Turn 🚱 until "尸 /'귀나!" (Pr.174) appears. |
| 5. | Parameter read |
| | Press SET . "9999" appears. |
| 6. | Clearing the parameter |
| | Turn 🚱 until " 🚽 " (Pr.3) appears. Press 🛛 set to delete the parameter. |
| | "尸 기기니" and "긤"are displayed alternately. |
| | To continue deleting parameters, repeat steps 5 and 6. |
| | |
| | • Pr.77 Parameter write selection, Pr.160, Pr.296 Password lock level, Pr.297 Password lock/unlock and Pr.991 PU contrast adjustment can always be read regardless of the user group setting. (For Pr.991, only when the FR-LU08 or the |
| | FR-PU07 is connected.) |
| | • Pr.77, Pr.160, Pr.172 to Pr.174, Pr.296, and Pr.297 cannot be registered in a user group. |

- When Pr.174 is read, "9999" is always displayed. "9999" can be written, but it does not function.
- Pr.172 is disabled if set to a value other than "9999".

Parameters referred to

Pr.15 Jog frequency, Pr.16 Jog acceleration/deceleration time IP page 261 Pr.77 Parameter write selection IP page 206 Pr.296 Password lock level, Pr.297 Password lock/unlock IP page 208 Pr.550 NET mode operation command source selection IP page 251 Pr.551 PU mode operation command source selection IP page 251 Pr.591 PU contrast adjustment IP page 200

5.4.18 PWM carrier frequency and Soft-PWM control

The motor sound can be changed.

| Pr. | Name | Initial value | Setting range | Description | |
|-------------|---------------------------------------|------------------|--------------------------|---|--|
| 72 | | | 0 to 15 ^{*1} | The PWM carrier frequency can be changed. The setting value represents the frequency in kHz. However, "0" indicates 0.7 kHz, "15" | |
| E600 | PWM frequency selection | 2 | 0 to 6, 25 ^{*2} | indicates 14.5 kHz, and "25" indicates 2.5 kHz. (The setting value "2 is for the sine wave filter only.) | |
| 240 | Soft-PWM operation | 1 | 0 | Soft-PWM control disabled. | |
| E601 | selection | 1 | 1 | Soft-PWM control enabled. | |
| 260 E602 | PWM frequency automatic switchover | 1 | 0 | PWM carrier frequency automatic reduction function disabled (for the LD rating). | |
| E002 | automatic switchover | | 1 | PWM carrier frequency automatic reduction function enabled. | |

*1 The setting range of the FR-F820-02330(55K) or lower and the FR-F840-01160(55K) or lower

*2 The setting range of the FR-F820-03160(75K) or higher and the FR-F840-01800(75K) or higher

Changing the PWM carrier frequency (Pr.72)

- The PWM carrier frequency of the inverter can be changed.
- Changing the PWM carrier frequency can be effective for avoiding the resonance frequency of the mechanical system or motor, as a countermeasure against EMI generated from the inverter, or for reducing leakage current caused by PWM switching.
- Under PM motor control, the following carrier frequencies are used. (To select fast-response operation, refer to Pr.800 Control method selection on page 177.)

| Br 72 patting | Carrier frequency (kHz) | | | | |
|---------------|---------------------------|--------------------|--|--|--|
| Pr.72 setting | Normal-response operation | Fast-response mode | | | |
| 0 | | | | | |
| 1 | | | | | |
| 2 | 2 | | | | |
| 3 | 2 | 4 | | | |
| 4 | | 4 | | | |
| 5 | | | | | |
| 6 | | | | | |
| 7 | 6 ^{*1} | | | | |
| 8 | 0 | | | | |
| 9 | | 8 | | | |
| 10 | | 0 | | | |
| 11 | 10 ^{*1} | | | | |
| 12 | | | | | |
| 13 | | 12 | | | |
| 14 | 14 ^{*1} | 12 | | | |
| 15 | 14 | | | | |

- *1 In the low-speed range (less than 10% of the rated motor frequency), the carrier frequency is automatically changed to 2 kHz (for the FR-F820-00490(11K) or lower and the FR-F840-00250(11K) or lower).
- When using an optional sine wave filter (MT-BSL/BSC), set "25" (2.5 kHz) in Pr.72 (for the FR-F820-03160(75K) or higher and FR-F840-01800(75K) or higher).

NOTE

- In the low-speed range (less than about 10 Hz), the carrier frequency may be automatically lowered. Motor noise increases, but not to the point of failure.
- When Pr.72 = "25", the following limitations apply.
 - V/F control is forcibly set.
 - Soft-PWM control is disabled.
 - The maximum output frequency is 60 Hz.

5

♦ Soft-PWM control (Pr.240)

- Soft-PWM control is a function that changes the motor noise from a metallic sound into an inoffensive, complex tone.
- Setting Pr.240 = "1" will enable the Soft-PWM control.
- To enable the Soft-PWM control, set **Pr.72** to 5 kHz or less for the FR-F820-02330(55K) or lower or the FR-F840-01160(55K) or lower. For the FR-F820-03160(75K) or higher or the FR-F840-01800(75K) or higher, set **Pr.72** to 4 kHz or less.

NOTE

• While a sine wave filter (Pr.72 = "25") is being used, the Soft-PWM control is disabled.

PWM carrier frequency automatic reduction function (Pr.260)

- Setting **Pr.260** = "1 (initial value)" will enable the PWM carrier frequency auto-reduction function. If a heavy load is continuously applied while the inverter carrier frequency is set to 3 kHz or higher (**Pr.72** ≥ "3"), the carrier frequency is automatically reduced to prevent occurrence of the Inverter overload trip (electronic thermal relay function) (E.THT). The carrier frequency is reduced to as low as 2 kHz. Motor noise increases, but not to the point of failure.
- When the carrier frequency automatic reduction function is used, operation with the carrier frequency set to 3 kHz or higher (**Pr.72** ≥ 3) automatically reduces the carrier frequency for heavy-load operation as shown below.

| Pr.260 setting | Pr.570 setting | Carrier frequency automatic reduction operation |
|-------------------|-----------------|--|
| 1 | 0 (SLD), 1 (LD) | The carrier frequency will reduce automatically with continuous operation of 85% of the inverter rated current or higher. |
| 0 | 0 (SLD) | The carrier frequency will reduce automatically with continuous operation of 85% of the inverter rated current or higher. |
| U | 1 (LD) | Without carrier frequency automatic reduction (Perform continuous operation with the carrier frequency set to 2 kHz or lower or with less than 85% of the inverter rated current.) |

NOTE

- Reducing the PWM carrier frequency is effective as a countermeasure against EMI from the inverter or for reducing leakage current, but doing so increases the motor noise.
- When the PWM carrier frequency is set to 1 kHz or lower (**Pr.72** ≤ 1), the increase in the harmonic current causes the fast-response current limit to activate before the stall prevention operation, which may result in torque shortage. In this case, disable the fast-response current limit in **Pr.156 Stall prevention operation selection**.

Parameters referred to

Pr.156 Stall prevention operation selection 🖙 page 290 Pr.570 Multiple rating setting 🖙 page 204 Pr.800 Control method selection 🖙 page 177

5.4.19 Inverter parts life display

The degree of deterioration of the control circuit capacitor, main circuit capacitor, cooling fan, inrush current limit circuit, and relay contacts of terminals A, B, and C can be diagnosed on the monitor. When a part approaches the end of its life, an alarm can be output by self diagnosis to prevent a fault. (Note that the life diagnosis of this function should be used as a guideline only, because with the exception of the main circuit capacitor, the life values are theoretical calculations.)

| Pr. | Name | Initial value | Setting range | Description |
|---------------------------|---|---------------|--------------------------|---|
| 255 E700 | Life alarm status display | 0 | (0 to 255) ^{*1} | Displays whether or not the parts of the control circuit capacitor, main circuit capacitor, cooling fan, and inrush current limit circuit have reached the life alarm output level. Read-only. |
| 256 E701 ^{*2} | Inrush current limit circuit life display | 100% | (0% to 100%) | Displays the deterioration degree of the inrush current limit circuit. Read-only. |
| 257 E702 | Control circuit capacitor life display | 100% | (0% to 100%) | Displays the deterioration degree of the control circuit capacitor. Read-only. |
| 258 E703 ^{*2} | Main circuit capacitor life display | 100% | (0% to 100%) | Displays the deterioration degree of the main circuit capacitor. Read-only. |
| 2100 | | | | The value measured by Pr.259 is displayed. |
| 259 | Main circuit capacitor life | | 0, 1 (2, 3, 8, 9) | Setting "1" and turning the power supply OFF starts the measurement of the main circuit capacitor life. If the setting value of Pr.259 becomes "3" after turning the power supply ON again, it means that the measurement is completed. The deterioration degree is read to Pr.258 . |
| E704 ^{*2} | measuring | 0 | 11 (12, 13, 18, 19) | When "11" is set, turning OFF the power supply starts the measurement of the main circuit capacitor life. If the setting value of Pr.259 becomes "13" after turning the power supply ON again, it means that the measurement is completed. The degree of deterioration is read to Pr.258 . |
| 506 E705 ^{*2} | Display estimated main circuit capacitor residual life | 100% | (0% to 100%) | Displays the estimated residual life of the main circuit capacitor. Read-only. |
| 507 E706 | Display/reset ABC1 relay contact life | 100% | 0% to 100% | Displays the degree of deterioration of the relay contacts of terminals A1, B1, and C1. |
| 508 E707 | Display/reset ABC2 relay contact life | 100% | 0% to 100% | Displays the degree of deterioration of the relay contacts of terminals A2, B2, and C2. |

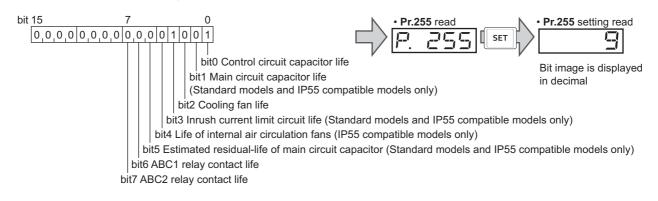
*1 The setting range (read-only) differs depending on the inverter model (standard model, separate converter type, or IP55 compatible model).
 *2 The setting is available only for standard models and IP55 compatible models.

Life alarm display and signal output (Y90 signal, Pr.255)

Point P

 In the life diagnosis of the main circuit capacitor, the Life alarm (Y90) signal is not output unless measurement by turning OFF the power supply is performed.

• Whether or not the parts of the control circuit capacitor, main circuit capacitor, cooling fan, inrush current limit circuit, internal air circulation fans, or relay contacts of terminals A, B, and C have reached the life alarm output level can be checked with **Pr.255 Life alarm status display** and the Life alarm (Y90) signal. (Internal air circulation fans are equipped with IP55 compatible models.)



 When the parts have reached the life alarm output level, the corresponding bits of Pr.255 turns ON. The ON/OFF state of the bits can be checked with Pr.255. The following table shows examples.

| Pr. | Pr.255 | | bit 6 | bit 5 | bit 4 | bit 3 | bit 2 | bit 1 | bit 0 | Remarks |
|---------|----------|-------|-------|-------|-------|-------|-------|-------|-------|--|
| Decimal | Binary | bit 7 | DILO | DILD | DIL 4 | DILS | DIL 2 | ו זונ | DILU | Reliaiks |
| 239 | 11101111 | 0 | 0 | 0 | × | 0 | 0 | 0 | 0 | All parts have reached alarm output level for standard structure models. |
| 5 | 101 | × | × | × | × | × | 0 | × | 0 | Control circuit capacitor and cooling fan have reached alarm output level. |
| 0 | 0 | × | × | × | × | × | × | × | × | No parts have reached alarm output level. |

o: Parts reaching alarm output level ×: Parts not reaching alarm output level

· Diagnosable parts differ depending on the type of the inverter.

| Part | Applicable inverter | | | | | | | | |
|--|---------------------|--------------------------|-----------------------|--|--|--|--|--|--|
| Fait | Standard model | Separated converter type | IP55 compatible model | | | | | | |
| Control circuit capacitor | 0 | 0 | 0 | | | | | | |
| Main circuit capacitor | 0 | × | 0 | | | | | | |
| Cooling fan | 0 | 0 | 0 | | | | | | |
| Inrush current limit circuit | 0 | × | 0 | | | | | | |
| Internal air circulation fan | × | × | 0 | | | | | | |
| Main circuit capacitor (estimated residual life) | 0 | × | 0 | | | | | | |
| ABC relay contact | 0 | 0 | 0 | | | | | | |

o: Diagnosable, x: Undiagnosable

- The Life alarm (Y90) signal turns ON when the life alarm output level is reached for either of the following: the control circuit capacitor life, main circuit capacitor life, cooling fan life, inrush current limit circuit life, internal air circulation fan life, estimated residual-life of the main circuit capacitor, ABC1 relay contact life, or ABC2 relay contact life.
- For the terminal used for the Y90 signal, set "90" (positive logic) or "190" (negative logic) in any parameter from Pr.190 to Pr.196 (Output terminal function selection).

NOTE

- When using an option (FR-A8AY, FR-A8AR, FR-A8NC, FR-A8NCE, or FR-A8NCG), warning signals can be output individually: the Control circuit capacitor life (Y86) signal, Main circuit capacitor life (Y87) signal, Cooling fan life (Y88) signal, Inrush current limit circuit life (Y89) signal, Estimated residual-life of main circuit capacitor (Y248) signal, ABC1 relay contact life (Y249) signal, and ABC2 relay contact life (Y250) signal.
- Changing the terminal assignment using Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

Life display of the inrush current limit circuit (Pr.256) (Standard models and IP55 compatible models)

- The life of the inrush current limit circuit (relay, contactor and inrush resistor) is displayed in Pr.256.
- The number of contact (relay, contactor, thyristor) ON times is counted, and it is counted down from 100% (0 time) every 1%/10,000 times. When the counter reaches 10% (900,000 times), bit 3 of Pr.255 is turned ON (set to 1) and the Y90 signal is also output as an alert.

Life display of the control circuit capacitor (Pr.257)

- The deterioration degree of the control circuit capacitor is displayed in Pr.257.
- In the operating status, the control circuit capacitor life is calculated from the energization time and temperature, and is counted down from 100%. When the counter goes down from 10%, bit 0 of Pr.255 is turned ON (set to 1) and the Y90 signal is also output as an alert.

Life display of the main circuit capacitor (Pr.258, Pr.259) (Standard models and IP55 compatible models)

Point P

- For accurate life measurement of the main circuit capacitor, wait three hours or longer after turning OFF. The temperature left in the main circuit capacitor affects measurement.
- The deterioration degree of the main circuit capacitor is displayed in Pr.258.
- With the main circuit capacitor capacity at factory shipment as 100%, the capacitor life is displayed in **Pr.258** every time measurement is made. When the measured value falls to 85% or lower, bit 1 of **Pr.255** is turned ON (set to 1) and the Y90 signal is also output as an alert.
- Measure the capacitor capacity according to the following procedure and check the deterioration degree of the capacitor capacity.
 - **1.** Check that the motor is connected and at a stop.
 - 2. Set "1 or 11" (measuring start) in Pr.259.
 - **3.** Switch the power OFF. The inverter applies DC voltage to the motor to measure the capacitor capacity while the inverter is OFF.
 - **4.** After confirming that the power lamp is OFF, turn ON the power again.
 - **5.** Check that "3 or 13" (measurement complete) is set in **Pr.259**, read **Pr.258**, and check the degree of deterioration for the main circuit capacitor.

| Pr.259 | Description | Remarks |
|--------|----------------------|--|
| 0 | No measurement | Initial value |
| 1, 11 | Start measurement | Measurement starts when the power supply is switched OFF. (Only once when Pr.259 = "1") When Pr.259 = "11", the measurement starts every time the power supply is turned OFF. |
| 2, 12 | During measurement | |
| 3, 13 | Measurement complete | Only displayed and cannot be set. (When "11" is set in Pr.259 , "12, |
| 8, 18 | Forced end | 13, 18, or 19" is displayed.) |
| 9, 19 | Measurement error | |

🗖 ΝΟΤΕ

- When the main circuit capacitor life is measured under the following conditions, "forced end" (Pr.259 = "8 or 18"), or "measurement error" (Pr.259 = "9 or 19") may occur, or the status may remain in "measurement start" (Pr.259 = "1 or 11"). To perform measurement, first eliminate the following conditions. Under the following conditions, even if "measurement complete" (Pr.259 = "3 or 13") is reached, measurement cannot be performed correctly.
 - FR-HC2, FR-XC (common bus regeneration mode), FR-CV, MT-RC, or a sine wave filter (when **Pr.72** = "25") is connected.
 - Terminals R1/L11, S1/L21 or DC power supply is connected to terminals P/+ and N/-.
 - The power supply is switched ON during measurement.
 - The motor is not connected to the inverter.
 - The motor is running (coasting).
 - The motor capacity is smaller than the inverter capacity by two ranks or more.
 - The inverter output is shut off or a fault occurred while the power was OFF.
 - The inverter output is shut off with the MRS signal.
 - The start command is given while measuring.
 - The applied motor setting is incorrect.
- Operation environment: Surrounding air temperature (annual average of 40°C (free from corrosive gas, flammable gas, oil mist, dust and dirt)).
 - Output current: 80% of the inverter rating
- Since repeated inrush currents at power ON will shorten the life of the converter circuit, frequent starts and stops of the magnetic contactor must be avoided.

<u>∕</u>MARNING

When measuring the main circuit capacitor capacity (**Pr.259** = "1 or 11"), the DC voltage is applied to the motor for about 1 second at power OFF. Never touch the motor terminal, etc. right after powering OFF to prevent an electric shock.

Life display of the cooling fan

- For the terminal used for the LF signal, set "98" (positive logic) or "198" (negative logic) in any parameter from **Pr.190 to Pr.196 (Output terminal function selection)**.

- NOTE

- When the inverter is mounted with two or more cooling fans, "FN" is displayed even only one of the fans is detected.
- Changing the terminal assignment using **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.
- · For replacement of each part, contact the nearest Mitsubishi FA center.

Estimated residual life display of the main circuit capacitor (Pr.506) (Standard models and IP55 compatible models)

- Even when the power supply cannot be turned OFF, the remaining life of the main circuit capacitor can be estimated without stopping the operation. Note that the remaining life of the main circuit capacitor estimated by this function is theoretical, and should be used as a guideline only.
- The estimated residual life of the main circuit capacitor is displayed in Pr.506.
- The remaining life of the main circuit capacitor is calculated from the energization time and the inverter output power (100% = Start of service life). When the remaining life of the main circuit capacitor falls below 10%, bit 5 of Pr.255 Life alarm status display turns ON and a warning is output by the Y90 signal.

◆ Life display of the relay contacts of terminals A, B, and C (Pr.507, Pr.508)

- The degree of deterioration of the relay contacts of terminals A1, B1, and C1 is displayed in **Pr.507**, and that for terminals A2, B2, and C2 is displayed in **Pr.508**.
- The number of times the contacts of relay turn ON is counted down from 100% (0 time) by 1% (500 times). When the counter reaches 10% (45,000 times), bit 6 or bit 7 of **Pr.255** turns ON and a warning is output by the Y90 signal.
- Any value can be set in Pr.507 and Pr.508. After replacement of the control circuit terminal block or installation of a control terminal option, set Pr.507 and Pr.508 again.

Life display of internal air circulation fans (IP55 compatible models)

- For the terminal used for the LF signal, set "98" (positive logic) or "198" (negative logic) in any parameter from Pr.190 to Pr.196 (Output terminal function selection).

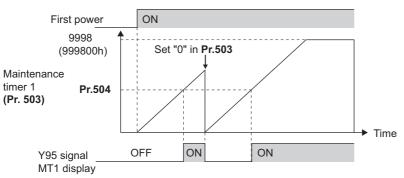


- Changing the terminal assignment using **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.
- For replacement of each part, contact the nearest Mitsubishi FA center.

5.4.20 Maintenance timer alarm

The Maintenance timer (Y95) signal is output when the inverter's cumulative energization time reaches the time period set with the parameter. MT1, MT2 or MT3 is displayed on the operation panel. This can be used as a guideline for the maintenance time of peripheral devices.

| Pr. | Name | Initial value | Setting range | Description |
|--------------|--|---------------|---------------|--|
| 503 E710 | Maintenance timer 1 | 0 | 0 (1 to 9998) | Displays the inverter's cumulative energization time in increments of 100 h (read-only). Writing the setting of "0" clears the cumulative energization time while Pr.503 = "1 to 9998". (Writing is disabled when Pr.503 = "0".) |
| 504 E711 | Maintenance timer 1 warning output set time | 9999 | 0 to 9998 | Set the time until the Maintenance timer (Y95) signal is output. "MT1" is displayed on the operation panel. |
| L /11 | warning output set time | | 9999 | Without the function |
| 686 E712 | Maintenance timer 2 0 | | 0 (1 to 9998) | The same function as Pr.503 . |
| 687 | Maintenance timer 2 | 9999 | 0 to 9998 | The same function as Pr.504 . "MT2" is displayed on the |
| E713 | warning output set time | 9999 | 9999 | operation panel. |
| 688 E714 | Maintenance timer 3 | 0 | 0 (1 to 9998) | The same function as Pr.503 . |
| 689 | Maintenance timer 3 | 9999 | 0 to 9998 | The same function as Pr.504 . "MT3" is displayed on the |
| E715 | warning output set time | 3333 | 9999 | operation panel. |



Operation example of the maintenance timer 1 (Pr.503, Pr.504) (with both MT2 and MT3 OFF)

- The cumulative energization time of the inverter is stored in the EEPROM every hour and displayed in Pr.503 (Pr.686, Pr.688) in 100 h increments. Pr.503 (Pr.686, Pr.688) is clamped at 9998 (999800 h).
- When the value in Pr.503 (Pr.686, Pr.688) reaches the time (100 h increments) set in Pr.504 (Pr.687, Pr.689), the Maintenance timer (Y95) signal is output, and also " [[(MT1), " [(MT1), " [(MT2), or " [[(MT3) is displayed on the operation panel.
- For the terminal used for the Y95 signal output, assign the function by setting "95 (positive logic)" or "195 (negative logic)" in any parameter from Pr.190 to Pr.196 (Output terminal function selection).

NOTE

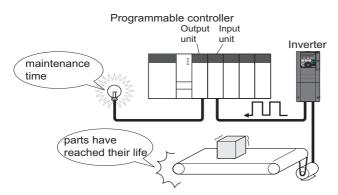
- The Y95 signal turns ON when any of MT1, MT2 or MT3 is activated. It does not turn OFF unless all of MT1, MT2 and MT3 are cleared.
- If all of MT1, MT2 and MT3 are activated, they are displayed in the priority of "MT1 > MT2 > MT3".
- The cumulative energization time is counted every hour. Energization time of less than 1 h is not counted.
- Changing the terminal assignment using **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.190 to Pr.196 (Output terminal function selection) 330

5.4.21 Current average value monitor signal

The output current average value during constant-speed operation and the maintenance timer value are output to the Current average monitor (Y93) signal as a pulse. The output pulse width can be used in a device such as the I/O unit of a programmable controller as a guideline for the maintenance time for mechanical wear, belt stretching, or deterioration of devices with age. The pulse is repeatedly output during constant-speed operation in cycles of 20 seconds to the Current average monitor (Y93) signal.



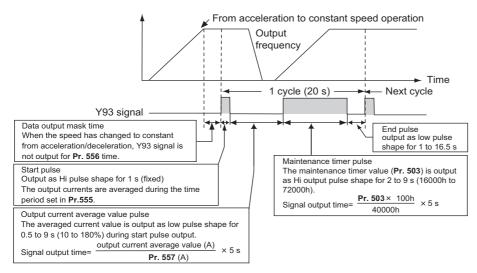
| Pr. | Name | Initial value | Setting range | Description |
|-------------|--|---------------|---------------------------|--|
| 555 E720 | Current average time | 1 s | 0.1 to 1 s | Set the time for calculating the average current during start pulse output (1 second). |
| 556 E721 | Data output mask time | 0 s | 0 to 20 s | Set the time for not obtaining (masking) transitional state data. |
| 557 | | | 0 to 500 A ^{*1} | Set the reference (100%) for outputting the output current |
| F722 | monitor signal output reference current | current | 0 to 3600 A ^{*2} | average value signal. |

*1 For the FR-F820-02330(55K) or lower, and FR-F840-01160(55K) or lower.

*2 For the FR-F820-03160(75K) or higher, and FR-F840-01800(75K) or higher.

Operation example

- The pulse output of the Current average monitor (Y93) signal is indicated below.
- For the terminal used for the Y93 signal output, assign the function by setting "93 (positive logic)" or "193 (negative logic)" in any parameter from Pr.190 to Pr.194 (Output terminal function selection). (This cannot be assigned by setting in Pr.195 ABC1 terminal function selection or Pr.196 ABC2 terminal function selection.)



Pr.556 Data output mask time setting

• Immediately after acceleration/deceleration is shifted to constant-speed operation, the output current is unstable (transitional state). Set the time for not obtaining (masking) transitional state data in **Pr.556**.

Pr.555 Current average time setting

• The output current average is calculated during start pulse (1 second) HIGH output. Set the time for calculating the average current during start pulse output in **Pr.555**.

Pr.557 Current average value monitor signal output reference current setting

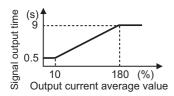
Set the reference (100%) for outputting the output current average value signal. The signal output time is calculated with the following formula.

 Output current average value
 × 5 s
 (Output current average value 100%/5 s)

The output time range is 0.5 to 9 seconds. When the output current average value is less than 10% of the setting value in **Pr.557**, the output time is 0.5 second, and when it is more than 180%, the output time is 9 seconds.

For example, when **Pr.557** = 10 A and the output current average value is 15 A:

15 A/10 A × 5 s = 7.5 s, thus the Current average monitor signal maintains LOW output for 7.5 seconds.



♦ Pr.503 Maintenance timer 1 output

After LOW output of the output current value is performed, HIGH output of the maintenance timer value is performed. The maintenance timer value output time is calculated with the following formula.

 Pr.503 × 100
 × 5 s
 (Maintenance timer value 100%/5 s)

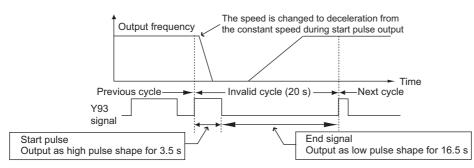
 40000h
 × 5 s
 (Maintenance timer value 100%/5 s)

The output time range is 2 to 9 seconds. When the value in **Pr.503** is less than 16000 hours, the output time is 2 seconds. When the value is more than 72000 hours, the output time is 9 seconds.





- Masking of the data output and sampling of the output current are not performed during acceleration/deceleration.
- If constant speed changes to acceleration or deceleration during start pulse output, it is judged as invalid data, and the signal
 maintains HIGH start pulse output for 3.5 seconds and LOW end pulse output for 16.5 seconds. After the start pulse output is
 completed, minimum 1-cycle signal output is performed even if acceleration/deceleration is performed.



- If the output current value (inverter output current monitor) is 0 A at the completion of the 1-cycle signal output, no signal is output until the next constant-speed state.
- Under the following conditions, the Y93 signal maintains LOW output for 20 seconds (no data output).
 - When acceleration or deceleration is operating at the completion of the 1-cycle signal output
 - When automatic restart after instantaneous power failure (**Pr.57 Restart coasting time** ≠ "9999") is set, and the 1-cycle signal output is completed during the restart operation.
 - When automatic restart after instantaneous power failure (**Pr.57** ≠ "9999") is set, and the restart operation was being performed at the completion of data output masking.
- Pr.686 Maintenance timer 2 and Pr.688 Maintenance timer 3 cannot be output.
- Changing the terminal assignment using Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

≪ Parameters referred to 🚿

Pr.57 Restart coasting time is page 466, page 472

- Pr.190 to Pr.196 (Output terminal function selection) F page 330
- Pr.503 Maintenance timer 1, Pr.686 Maintenance timer 2, Pr.688 Maintenance timer 3 5 page 224

5.5 (F) Setting of acceleration/deceleration time and acceleration/deceleration pattern

| Purpose | Para | Refer to page | | |
|---|---|---|--|----------|
| To set the motor acceleration/ deceleration time | Acceleration/deceleration time | P.F000 to P.F003, P.F010, P.F011, P.F020 to P.F022, P.F070, P.F071 | Pr.7, Pr.8, Pr.16, Pr.20, Pr.21, Pr.44, Pr.45, Pr.147, Pr.611, Pr.791, Pr.792 | 228 |
| To set the acceleration/ deceleration pattern suitable for an application | Acceleration/deceleration pattern and backlash measures | P.F100, P.F200 to P.F203 | Pr.29, Pr.140 to Pr.143 | 231 |
| To command smooth speed transition with terminals | Remote setting function | P.F101 | Pr.59 | 234 |
| Starting frequency | Starting frequency and start-time hold | P.F102, P.F103 | Pr.13, Pr.571 | 238, 239 |

5.5.1 Setting the acceleration and deceleration time

The following parameters are used to set motor acceleration/deceleration time.

Set a larger value for a slower acceleration/deceleration, or a smaller value for a faster acceleration/deceleration.

For the acceleration time at automatic restart after instantaneous power failure, refer to **Pr.611 Acceleration time at a restart** (on page 466 and page 472).

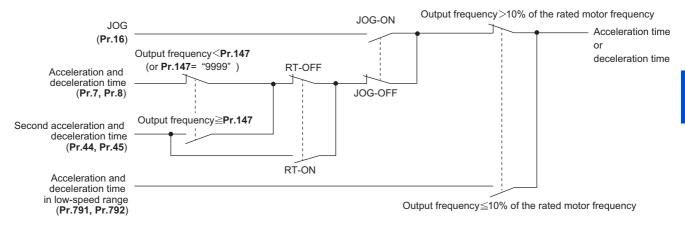
| Pr. | Name | Initial | value | Cotting range | Description | | | |
|------------|---|--|-------|---------------|--|---|--|--|
| Pr. | Name | FM | СА | Setting range | | Description | | |
| 20 F000 | Acceleration/ deceleration reference frequency | 60 Hz | 50 Hz | 1 to 590 Hz | Set the frequency that is the basis of acceleration/deceleration time As acceleration/deceleration time, set the time required to change the frequency from a stop status (0 Hz) to the frequency set in Pr.20 and vice versa. | | | |
| 21 | Acceleration/ | | | 0 | Increment: 0.1 s | Select the increment for the acceleration/ | | |
| F001 | deceleration time increments | 0 | | 1 | Increment: 0.01 s | deceleration time setting. | | |
| 16 F002 | Jog acceleration/ deceleration time | 0.5 s | | 0 to 3600 s | frequency from a st | n/deceleration time (time required to change the op status (0 Hz) to the frequency set in Pr.20 and B operation. (Refer to page 261.) | | |
| 611 | Acceleration time | | | 0 to 3600 s | Set the acceleration | n time for restart (from stop status to Pr.20). | | |
| F003 | at a restart | 9999 | | 9999 | Standard acceleration time (for example, Pr.7) is applied as the acceleration time at restart. (Refer to page 466 and page 472.) | | | |
| 7 | | 5 s ^{*1} 15 s ^{*2} | | | Set the motor acceleration time (time required to change the frequency from a stop status (0 Hz) to the frequency set in Pr.20). | | | |
| F010 | Acceleration time | | | 0 to 3600 s | | | | |
| 8 | Deceleration time | 10 s ^{*1} 30 s ^{*1} | | 0 to 3600 s | Set the motor deceleration time (time required to change the frequency from the frequency set in Pr.20 to stop status (0 Hz)). | | | |
| F011 | Deceleration time | | | | | | | |
| 44 F020 | Second acceleration/ deceleration time | 5 s | | 0 to 3600 s | Set the acceleration ON. | n/deceleration time used while the RT signal is | | |
| 45 | Second | 9999 | | 0 to 3600 s | Set the deceleration | n time used while the RT signal is ON. | | |
| F021 | deceleration time | 9999 | | 9999 | The acceleration tir | me applies to the deceleration time. | | |
| 147 | Acceleration/ deceleration time | 9999 | | 0 to 590 Hz | Set the frequency where the acceleration/deceleration time switcher to the time set in Pr.44 and/or Pr.45 . | | | |
| F022 | switching frequency | 0000 | | 9999 | Function disabled. | | | |
| 791 | Acceleration time in low-speed | 9999 | | 0 to 3600 s | Set the acceleration time in a low-speed range (less than 1/10 of th rated motor frequency). | | | |
| F070 | range | 3333 | | 9999 | The acceleration time set in Pr.7 is applied. (While the RT signal is ON, the second function is enabled.) | | | |

| Pr. | Name | Initial | value | Setting range | Description | |
|------|--|---------|-------|---------------|---|--|
| гі. | INAILIE | FM | CA | Setting range | | |
| 792 | Deceleration time in low-speed 9999 | | | 0 to 3600 s | Set the deceleration time in a low-speed range (less than 1/10 of the rated motor frequency). | |
| F071 | in low-speed range | 9999 | | 9999 | The deceleration time set in Pr.8 is applied. (While the RT signal is ON, the second function is enabled.) | |

*1 For the FR-F820-00340(7.5K) or lower, and FR-F840-00170(7.5K) or lower.

*2 For the FR-F820-00490(11K) or higher, and FR-F840-00250(11K) or higher.

Control block diagram



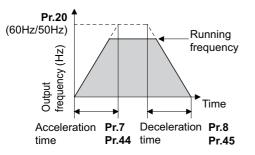
Acceleration time setting (Pr.7, Pr.20)

- Use **Pr.7 Acceleration time** to set the acceleration time required to change the frequency to the frequency set in **Pr.20 Acceleration/deceleration reference frequency** from stop status.
- Set the acceleration time according to the following formula.

Acceleration time setting = **Pr.20** setting × (Acceleration time to change the frequency from stop status to maximum frequency) / (Maximum frequency - **Pr.13** setting)

 For example, the following calculation is performed to find the setting value for Pr.7 when increasing the output frequency to the maximum frequency of 50 Hz in 10 seconds with Pr.20 = 60 Hz (initial value) and Pr.13 = 0.5 Hz.

Pr.7 setting = 60 Hz × 10 s / (50 Hz - 0.5 Hz) ≈ 12.1 s



Deceleration time setting (Pr.8, Pr.20)

- Use **Pr.8 Deceleration time** to set the deceleration time required to change the frequency to a stop status from the frequency set in **Pr.20 Acceleration/deceleration reference frequency**.
- · Set the deceleration time according to the following formula.

Deceleration time setting = **Pr.20** setting × (Deceleration time to change the frequency from maximum frequency to stop status) / (Maximum frequency - **Pr.10** setting)

• For example, the following calculation is used to find the setting value for **Pr.8** when decreasing the output frequency from the maximum frequency of 50 Hz in 10 seconds with **Pr.20** = 120 Hz and **Pr.10** = 3 Hz.

Pr.8 setting = 120 Hz × 10 s / (50 Hz - 3 Hz) ≈ 25.5 s



- If the acceleration/deceleration time is set, the actual motor acceleration/deceleration time cannot be made shorter than the shortest acceleration/deceleration time determined by the mechanical system J (moment of inertia) and motor torque.
- If the **Pr.20** setting is changed, the **Pr.125** and **Pr.126** (frequency setting signal gain frequency) settings do not change.
- Set Pr.125 and Pr.126 to adjust the gains.
 Under PM motor control, if the protective function (E.OLT) is activated due to insufficient torque in the low-speed range, set longer acceleration/deceleration times only in the low-speed range in Pr.791 Acceleration time in low-speed range and

Changing the minimum increment of the acceleration/deceleration time (Pr.21)

Use Pr.21 to set the minimum increment of the acceleration/deceleration time.
 Setting value "0 (initial value)": minimum increment 0.1 second
 Setting value "1": minimum increment 0.01 second

Pr.792 Deceleration time in low-speed range.

Pr.21 setting allows the minimum increment of the following parameters to be changed.
 Pr.7, Pr.8, Pr.16, Pr.44, Pr.45, Pr.111, Pr.264, Pr.265, Pr.582, Pr.583, Pr.791, Pr.792, Pr.1477, Pr.1478

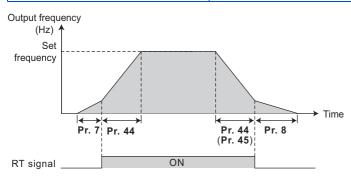
NOTE

- Pr.21 setting does not affect the minimum increment setting of Pr.611 Acceleration time at a restart.
- The FR-DU08 and the FR-PU07 provide a five-digit readout (including the number of decimal places) on a value of parameters. Therefore, a value of "1000" or larger is set/displayed only in increments of 0.1 second even if **Pr.21** = "1".

Setting multiple acceleration/deceleration times (RT signal, Pr.44, Pr.45, Pr.147)

- **Pr.44** and **Pr.45** are applied when the RT signal is ON or when the output frequency is equal to or higher than the frequency set in **Pr.147** Acceleration/deceleration time switching frequency.
- Even at the frequency lower than the Pr.147 setting, turning ON the RT signal switches the acceleration/deceleration time to the second acceleration/deceleration time. The priority of the signals and settings is as follows: RT signal > Pr.147 setting.
- When "9999" is set in Pr.45, the deceleration time becomes equal to the acceleration time (time set in Pr.44).
- While the **Pr.147** setting is equal to or less than the setting of **Pr.10 DC injection brake operation frequency** or **Pr.13 Starting frequency**, the time used as the acceleration/deceleration time switches to the time set in **Pr.44 (Pr.45)** when the output frequency reaches or exceeds the **Pr.10** or **Pr.13** setting.

| Pr.147 setting | Setting applied to the acceleration/deceleration time | Description |
|---|--|--|
| 9999 (initial value) | Pr.7, Pr.8 | Acceleration/deceleration time is not automatically changed. |
| 0.00 Hz | Pr.44, Pr.45 | Second acceleration/deceleration time is applied from the start. |
| 0.01 Hz \leq Pr.147 setting \leq Set frequency | Output frequency < Pr.147 setting: Pr.7, Pr.8 Pr.147 setting ≤ Output frequency: Pr.44, Pr.45 | Acceleration/deceleration time is automatically changed. |
| Set frequency < Pr.147 setting | Pr.7, Pr.8 | Not changed as the frequency has not reached the switchover frequency. |

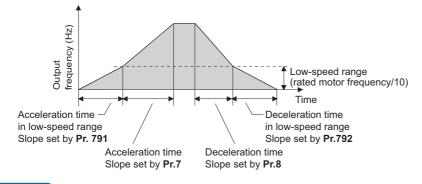




- The reference frequency during acceleration/deceleration depends on the setting of Pr.29 Acceleration/deceleration pattern selection. (Refer to page 231.)
- The RT signal can be assigned to an input terminal by setting **Pr.178 to Pr.189 (Input terminal function selection)**. Changing the terminal assignment may affect other functions. Set parameters after confirming the function of each terminal.
- The RT signal is the Second function selection signal. The RT signal also enables other second functions. (Refer to page 377.)
- The RT signal is assigned to terminal RT in the initial status. Set "3" in one of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the RT signal to another terminal.

Setting the acceleration/deceleration time in the low-speed range (Pr.791, Pr.792)

If torque is required in the low-speed range (less than 10% of the rated motor frequency) under PM motor control, set a value larger than the setting of Pr.7 Acceleration time (Pr.8 Deceleration time) in Pr.791 Acceleration time in low-speed range (Pr.792 Deceleration time in low-speed range) so that the mild acceleration/deceleration is performed in the low-speed range. (When the RT signal is turned ON, the second acceleration/deceleration time is prioritized.)



- NOTE

- Set Pr.791 (Pr.792) to a value larger than the Pr.7 (Pr.8) setting. If a value smaller than Pr.7 (Pr.8) is set in Pr.791 (Pr.792), the Pr.791 (Pr.792) setting is regarded as the same setting as the Pr.7 (Pr.8) setting.
- Refer to page 641 for the rated motor frequency of the MM-EFS or MM-THE4 motor.

Parameters referred to

Pr.3 Base frequency CF page 552

Pr.10 DC injection brake operation frequency F page 560

Pr.29 Acceleration/deceleration pattern selection Pr.29 Acceleration/deceleration pattern selection page 231 Pr.125, Pr.126 (Frequency setting gain frequency) page 357

Pr.178 to Pr.189 (Input terminal function selection) are page 373

Pr.264 Power-failure deceleration time 1, Pr.265 Power-failure deceleration time 2 3 page 478

5.5.2 Acceleration/deceleration pattern

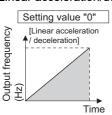
The acceleration/deceleration pattern can be set according to the application.

In addition, the backlash measures that stop acceleration/deceleration by the frequency or time set with parameters at acceleration/deceleration can be set.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|---|------------------|---------------|--|
| | | | 0 | Linear acceleration/deceleration |
| 20 | | | 1 | S-pattern acceleration/deceleration A |
| 29 F100 | Acceleration/deceleration pattern selection | 0 | 2 | S-pattern acceleration/deceleration B |
| 1 100 | Selection | | 3 | Backlash measure |
| | | | 6 | Variable-torque acceleration/deceleration |
| 140 F200 | Backlash acceleration stopping frequency | 1 Hz | 0 to 590 Hz | |
| 141 F201 | Backlash acceleration stopping time | 0.5 s | 0 to 360 s | Set the stopping frequency and time during backlash |
| 142 F202 | Backlash deceleration stopping frequency | 1 Hz | 0 to 590 Hz | measures. Valid by backlash measures (Pr.29 = "3"). |
| 143 F203 | Backlash deceleration stopping time | 0.5 s | 0 to 360 s | |

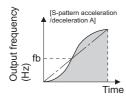
Linear acceleration/deceleration (Pr.29 = "0 (initial value)")

• When the frequency is changed for acceleration, deceleration, etc. during inverter operation, the output frequency is changed linearly (linear acceleration/deceleration) to reach the set frequency without straining the motor and inverter. Linear acceleration/deceleration has a uniform frequency/time slope.



S-pattern acceleration/deceleration A (Pr.29 = "1")

- Use this when acceleration/deceleration is required for a short time until a high-speed area equal to or higher than the base frequency, such as for the main shaft of the machine.
- The acceleration/deceleration pattern has the **Pr.3 Base frequency** (**Pr.84 Rated motor frequency** under PM motor control) (fb) as the point of inflection in an S-pattern curve, and the acceleration/deceleration time can be set to be suitable for the motor torque reduction in the constant-power operation range at the base frequency (fb) or more.



· Acceleration/deceleration time calculation method when the set frequency is equal to or higher than the base frequency

Acceleration time $t = (4/9) \times (T/fb^2) \times f^2 + (5/9) \times T$ Where T is the acceleration/deceleration time (s), f is the set frequency (Hz), and fb is the base frequency (rated motor frequency)

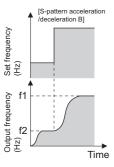
• Reference (0 Hz to set frequency) of acceleration/deceleration time when Pr.3 = 60 Hz

| Acceleration/deceleration | Set frequency (Hz) | | | | |
|---------------------------|--------------------|-----|-----|-----|--|
| time (s) | 60 | 120 | 200 | 400 | |
| 5 | 5 | 12 | 27 | 102 | |
| 15 | 15 | 35 | 82 | 305 | |

• For the acceleration/deceleration time setting of the S-pattern acceleration/deceleration A, set the time to **Pr.3** (**Pr.84** under PM motor control) instead of **Pr.20 Acceleration/deceleration reference frequency**.

S-pattern acceleration/deceleration B (Pr.29 = "2")

• This is useful for preventing collapsing stacks such as on a conveyor. S-pattern acceleration/deceleration B can reduce the impact during acceleration/deceleration by accelerating/decelerating while maintaining an S-pattern from the present frequency (f2) to the target frequency (f1).

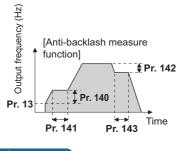




• When the RT signal turns ON during acceleration or deceleration with the S-pattern acceleration/deceleration B enabled, a pattern of acceleration or deceleration changes to linear at the moment.

Backlash measures (Pr.29 = "3", Pr.140 to Pr.143)

- Reduction gears have an engagement gap and have a dead zone between forward rotation and reverse rotation. This dead
 zone is called backlash, and this gap disables a mechanical system from following motor rotation. More specifically, a
 motor shaft develops excessive torque when the direction of rotation changes or when constant-speed operation shifts to
 deceleration, resulting in a sudden motor current increase or regenerative status.
- To avoid backlash, acceleration/deceleration is temporarily stopped. Set the acceleration/deceleration stopping frequency and time in Pr.140 to Pr.143.

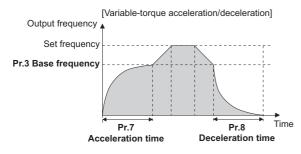


NOTE

• Setting the backlash measures increases the acceleration/deceleration time by the stopping time.

Variable-torque acceleration/deceleration (Pr.29 = "6")

• This function is useful for variable-torque load such as a fan and blower to accelerate/decelerate in short time. Linear acceleration/deceleration is performed in the area where the output frequency > base frequency.



- NOTE

- When the base frequency is out of the range 45 to 65 Hz, the linear acceleration/deceleration is performed even if **Pr.29** = "6".
- Even if **Pr.14 Load pattern selection** = "1 (variable torque load)", variable torque acceleration/deceleration setting is prioritized and the inverter operates as **Pr.14** = "0 (constant torque load)".
- For the variable torque acceleration/deceleration time setting, set the time period to reach **Pr.3 Base frequency**. (Not the time period to reach **Pr.20 Acceleration/deceleration reference frequency**.)
- The variable torque acceleration/deceleration is disabled during PM motor control. (Linear acceleration/deceleration is performed.)

Parameters referred to

Pr.3 Base frequency is page 5

Pr.7 Acceleration time, Pr.8 Deceleration time, Pr.20 Acceleration/deceleration reference frequency ☞ page 228 Pr.10 DC injection brake operation frequency ☞ page 560 Pr.14 Load pattern selection ☞ page 554

Pr.178 to Pr.189 (Input terminal function selection) i page 373

5.5.3 Remote setting function

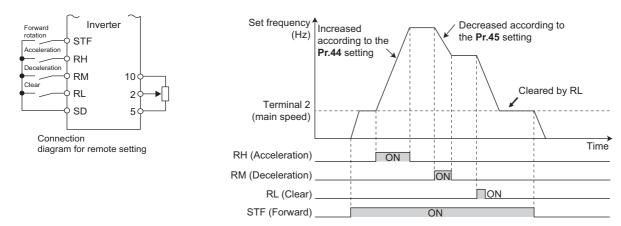
Even if the operation panel is located away from the enclosure, contact signals can be used to perform continuous variablespeed operation, without using analog signals.

| | | Initial | Setting | | Description | | |
|------------|---------------------------|---------|---------|-------------------------------|---|--|--|
| Pr. | Name | value | range | RH, RM, RL signal function | Frequency setting storage | Deceleration to the main speed or lower | |
| | | | 0 | Multi-speed setting | — | | |
| | | | 1 | Remote setting | Enabled | | |
| | | | 2 | Remote setting | Disabled | Not available | |
| 59 F101 | Remote function selection | 0 | 3 | Remote setting | Disabled (Turning the STF/ STR signal OFF clears remotely-set frequency.) | | |
| 1 101 | 3010011 | | 11 | Remote setting | Enabled | | |
| | | | 12 | Remote setting | Disabled | | |
| | | | 13 | Remote setting | Disabled (Turning the STF/ STR signal OFF clears remotely-set frequency.) | Available | |

Remote setting function

• When **Pr.59** ≠ "0" (remote setting enabled), the functions of the signals are as shown in the following table.

| Signal name | Function | Description |
|----------------------------|-----------------|--|
| STF/STR | Forward/Reverse | The inverter accelerates the motor in the forward or reverse direction up to the main speed or to the frequency stored by the remote setting function. |
| RH | Acceleration | The set frequency increases according to the Pr.44 setting. |
| RM | Deceleration | The set frequency decreases according to the Pr.45 setting. |
| RL | Clear | The set frequency is cleared and the main speed is applied. |
| Terminal 2 (analog signal) | Main speed | The setting of the main speed is used as a base. The main speed is increased by the RH signal and decreased by the RM signal. |



Main speed

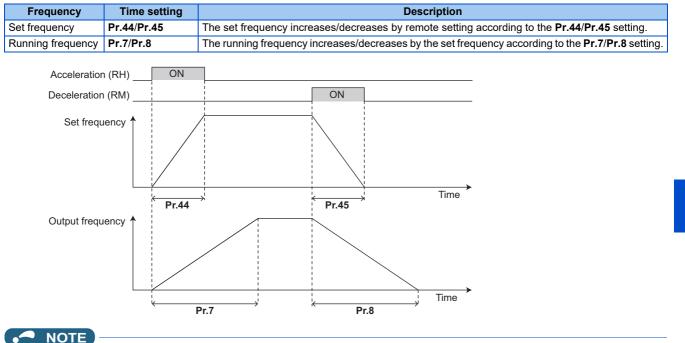
• The main speed used in the remote setting corresponds with each of the following operation modes.

| Operation mode | Main speed |
|---|--|
| PU operation mode / NET operation mode | Digital setting |
| External operation mode / PU/External combined operation mode 2 (Pr.79 = "4") | Analog input ^{*1} |
| PU/External combined operation mode 1 (Pr.79 = "3") | Analog input via terminal 4 (AU signal ON) ^{*1} |

*1 Set Pr.28 Multi-speed input compensation selection to "1" when enabling compensation for input via terminal 1.

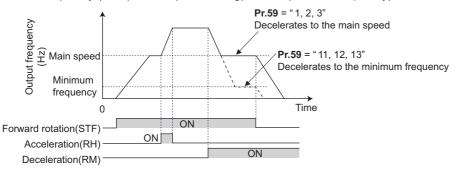
Acceleration/deceleration operation

• The running frequency changes as follows when the set frequency is changed by the remote setting function.



- If the time setting of the running frequency is longer than the time setting of the set frequency, the motor accelerates/ decelerates according to the time setting of the running frequency.
- · Deceleration to the main speed or lower

By setting **Pr.59** = "11 to 13", the speed can be decelerated to the frequency lower than the main speed (set by the External operation frequency (except multi-speed setting) or PU operation frequency).



- Regardless of whether the remote setting is enabled or disabled, the acceleration/deceleration time set for the running frequency can be changed to the second acceleration/deceleration time by turning ON the RT signal.
- The acceleration/deceleration time setting of the set frequency is fixed at the Pr.44/Pr.45 setting.

Frequency setting storage

• The remotely set frequency is stored, held, or cleared according to the **Pr.59** setting. When the inverter is turned ON again and the operation is resumed, the setting shown in the parentheses will be applied.

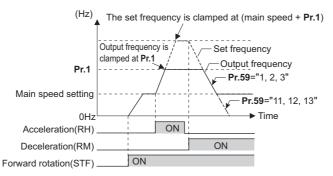
| Pr.59 setting | Power OFF | STF/STR signal OFF | |
|---------------|---------------------------|-------------------------|--|
| 1, 11 | Stored (stored frequency) | Held (stored frequency) | |
| 2, 12 | Cleared (main speed) | Held (stored frequency) | |
| 3, 13 | Cleared (main speed) | Cleared (main speed) | |

Storage conditions

The remotely-set frequency is stored at the point when the start signal (STF or STR) turns OFF. The remotely-set frequency is stored every minute after turning OFF (ON) the RH and RM signals together. Every minute, the frequency is overwritten in the EEPROM if the latest frequency is different from the previous one when comparing the two. This cannot be written using the RL signal.



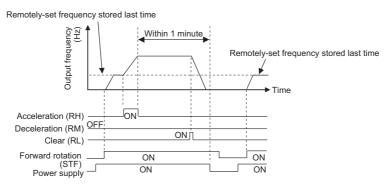
- When switching the start signal from ON to OFF, or changing frequency by the RH or RM signal frequently, set the frequency setting value storage function (write to EEPROM) invalid (Pr.59 = "2, 3, 12, 13"). If the frequency setting value storage function is valid (Pr.59 = "1, 11"), the frequency is written to EEPROM frequently, and this will shorten the life of the EEPROM.
- The range of frequency changeable using the acceleration (RH) signal and the deceleration (RM) signal is 0 to the maximum frequency (set in **Pr.1** or **Pr.18**). Note that the maximum value of set frequency is equal to the total of the main speed and the maximum frequency.



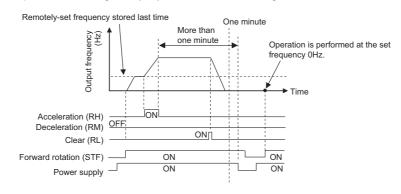
- Even if the start signal (STF or STR) is OFF, turning ON the RH or RM signal varies the preset frequency.
- The RH, RM, or RL signal can be assigned to an input terminal by setting **Pr.178 to Pr.189 (Input terminal function selection)**. Changing the terminal assignment may affect other functions. Set parameters after confirming the function of each terminal.
- · The inverter can be used in the Network operation mode.
- · The remote setting function is invalid during JOG operation and PID control operation.
- The multi-speed operation function is invalid when remote setting function is selected.

When setting frequency is "0"

• Even when the remotely-set frequency is cleared by turning ON the RL (clear) signal after turning OFF (ON) both the RH and RM signals, the inverter operates at the remotely-set frequency stored in the last operation if power is reapplied before one minute has elapsed since turning OFF (ON) both the RH and RM signals.



• When the remotely-set frequency is cleared by turning ON the RL (clear) signal after turning OFF (ON) both the RH and RM signals, the inverter operates at the frequency in the remotely-set frequency cleared state if power is reapplied before one minute has elapsed since turning OFF (ON) both the RH and RM signals.



Ŵ CAUTION

When using the remote setting function, set the maximum frequency again according to the machine. •

A Parameters referred to

Pr.1 Maximum frequency, Pr.18 High speed maximum frequency 37 page 287

Pr.7 Acceleration time, Pr.8 Deceleration time, Pr.44 Second acceleration/deceleration time, Pr.45 Second deceleration time Pr.28 Multi-speed input compensation selection Page 263 Pr.178 to Pr.189 (Input terminal function selection) Page 373

5.5.4 Starting frequency and start-time hold function

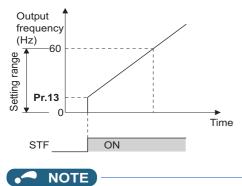
Magnetic flux

It is possible to set the starting frequency and hold the set starting frequency for a certain period of time. Set these functions when a starting torque is needed or the motor drive at start needs smoothing.

| Pr. | Name | Initial value | Setting range | Description |
|------------|-------------------------|---------------|---------------|--|
| 13 F102 | Starting frequency | 0.5 Hz | 0 to 60 Hz | Set the starting frequency at which the start signal is turned ON. |
| 571 | Holding time at a start | art 9999 | | Set the holding time of the frequency set in Pr.13 . |
| F103 | noiding time at a start | 9999 | 9999 | The holding function at start is disabled. |

Starting frequency setting (Pr.13)

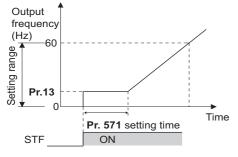
- The frequency at start can be set in the range of 0 to 60 Hz.
- · Set the starting frequency at which the start signal is turned ON.



The inverter does not start if the frequency setting signal has a value lower than that of Pr.13.
 For example, while Pr.13 = 5 Hz, the inverter output starts when the frequency setting signal reaches 5 Hz.

Start-time hold function (Pr.571)

- This function holds during the period set in Pr.571 and the output frequency set in Pr.13 Starting frequency.
- · This function performs initial excitation to smooth the motor drive at a start.



NOTE

- When Pr.13 = 0 Hz, the starting frequency is held at 0.01 Hz.
- · When the start signal was turned OFF during start-time hold, deceleration is started at that point.
- At switching between forward rotation and reverse rotation, the starting frequency is valid but the start-time hold function is disabled.

Note that when **Pr.13** is set to a value equal to or lower than the setting of **Pr.2 Minimum frequency**, simply turning ON the start signal runs the motor at the frequency set in **Pr.2** even if the command frequency is not given.

Parameters referred to

Pr.2 Minimum frequency page 287

Minimum motor speed frequency at the motor start 5.5.5 up

PM

Set the frequency where the PM motor starts running.

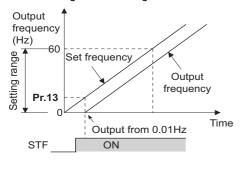
Set the deadband in the low-speed range to eliminate noise and offset deviation when setting a frequency with analog input.

| Pr. | Name | Initial value | Setting range | Description |
|------------|--------------------|---|---------------|---|
| 13 F102 | Starting frequency | Minimum frequency / Minimum rotations per minute | 0 to 60 Hz | Set the frequency where the motor starts running. |

Starting frequency setting (Pr.13)

- The frequency where the PM motor starts running can be set in the range of 0 to 60 Hz.
- When the frequency command specifies the frequency less than the one set in Pr.13 Starting frequency, the PM motor is stopped.

When the frequency command specifies the frequency equal to the set frequency or higher, the PM motor accelerates according to the setting of Pr.7 Acceleration time.



• NOTE

- · Under induction motor control (under V/F control or Advanced magnetic flux vector control), the output starts at the frequency set in Pr.13. Under PM motor control, the output always starts at 0.01 Hz.
- The inverter does not start if the frequency setting signal has a value lower than that of Pr.13. For example, while Pr.13 = 20 Hz, the inverter output starts when the frequency setting signal reaches 20 Hz.

∕ CAUTION

Note that when Pr.13 is set to a value equal to or lower than Pr.2 Minimum frequency, simply turning ON the start signal runs the motor at the frequency set in Pr.2 even if the command frequency is not given.

≪ Parameters referred to 🚿

Pr.2 Minimum frequency are page 287 Pr.7 Acceleration time are page 228

5.6 (D) Operation command and frequency command

| Purpose | Par | ameter to set | | Refer to page |
|--|--|-----------------------------------|--|---------------|
| To select the operation mode | Operation mode selection | P.D000 | Pr.79 | 240 |
| To start up the inverter in Network operation mode at power-ON | Communication startup mode selection | P.D000, P.D001 | Pr.79, Pr.340 | 250 |
| To select the command source during communication operation | Operation and speed command sources during communication operation, command source selection | P.D010 to P.D013 | Pr.338, Pr.339, Pr.550, Pr.551 | 251 |
| To prevent the motor from rotating reversely | Reverse rotation prevention selection | P.D020 | Pr.78 | 257 |
| To set the frequency using pulse train input | Pulse train input | P.D100, P.D101, P.D110, P.D111 | Pr.291, Pr.384 to Pr.386 | 258 |
| To perform JOG (inching) operation | JOG operation | P.D200, P.F002 | Pr.15, Pr.16 | 261 |
| To control the frequency with combinations of terminals | Multi-speed operation | P.D300 to P.D315 | Pr.28, Pr.4 to Pr.6, Pr.24 to Pr.27, Pr.232 to Pr.239 | 263 |

5.6.1 Operation mode selection

Select the operation mode of the inverter.

The mode can be changed among operations using external signals (External operation), operation by the operation panel or the parameter unit (PU operation), combined operation of PU operation and External operation (External/PU combined operation), and Network operation (when RS-485 terminals or a communication option is used).

| Pr. | Name | Initial value | Setting range | Description |
|------------|--------------------------|---------------|---------------|-----------------------------|
| 79 D000 | Operation mode selection | 0 | 0 to 4, 6, 7 | Selects the operation mode. |

The following table lists valid and invalid commands in each operation mode.

| Pr.79 setting | | | LED indicator | Refer to page | |
|----------------------|--|--|---|--|-----|
| 0 (initial value) | External/PU switchover mod The inverter operation mode At power ON, the inverter is | PU operation mode PU EXT NET External operation mode PU EXT NET Operation mode PU EXT NET | 245 | | |
| | Operation mode | Frequency command | Start command | PU operation | |
| 1 | Fixed at PU operation mode. | ed at PU operation Sent from the operation panel Sent by pressing FWD or | | | |
| 2 | Fixed at External operation mode. However, the inverter operation mode can also be changed to the Network operation mode. | Sent using external signals (input via terminal 2 or 4, using the JOG signal, using the multi-speed setting function, etc.). | Sent using external signals (via terminal STF or STR). | External operation mode PU EXT NET operation mode PU EXT NET | 245 |
| 3 | External/PU combined operation mode 1 | | | | |
| 4 | External/PU combined operation mode 2 | operation mode PU EXT NET | 246 | | |
| 6 | Operation mode switchover Switching from among the P operation. | PU operation mode PU EXT NET External operation | 246 | | |
| 7 | External operation mode (Pl X12 signal ON: Switchover t operation). X12 signal OFF: Switchover | Mode PU EXT NET operation mode PU EXT NET | 247 | | |

*1 The following is the frequency commands listed in descending order of priority when "3" is set in **Pr.79**: Multi-speed setting function (RL/RM/RH/ REX signal) > PID control (X14 signal) > terminal 4 analog input (AU signal) > digital input from the operation panel.

Operation mode basics

- The operation mode specifies the source of the start command and the frequency command for the inverter.
- · Basic operation modes are as follows.

External operation mode: For giving a start command and a frequency command with an external potentiometer or switches which are connected to the control circuit terminal.

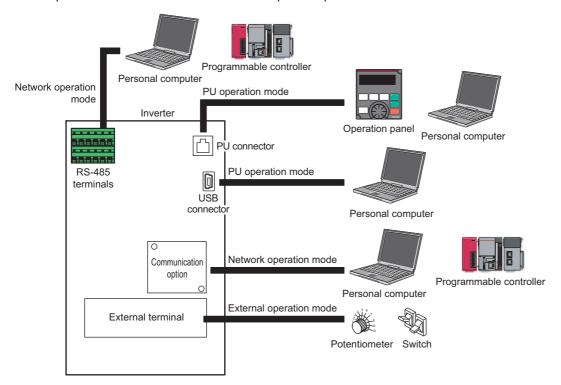
: For giving a start command and a frequency command from the operation panel, parameter unit, or through RS-485 communication via the PU connector.

For giving a start command and a frequency command via the RS-485 terminals or communication option.

Network operation mode : (NET operation mode)

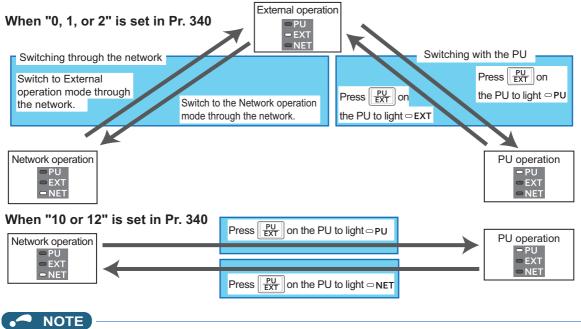
PU operation mode

• The operation mode can be selected from the operation panel or with the communication instruction code.



- There is a choice of two settings, "3" and "4", for the External/PU combined operation mode. The startup method differs according to the setting value.
- In the initial setting, the PU stop function (function to stop the inverter operation by pressing resting) on the operation panel or the parameter unit) is enabled even in the operation mode other than the PU operation mode. (Refer to **Pr.75** on page 196.)

Operation mode switching method



For details on switching by external terminals, refer to the following pages.

PU operation external interlock (X12 signal) 🖙 page 247

PU/External operation switchover (X16 signal) i page 248

PU/NET operation switchover (X65 signal), External/NET operation switchover (X66 signal) 🖙 page 248 Pr.340 Communication startup mode selection 🖙 page 250

Operation mode selection flow

Referring to the following table, select the basic parameter settings or terminal wiring related to the operation mode.

| Method to give start command | Method to give frequency setting command | Input interface | Parameter setting | Operation method |
|---|---|--|---|--|
| | Using external signals (input via terminal 2/4, using the JOG signal, using the multi-speed setting function, etc.) | Terminal STF (forward rotation) / STR (reverse rotation). (Refer to page page 563.) Terminal 2 and 4 (analog), RL, RM, RH, JOG, etc. | Pr.79 = "2" (Fixed at External operation mode) | Frequency setting: Turn ON a terminal used for frequency setting. Start command: Turn ON terminal STF/STR. |
| Using external signals (via terminal | From PU (digital setting) | Terminal STF (forward rotation) / STR (reverse rotation). (Refer to page 563.) | Pr.79 = "3" (External/PU combined operation mode 1) | Frequency setting: Use the DU (digital setting). Start command: Turn ON terminal STF/STR. |
| STF/STR) | Through communication (via RS-485 terminals) | Terminal STF (forward rotation) / STR (reverse rotation). (Refer to page 563.) RS-485 terminals (Refer to page 497.) | Pr.338 = "1" Pr.340 = "1 or 2" | Frequency setting: Transmit a frequency command through communication. Start command: Turn ON terminal STF/STR. |
| | Through communication (via communication option) | Terminals on communication option (refer to the Instruction Manual of the option) | Pr.338 = "1" Pr.340 = "1" | Frequency setting: Transmit a frequency command through communication. Start command: Turn ON terminal STF/STR. |
| | Using external signals (input via terminal 2/4, using the JOG signal, using the multi-speed setting function, etc.) | Terminal 2 and 4 (analog) RL, RM, RH, JOG, etc. | Pr.79 = "4" (External/PU combined operation mode 2) | Frequency setting: Turn ON a terminal used for frequency setting. Start command: Press the FWD/REV key. |
| From PU (using FWD/REV key) | From PU (digital setting) | _ | Pr.79 = "1" (Fixed at PU operation mode) | Frequency setting: Use the PU (digital setting). Start command: Press the FWD/REV key. |
| | Through communication (via RS-485 terminals / communication option) | Not available. | | |
| Through | Using external signals (input via terminal 2/4, using the JOG signal, using the multi-speed setting function, etc.) | RS-485 terminals (refer to page 497), terminals 2/4 (analog), RL, RM, RH, JOG, etc. | Pr.339 = "1" Pr.340 = "1 or 2" | Frequency setting: Turn ON a terminal used for frequency setting. Start command: Transmit a start command through communication. |
| communication (via | From PU (digital setting) | Not available. | | |
| RS-485 terminals) | Through communication (via RS-485 terminals) | RS-485 terminals (refer to page 497) | Pr.340 = "1 or 2" | Frequency setting: Transmit a frequency command through communication. Start command: Transmit a start command through communication. |
| Through | Using external signals (input via terminal 2/4, using the JOG signal, using the multi-speed setting function, etc.) | Terminals on communication option (Refer to the Instruction Manual of the communication option.) Terminal 2 and 4 (analog), RL, RM, RH, JOG, etc. | Pr.339 = "1" Pr.340 = "1" | Frequency setting: Turn ON a terminal used for frequency setting. Start command: Transmit a start command through communication. |
| communication (via communication | From PU (digital setting) | Not available. | | |
| communication option) | Through communication (via communication option) | Terminals on communication option (refer to the Instruction Manual of the option) | Pr.340 = "1" | Frequency setting: Transmit a frequency command through communication. Start command: Transmit a start command through communication. |

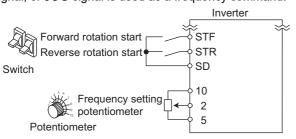
External operation mode (Pr.79 = "0 (initial value) or 2")

- Select the External operation mode when the start command and the frequency command are applied from a frequency setting potentiometer, start switch, etc. which are provided externally and connected to the control circuit terminals of the inverter.
- Generally, parameter change cannot be performed in the External operation mode. (Some parameters can be changed. Refer to **Pr.77** on page 206.)
- When Pr.79 = "0 or 2", the inverter starts up in the External operation mode at power-ON. (When using the Network operation mode, refer to page 250.)
- When parameter changing is seldom necessary, setting "2" fixes the operation mode to the External operation mode.

When frequent parameter changing is necessary, setting "0 (initial value)" allows the operation mode to be changed easily

to the PU operation mode by pressing $\begin{bmatrix} PU \\ EXT \end{bmatrix}$ on the operation panel. After switching to the PU operation mode, always return to the External operation mode.

• The STF or STR signal is used as a start command. The input voltage or current via terminal 2 or 4, multi-speed setting signal, or JOG signal is used as a frequency command.



PU operation mode (Pr.79 = "1")

• Select the PU operation mode when giving start and frequency commands by only the key operation of the operation panel or the parameter unit.

Also select the PU operation mode when giving commands through communication via the PU connector.

- When Pr.79 ="1", the inverter starts up in the PU operation mode at power-ON. The mode cannot be changed to other operation modes.
- The frequency can also be set by simply turning the setting dial on the operation panel like a volume knob. (Refer to Pr.161 Frequency setting/key lock operation selection on page 202.)

· When the PU operation mode is selected, the PU operation mode (PU) signal can be output.

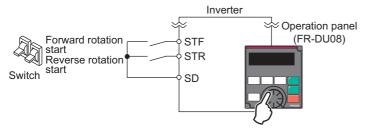
For the terminal used for the PU signal, set "10 (positive logic)" or "110 (negative logic)" in any parameter from **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function.

Operation panel (FR-DU08)



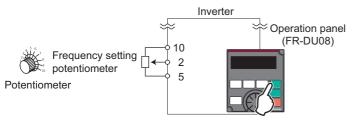
PU/External combined operation mode 1 (Pr.79 = "3")

- Select the PU/External combined operation mode 1 when giving a frequency command from the operation panel or the parameter unit and giving a start command with the external start switches.
- Set "3" in Pr.79. The mode cannot be changed to other operation modes.
- When the frequency commands are given using the multi-speed setting signals (external signals), they have a higher priority than the frequency commands given from the PU. When the AU signal is ON, inputting the command signals via terminal 4 is enabled.



PU/External combined operation mode 2 (Pr.79 = "4")

- Select the PU/External combined operation mode 2 when giving a frequency command from the external potentiometer, or using the multi-speed setting signals or the JOG signal, and giving a start command by key operation of the operation panel or the parameter unit.
- Set "4" in **Pr.79**. The mode cannot be changed to other operation modes.



Operation mode switchover during operation (Pr.79 = "6")

• During operation, the inverter operation mode can be switched from among the PU, External, and Network (Network operation mode is selectable when RS-485 terminals or communication option is used).

| Operation mode switchover | Operation/operating status |
|-------------------------------------|---|
| External operation→PU operation | Use the operation panel or parameter unit to change to the PU operation mode. The direction of motor rotation does not change due to the operation mode change from the External operation mode. The previous setting of frequency which has been set using a potentiometer (frequency command) is taken over. (However, note that the setting disappears when the power is turned OFF or when the inverter is reset.) |
| External operation→NET operation | Give the command through communication to change the operation mode to the Network operation mode. The direction of motor rotation does not change due to the operation mode change from the External operation mode. The previous setting of frequency which has been set using a potentiometer (frequency command) is taken over. (However, note that the setting disappears when the power is turned OFF or when the inverter is reset.) |
| PU operation→External operation | Press the key on the operation panel or parameter unit to change the operation mode to the External operation mode. The direction of operation is determined by external input signals used in the External operation mode. The setting frequency is determined by the external frequency command signal. |
| PU operation→NET operation | Give the command through communication to change the operation mode to the Network operation mode.The direction of motor rotation and the frequency setting does not change due to the operation mode change from the PU operation mode. |
| NET operation→External operation | Give the command through communication to change the operation mode to the External operation mode. The direction of operation is determined by external input signals used in the External operation mode. The setting frequency is determined by the external frequency command signal. |
| NET operation→PU operation | Use the operation panel or parameter unit to change to the PU operation mode.The direction of motor rotation and the frequency setting does not change due to the operation mode change from the Network operation mode. |

PU operation interlock (Pr.79 = "7")

- The operation mode can be forcibly switched to the External operation mode by turning OFF the PU operation external interlock (X12) signal. This function will be usable in a case where the inverter does not reply to external command signals during operation due to the operation mode accidentally unswitched from the PU operation mode to the External operation mode.
- To input the X12 signal, set "12" in any parameter from Pr.178 to Pr.189 (Input terminal function selection) to assign the function. (For details on Pr.178 to Pr.189, refer to page 373.)
- Set **Pr.79** = "7" (PU operation interlock).
- If the X12 signal is not assigned, the function of the MRS signal is switched to the PU operation interlock signal from MRS (output stop).

| V12 (MBS) signal | Function/Operation | | | | |
|------------------|---|------------------------------------|--|--|--|
| X12 (MRS) signal | Operation mode | Parameter writing ^{*1} | | | |
| ON | Switching of the operation mode (External, PU, and NET) is enabled. The signal is OFF during External operation. | Enabled. | | | |
| OFF | Operation mode is forcefully changed to the External operation mode. External operation is enabled. Switching to the PU or NET operation mode from the External operation mode is disabled. | Disabled except for Pr.79 . | | | |

*1 Depends on the Pr.77 Parameter write selection setting and other parameter write conditions. (Refer to page 206.)
• Functions/operations by X12 (MRS) signal ON/OFF

| Operating status | | | Operation | | Switching to PU or |
|-------------------|-------------------|----------------------|------------------------|--|--------------------|
| Operation mode | Status | X12 (MRS) signal | mode | Operating status | NET operation mode |
| | During stop | ON→OFF ^{*1} | | If frequency and start commands are given | Disabled |
| PU/NET | During running | ON→OFF ^{*1} | External ^{*2} | from external source, the inverter runs by those commands. | Disabled |
| Duning star | | OFF→ON | | During stop | Enabled |
| External | During stop | ON→OFF | External ^{*2} | During stop | Disabled |
| | During | OFF→ON | | Running→Output stop | Disabled |
| | running | ON→OFF | | Output stop→Running | Disabled |

*1 The mode is switched to the External operation mode regardless of the ON/OFF state of the start signal (STF/STR). Thus, the motor runs under the External operation mode when the X12 (MRS) signal turns OFF while the STF or STR signal is ON.

*2 When a fault occurs, the inverter can be reset by pressing STOP RESET on the operation panel.

NOTE

- The operation mode cannot be switched to the PU operation mode with the start signal (STF/STR) ON state even if the X12 (MRS) signal turns ON.
- If the MRS signal is ON and Pr.79 is written to a value other than "7" when the MRS signal is used as the PU interlock signal, the MRS signal will act as a regular MRS function (output stop). Also, when Pr.79 = "7", the MRS signal becomes the PU interlock signal.
- The logic of the signal follows the setting of **Pr.17 MRS input selection** also when the MRS signal is used as the PU operation interlock signal. When **Pr.17** = "2", ON and OFF in the above explanation are reversed.
- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Switching operation mode by external signal (X16 signal)

- When External operation and the operation from the operation panel are used together, the PU operation mode and External operation mode can be switched during a stop (during motor stop, start command OFF) by using the PU/External operation switchover (X16) signal.
- When **Pr.79** = "0, 6, or 7", switching between the PU operation mode and External operation mode is possible. (When **Pr.79** ="6", switchover is enabled during operation.)
- To input the X16 signal, set "16" in any parameter from **Pr.178 to Pr.189 (Input terminal function selection)** to assign the function to a terminal.

| Dr 7 | 79 sotting | X16 signal status and operation mode | | Remarks | |
|---------------------------|------------------------|--------------------------------------|-------------------|--|--|
| Pr.79 setting | | ON (External) | OFF (PU) | Reindiks | |
| 0 (initial value) | | PU operation mode | | Switching among the External, PU, and NET operation modes is enabled. | |
| 1 | | PU operation mode | | Fixed at PU operation mode. | |
| 2 | | External operation mode | | Fixed at External operation mode (Switching to NET operation mode enabled). | |
| 3, 4 | | External/PU combined operation mode | | Fixed at External/PU combined operation mode. | |
| 6 | | External operation mode | PU operation mode | Switching among the External, PU, and NET operation mode is enabled during operation. | |
| 7 | X12 (MRS) signal ON | External operation mode | PU operation mode | Switching among the External, PU, and NET operation mode is enabled (signal is OFF in the External operation mode). | |
| / X12 (MRS) signal OFF | | External operation mod | e | Fixed at External operation mode (forcibly switched to External operation mode). | |

- The operation mode is determined by the setting of **Pr.340 Communication startup mode selection** and the ON/OFF state of the X65 and X66 signals. (For the details, refer to page 248.)
- The priority of Pr.79 and Pr.340 and signals is as follows: Pr.79 > X12 > X66 > X65 > X16 > Pr.340.
- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Switching the operation mode by external signals (X65, X66 signals)

- When Pr.79 = "0, 2 or 6", the PU operation mode and External operation modes can be changed to the Network operation mode during a stop (during motor stop, start command OFF) by the PU/NET operation switchover (X65) signal, or the External/NET operation switchover (X66) signal. (When Pr.79 = "6", switchover is enabled during operation.)
- To switch between the Network operation mode and the PU operation mode
 - **1.** Set **Pr.79** = "0 (initial value) or 6".
 - 2. Set Pr.340 Communication startup mode selection = "10 or 12".
 - **3.** Set "65" in any parameter from **Pr.178 to Pr.189** to assign the PU/NET operation switchover (X65) signal to a terminal.
 - **4.** When the X65 signal is ON, the PU operation mode is selected. When the X65 signal is OFF, the NET operation mode is selected.

| Pr.340 | Pr.79 setting | | X65 signal state | | Remarks | |
|---------|--------------------------|-------------------------|---|----------------------------------|--|--|
| setting | | | ON (PU) | OFF (NET) | Reliaiks | |
| | 0 (initial value) | | PU operation mode ^{*1} | NET operation mode ^{*2} | — | |
| | 1 | | PU operation mode | | Fixed at PU operation mode. | |
| | 2 3, 4 10, 12 6 | | NET operation mode | | Fixed at NET operation mode. | |
| | | | External/PU combined operation mode | | Fixed at External/PU combined operation mode. | |
| 10, 12 | | | PU operation mode ^{*1} | NET operation mode ^{*2} | The operation mode can be changed during operation. | |
| | 7 | X12 (MRS) signal ON | Switching between the E and PU operation mode | • | The signal is OFF during operation in the External operation mode. | |
| | 1 | X12 (MRS) signal OFF | External operation mode | | The operation mode is forcibly switched to the External operation mode. | |

*1 When the X66 signal is ON, the NET operation mode is selected.

5.6 (D) Operation command and frequency command

- *2 When the X16 signal is OFF, the PU operation mode is selected. Also, when "0" is set for Pr.550 NET mode operation command source selection and the communication option is not connected (communication option is the command source), the PU operation mode is selected. When the X16 signal is ON, the External operation mode is selected.
- To switch between the Network operation mode and the External operation mode
 - 1. Set Pr.79 = "0 (initial value), 2, 6, or 7". (When Pr.79 = "7" and the X12 (MRS) signal is ON, the operation mode can be switched.)
 - 2. Set Pr.340 Communication startup mode selection = "0" (initial value), "1" or "2".
 - 3. Set "66" in one of Pr.178 to Pr.189 to assign the NET-External operation switching signal (X66) to a terminal.
 - 4. When the X66 signal is ON, the NET operation mode is selected. When the X66 signal is OFF, the External operation mode is selected.

| Pr.340 | Dr | 79 setting | X66 sigi | nal state | Remarks | |
|-------------------|--------------------------------------|----------------------------------|---------------------------------------|---------------------------------------|--|--|
| setting F1. | | r 9 setting | ON (NET) | OFF (External) | Remarks | |
| 0 (initial value) | | NET operation mode ^{*1} | External operation mode ^{*2} | — | | |
| | 1 | | PU operation mode | | Fixed at PU operation mode. | |
| | 2 | | NET operation mode ^{*1} | External operation mode | Switching to PU operation mode is disabled. | |
| 0 (initial | 0 (initial 3, 4 value), 1, 2 6 | | External/PU combined operation mode | | Fixed at External/PU combined operation mode. | |
| value), 1, 2 | | | NET operation mode ^{*1} | External operation mode ^{*2} | The operation mode can be changed during operation. | |
| | 7 | X12 (MRS) signal ON | NET operation mode ^{*1} | External operation mode ^{*2} | The signal is OFF during operation in the External operation mode. | |
| | 1 | X12 (MRS) signal OFF | External operation mod | e | The operation mode is forcibly switched to the External operation mode. | |

*1 When Pr.550 NET mode operation command source selection = "0" (communication option control source) and no communication option is connected, the External operation mode is selected.

*2 When the X16 signal is OFF, the PU operation mode is selected. Also, when the X65 signal is assigned, the operation mode follows the ON/OFF state of the X65 signal.

NOTE

- The priority of Pr.79 and Pr.340 and signals is as follows: Pr.79 > X12 > X66 > X65 > X16 > Pr.340.
- Changing the terminal assignment using Pr.178 to Pr.189 (Input terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

- Pr.15 Jog frequency Page 261 Pr.4 to Pr.6, Pr.24 to Pr.27, Pr.232 to Pr.239 Multi-speed operation Page 263 Pr.75 Reset selection/disconnected PU detection/PU stop selection 3 page 196 Pr.161 Frequency setting/key lock operation selection page 202 Pr.178 to Pr.189 (Input terminal function selection) F page 373 Pr.190 to Pr.196 (Output terminal function selection) F page 330
- Pr.340 Communication startup mode selection page 250

Pr.550 NET mode operation command source selection 3 page 251

5.6.2 Startup of the inverter in Network operation mode at power-ON

When power is switched ON or when power comes back ON after an instantaneous power failure, the inverter can be started up in the Network operation mode.

After the inverter starts up in the Network operation mode, parameter writing and operation can be commanded from programs. Set this mode when performing communication operation using the RS-485 terminals or a communication option.

| Pr. | Name | Initial value | Setting range | Description |
|------------|---------------------------------------|---------------|---------------|--|
| 79 D000 | Operation mode selection | 0 | 0 to 4, 6, 7 | Selects the operation mode. (Refer to page 240.) |
| | | | 0 | The inverter starts up in an operation mode selected in Pr.79 . |
| 340 | · · · · · · · · · · · · · · · · · · · | | 1, 2 | The inverter starts up in the Network operation mode. If an instantaneous power failure occurs when "2" is set, the operating status before the instantaneous power failure is maintained. |
| D001 | | 0 | 10, 12 | The inverter starts up in the Network operation mode. The operation mode can be changed between the PU operation mode and Network operation mode from the operation panel. If an instantaneous power failure occurs when "12" is set, running is continued at the condition before the instantaneous power failure. |

Selecting the operation mode for power-ON (Pr.340)

• Depending on the **Pr.79** and **Pr.340** settings, the operation mode at power-ON (reset) changes as described below.

| Pr.340 setting | Pr.79 setting | Operation mode at power-ON, at power restoration, or after a reset | Operation mode switching | |
|----------------------|----------------------|--|--|--|
| | 0 (initial value) | External operation mode | Switching among the External, PU, and NET operation modes is enabled. $^{\ast 2}$ | |
| | 1 | PU operation mode | Fixed at PU operation mode. | |
| | 2 | External operation mode | Switching between the External and NET operation modes is enabled. Switching to PU operation mode is disabled. | |
| 0 (initial | 3, 4 | External/PU combined operation mode | Operation mode switching is disabled. | |
| value) | 6 | External operation mode | Switching among the External, PU, and NET operation mode is enabled while running. | |
| | 7 | X12 (MRS) signal ON: External operation mode | Switching among the External, PU, and NET operation modes is enabled. ^{*2} | |
| | 7 | X12 (MRS) signal OFF: External operation mode | Fixed at External operation mode (forcibly switched to External operation mode). | |
| | 0 | NET operation mode | | |
| | 1 | PU operation mode | | |
| | 2 | NET operation mode |] | |
| 1, 2 ^{*1} | 3, 4 | External/PU combined operation mode | Same as Pr.340 = "0". | |
| | 6 | NET operation mode | | |
| | 7 | X12 (MRS) signal ON: NET operation mode | | |
| | ' | X12 (MRS) signal OFF: External operation mode | | |
| | 0 | NET operation mode | Switching between the PU and NET operation mode is enabled. ^{*3} | |
| | 1 | PU operation mode | Same as Pr.340 = "0". | |
| | 2 | NET operation mode | Fixed at NET operation mode. | |
| 10, 12 ^{*1} | 3, 4 | External/PU combined operation mode | Same as Pr.340 = "0". | |
| | 6 | NET operation mode | Switching between the PU and NET operation mode is enabled during operation. ^{*3} | |
| | 7 | External operation mode | Same as Pr.340 = "0". | |

*1 Use **Pr.340** = "2 or 12" setting to perform communication with the RS-485 terminals. Even if an instantaneous power failure occurs while **Pr.57 Restart coasting time** ≠ "9999", the inverter continues running at the condition before the instantaneous failure. When **Pr.340** = "1 or 10", if a power failure occurs while the start signal is being input through communication, the start signal is OFF at power restoration.

*2 The operation mode cannot be directly changed between the PU operation mode and Network operation mode.

*3 Switching between the PU and NET operation modes is available with the EXT key on the operation panel and the X65 signal.

✓ Parameters referred to >>> Pr.57 Restart coasting time □ page 466, page 472 Pr.79 Operation mode selection □ page 240

5.6.3 Start command source and frequency command source during communication operation

The start and frequency commands given from an external device can be made valid when using the RS-485 terminals or the communication option. The command source in the PU operation mode can also be selected.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|---|------------------|------------------|---|
| 338 | Communication | | 0 | Start command source is communication. |
| D010 | operation command source | 0 | 1 | Start command source is external. |
| | | | 0 | Frequency command source is communication. |
| 339 | Communication speed | | 1 | Frequency command source is external. |
| D011 | command source | 0 | 2 | Frequency command source is external. (When there is no external input, the frequency command given via communication is valid, and the frequency command given via terminal 2 is invalid.) |
| | NET mode operation command source selection | 9999 | 0 | The communication option is the command source when in the NET operation mode. |
| 550 D012 | | | 1 | The RS-485 terminals are the command source when in the NET operation mode. |
| 5012 | | | 9999 | Communication option is recognized automatically. Normally, the RS- 485 terminals are the command source. When the communication option is mounted, the communication option is the command source. |
| | | | 1 | The RS-485 terminals are the command source when in the PU operation mode. |
| 551 | PU mode operation | | 2 | The PU connector is the command source when in the PU operation mode. |
| D013 | command source selection | 9999 3 999 | 3 | The USB connector is the command source when in the PU operation mode. |
| | | | 9999 | USB automatic recognition Normally, the PU connector is the command source. When the USB is connected, the USB connector is the command source. |

Selection of command source in the network (NET) operation mode (Pr.550)

- Either of the RS-485 terminals or the communication option can be specified for the command source in the Network operation mode.
- For example, whether or not the communication option is installed, set **Pr.550** = "1" to write parameters or give the start and frequency commands via RS-485 terminals in the Network operation mode.

- NOTE

• In the initial setting, "9999" (communication option automatic recognition) is set for **Pr.550**. Thus, if the communication option is mounted, parameters cannot be written or the start and frequency commands cannot be sent by communications that use the RS-485 terminals. (Monitoring or parameter reading can be performed.)

Selection of the command source of the PU operation mode (Pr.551)

- Any of the PU connector, RS-485 terminals, or USB connector can be specified as the command source in the PU operation mode.
- To write parameters or execute the start and frequency commands through communication in the PU operation mode, set
 Pr.551 = "1" for communication via the RS-485 terminals, or set Pr.551 = "3" or "9999" for communication via the USB connector.



When Pr.550 = "1" (NET mode RS-485 terminals) and Pr.551 = "1" (PU mode RS-485 terminals), the PU operation mode has a precedence. For this reason, if the communication option is not mounted, switching to the Network operation mode is no longer possible.

| Pr.550 | Pr.551 | | Comman | d source | | |
|--------------------|----------------------------|------------------------------------|------------------------------------|------------------------------------|-------------------------------------|--|
| setting | setting | PU connector | USB connector | RS-485 terminals | Communication option | Remarks |
| | 1 | × | × | PU operation mode ^{*1} | NET operation mode ^{*2} | |
| | 2 | PU operation mode | × | × | NET operation mode ^{*2} | |
| 0 | 3 | × | PU operation mode | × | NET operation mode ^{*2} | |
| | 9999 (initial value) | PU operation mode ^{*3} | PU operation mode ^{*3} | × | NET operation mode ^{*2} | |
| | 1 | × | × | PU operation mode ^{*1} | × | Switching to NET operation mode disabled |
| | 2 | PU operation mode | × | NET operation mode | × | |
| 1 | 3 | × | PU operation mode | NET operation mode | × | |
| | 9999 (initial value) | PU operation mode ^{*3} | PU operation mode ^{*3} | NET operation mode | × | |
| | 1 | × | × | PU operation mode ^{*1} | NET operation mode ^{*2} | |
| | 2 | PU operation mode | × | × | NET operation mode ^{*2} | With communication option |
| 9999 | 2 | | | NET operation mode | × | Without communication option |
| (initial value) | 3 | × | PU operation mode | × | NET operation mode ^{*2} | With communication option |
| , | PU operation mo | | | NET operation mode | × | Without communication option |
| | 9999 (initial | PU operation | PU operation | × | NET operation mode ^{*2} | With communication option |
| | value) | mode ^{*3} | mode ^{*3} | NET operation mode | × | Without communication option |

· Changed setting values are enabled at power-ON or inverter reset.

*1 The MODBUS RTU protocol cannot be used in the PU operation mode. To use the MODBUS RTU protocol, set Pr.551 = "2".

*2 If the communication option is not mounted, switching to the NET operation mode is not possible.

*3 When **Pr.551** = "9999", the priority of the PU command source is USB connector > PU connector.

Controllability through communication

| | | | | | Controllability | in each opera | tion mode | |
|----------------------|-----------------------------------|--|-----------------|--------------------|--|--|--|---|
| Command interface | Conditions (Pr.551 setting) | Item | PU operation | External operation | Combined operation mode 1 (Pr.79 = "3") | Combined operation mode 2 (Pr.79 = "4") | NET operation (via RS-485 terminals) ^{*7} | NET operation (via option) ^{*8} |
| | | Operation (start) | 0 | × | × | 0 | × | · |
| | 2 (PU connector), | command Operation (stop) command | 0 | Δ*4 | Δ*4 | 0 | Δ*4 | |
| | 9999 | Frequency setting | 0 | × | 0 | × | × | |
| | (automatic recognition, | Monitor | 0 | 0 | 0 | 0 | 0 | |
| | without USB | Parameter writing | ° ^{*5} | × ^{*6} | ° ₅ | ° ^{*5} | × ^{*6} | |
| | connection) | Parameter read | 0 | 0 | 0 | 0 | 0 | |
| PU | | Inverter reset | 0 | 0 | 0 | 0 | 0 | |
| connector*1 | | Operation (start) command | × | × | × | × | × | |
| | Terminals | Operation (stop) command | Δ ^{*4} | Δ^{*4} | $\Delta^{\star 4}$ | Δ ^{*4} | Δ*4 | |
| | other than | Frequency setting | × | × | × | × | × | |
| | the above | Monitor | 0 | 0 | 0 | 0 | 0 | |
| | | Parameter writing | × ^{*6} | × ^{*6} | × ^{*6} | × ^{*6} | ×*6 | |
| | | Parameter read | 0 | 0 | 0 | 0 | 0 | |
| | | Inverter reset | 0 | 0 | 0 | 0 | 0 | |
| | | Operation command (start, stop) | 0 | × | × | 0 | × | |
| | 1 (RS-485 terminals) | Frequency setting | 0 | × | 0 | × | × | |
| | | Monitor | 0 | 0 | 0 | 0 | 0 | |
| | | Parameter writing | ° ^{*5} | × ^{*6} | ° ^{*5} | ° ^{*5} | ×*6 | |
| | | Parameter read | 0 | 0 | 0 | 0 | 0 | |
| RS-485 terminals | | Inverter reset Operation command (start, stop) | • × | • × | • × | 。 × | ° °*2 | × |
| | | Frequency setting | × | × | × | × | ° ^{*2} | × |
| | Terminals other than | Monitor | 0 | 0 | 0 | 0 | 0 | 0 |
| | the above | Parameter writing | × ^{*6} | × ^{*6} | ×*6 | ×*6 | ° ^{*5} | ×*6 |
| | | Parameter read | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Inverter reset | × | × | × | × | o ^{*3} | × |
| | 3 (USB | Operation command (start, stop) | 0 | × | × | 0 | × | |
| | connector), 9999 | Frequency setting | 0 | × | 0 | × | × | |
| | (automatic | Monitor | 0 | 0 | 0 | 0 | 0 | |
| | recognition, | Parameter writing | °*5 | × ^{*6} | × ^{*6} | × ^{*6} | × ^{*6} | |
| | with USB | Parameter read | 0 | 0 | 0 | 0 | 0 | |
| USB | connection) | Inverter reset | 0 | 0 | 0 | 0 | 0 | |
| connector | | Operation command (start, stop) | × | × | × | × | × | |
| | Terminals | Frequency setting | × | × | × | × | × | |
| | other than | Monitor | 0 | 0 | 0 | 0 | 0 | |
| | the above | Parameter writing | × ^{*6} | × ^{*6} | × ^{*6} | ×*6 | ×*6 | |
| | | Parameter read | 0 | 0 | 0 | 0 | 0 | |
| | | Inverter reset | 0 | 0 | 0 | 0 | 0 | |
| | | Operation command (start, stop) | × | × | × | × | × | ° ^{*2} |
| | | Frequency setting | × | × | × | × | × | ° ^{*2} |
| Option | — | Monitor | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Parameter writing | × ^{*6} | × ^{*6} | × ^{*6} | × ^{*6} | ×*6 | ° ^{*5} |
| | | Parameter read | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Inverter reset | × | × | × | × | × | ° ^{*3} |

| | | | Controllability in each operation mode | | | | | | |
|----------------------|-----------------------------------|---------------------------------|--|--------------------|--|--|--|---|--|
| Command interface | Conditions (Pr.551 setting) | ltem | PU operation | External operation | Combined operation mode 1 (Pr.79 = "3") | Combined operation mode 2 (Pr.79 = "4") | NET operation (via RS-485 terminals) ^{*7} | NET operation (via option) ^{*8} | |
| External | | Inverter reset | 0 | 0 | 0 | 0 | 0 | | |
| control | — | Operation command (start, stop) | × | 0 | 0 | × | ×*2 | | |
| terminal | | Frequency setting | × | 0 | × | 0 | ×*2 | | |

o: Valid, ×: Invalid, Δ: Partially valid

- *1 RS-485 communication via PU connector
- *2 Follows the **Pr.338 Communication operation command source** and **Pr.339 Communication speed command source** settings. (Refer to page 251.)
- *3 At occurrence of RS-485 communication error, the inverter cannot be reset from the computer.
- *4 Only PU stop is enabled. "PS" is displayed on the operation panel during PU stop. The operation follows the **Pr.75 Reset selection**/ disconnected PU detection/PU stop selection setting. (Refer to page 196.)
- *5 Writing of some parameters may be disabled by the Pr.77 Parameter write selection setting and the operating condition. (Refer to page 206.)
- *6 Some parameters are write-enabled independently of the operation mode and command source presence/absence. Writing is also enabled when Pr.77 = "2"
 - (refer to page 206). Parameter clear is disabled.
- *7 When **Pr.550 NET mode operation command source selection** = "1" (RS-485 terminals enabled), or **Pr.550 NET mode operation command source selection** = "9999" with no communication option connected.
- *8 When Pr.550 NET mode operation command source selection = "0" (communication option enabled), or Pr.550 NET mode operation command source selection = "9999" with communication option connected.

Operation when a communication error occurs

| | | | Operation i | in each operat | ion mode at er | ror occurrences | | | |
|---|---|----------------------------------|--------------------------------|--|--|--|--|--|--|
| Fault type | Conditions (Pr.551 setting) | PU operation | External operation | Combined operation mode 1 (Pr.79 = "3") | Combined operation mode 2 (Pr.79 = "4") | NET operation (via RS-485 terminals) ^{*5} | NET operation (via option) ^{*6} | | |
| Inverter fault | — | Stop | | | | | | | |
| PU connector disconnection | 2 (PU connector), 9999 (automatic recognition) | Stop/continued* | 1*4 | | | | | | |
| | Other than 2 | Stop/continued* | 1 | | | | | | |
| Communication error | 2 (PU connector) | Stop/ continued ^{*2} | Continued Stop/ continued*2 | | | Continued | | | |
| | Other than 2 | Continued | | | | | | | |
| Communication error | 1 (RS-485 terminals) | Stop/ continued ^{*2} | Continued | | Stop/ continued ^{*2} | Continued | | | |
| at RS-485 terminals | Other than 1 | Continued | • | | · | Stop/ continued ^{*2} | Continued | | |
| Communication error at USB connector | 3 (USB connector), 9999 (automatic recognition) | Stop/ continued ^{*2} | Continued | | | | | | |
| | Other than 3 | Continued | | | | | | | |
| Communication error at communication option | — | Continued | | | | | Stop/ continued ^{*3} | | |

*1 Selectable with Pr.75 Reset selection/disconnected PU detection/PU stop selection.

*2 Selectable with Pr.122 PU communication check time interval, Pr.336 RS-485 communication check time interval, and Pr.548 USB communication check time interval.

*3 The operation depends on the communication option setting.

*4 In the PU JOG operation mode, operation always stops when the PU is disconnected. The operation at a PU disconnection fault (E.PUE) occurrence is as set in **Pr.75 Reset selection/disconnected PU detection/PU stop selection**.

*5 When **Pr.550 NET mode operation command source selection** = "1" (RS-485 terminals enabled), or **Pr.550 NET mode operation command source selection** = "9999" with no communication option connected.

*6 When **Pr.550 NET mode operation command source selection** = "0" (communication option enabled), or **Pr.550 NET mode operation** command source selection = "9999" with communication option connected.

Selecting the command interface in the Network operation mode (Pr.338, Pr.339)

- Selecting a command interface is required for the following two types of commands: the operation command using the start signals and the signals related to the inverter function selection, and the speed command using signals related to the frequency setting.
- The following table shows the command interface for each function in the Network operation mode, determined by the parameter settings: an external terminal or a communication interface (RS-485 terminals or communication option).

| Pr.338 | Communication operation command source | 0: NET | | | 1: EXT | | | Damada |
|---|--|-----------|-----------|-----------|-----------|-----------|-----------|--|
| Pr.339 C | ommunication speed command source | 0: NET | 1: EXT | 2: EXT | 0: NET | 1: EXT | 2: EXT | Remarks |
| Running frequency command given through communication | | NET | — | NET | NET | — | NET | |
| Terminal 2 | <u>.</u> | — | EXT | — | — | EXT | — | |
| Terminal 4 | l. | — | EXT | | — | EXT | | |
| Terminal 1 | | Comp | ensatio | on | | | | |
| RL ^{*1} | Low-speed operation command / Remote setting (setting clear) | NET | EXT | | NET | EXT | | Pr.59 = "0": multi-speed setting |
| RM ^{*1} | Middle-speed operation command / Remote setting (deceleration) | NET | EXT | | NET | EXT | | function. Pr.59 \neq "0": remote function. |
| RH ^{*1} | High-speed operation command / Remote setting (acceleration) | NET | EXT | | NET | EXT | | |
| RT ^{*1} | Second function selection | NET | | | EXT | | | |
| AU ^{*1} | Terminal 4 input selection | — | Comb | oined | — | Comb | ined | |
| JOG ^{*1} | Jog operation selection | _ | | | EXT | | | |
| CS ^{*1} Selection of automatic restart after instantaneous power failure / flying start | | EXT o | or NET | | EXT | | | External or Network is selected according to the setting in Pr.162 . (The emergency electronic bypass is enabled only when the command source is External.) ^{*2} |
| ОН ^{*1} | External thermal relay input | EXT | | | | | | |
| REX ^{*1} | 15-speed selection | NET | EXT | | NET | EXT | | Pr.59 = "0": multi-speed setting function. |
| X10 ^{*1} | Inverter run enable | EXT | | | | | | |
| X11 ^{*1} | FR-HC2/FR-CC2 connection, instantaneous power failure detection | EXT | | | | | | |
| X12 ^{*1} | PU operation external interlock | EXT | | | | | | |
| X13 ^{*1} | External DC injection brake operation start | NET | | | EXT | | | |
| X14 ^{*1} | PID control valid | NET | EXT | | NET | EXT | | |
| X16 ^{*1} | PU/External operation switchover | EXT | | | | | | |
| X18 ^{*1} | V/F switchover | NET | | | EXT | | | |
| | Output stop | Comb | oined | | EXT | | | When Pr.79 ≠ "7" |
| MRS ^{*1} | PU operation interlock | EXT | | | | | | When Pr.79 = "7", or when the X12 signal is not assigned. |
| STP (STOP) ^{*1} | Start self-holding selection | _ | | | EXT | | | |
| X28 ^{*1} | Start-time tuning start external input | NET | | EXT | | | | |
| X37 ^{*1} | Traverse function selection | NET | | EXT | | | | |
| PDI1 ^{*1} | PID multistage set point setting 1 | NET | EXT | | NET | EXT | | |
| PDI2 ^{*1} | PID multistage set point setting 2 | NET | EXT | | NET | EXT | | |
| PDI3 ^{*1} | PID multistage set point setting 3 | NET | EXT | | NET | EXT | | |
| TRG ^{*1} | Trace trigger input | Comb | | | EXT | 1 | | |
| TRC ^{*1} | Trace sampling start/end | Comb | | | EXT | | | |
| X48 ^{*1} | Power failure stop external | EXT | | | 1 | | | |

| Pr.338 | Communication operation command source | | 0: NET | | | 1: EX1 | • | Demorte |
|--------------------|---|------------|-----------|-----------|-----------|-----------|--|---------|
| Pr.339 C | communication speed command source | 0: NET | 1: EXT | 2: EXT | 0: NET | 1: EXT | 2: EXT | Remarks |
| SQ ^{*1} | Sequence start | EXT or NET | | EXT | EXT | | *When Pr.414 = "1", the interface used for signal input is enabled. When Pr.414 = "2", External is enabled. | |
| X51 ^{*1} | Fault clear | Comb | oined | | EXT | | | |
| JOGF ^{*1} | JOG forward rotation command | — | | | EXT | | | |
| JOGR ^{*1} | JOG reverse rotation command | — | | | EXT | | | |
| STF ^{*1} | Forward rotation command | NET | | | EXT | | | |
| STR ^{*1} | Reverse rotation command | NET | | | EXT | | | |
| RES ^{*1} | Inverter reset | EXT | | | | | | |
| X64 ^{*1} | PID forward/reverse action switchover | NET | EXT | | NET | EXT | | |
| X65 ^{*1} | PU/NET operation switchover | EXT | | | | | | |
| X66 ^{*1} | External/NET operation switchover | EXT | | | | | | |
| X67 ^{*1} | Command source switchover | EXT | | | | | | |
| X70 ^{*1} | DC feeding operation permission signal | NET | | | EXT | | | |
| X71 ^{*1} | DC feeding cancel signal | NET | | | EXT | | | |
| X72 ^{*1} | PID P control switchover | NET | EXT | | NET | EXT | | |
| X73 ^{*1} | Second PID P control switchover | NET | EXT | | NET | EXT | | |
| X77 ^{*1} | Pre-charge end command | NET | EXT | | NET | EXT | | |
| X78 ^{*1} | Second pre-charge end command | NET | EXT | | NET | EXT | | |
| X79 ^{*1} | Second PID forward/reverse action switchover | NET | EXT | | NET | EXT | | |
| X80 ^{*1} | Second PID control valid | NET | EXT | | NET | EXT | | |
| PGT ^{*1} | PID gain tuning start/forced end | NET | EXT | | NET | EXT | | |
| X84 ^{*1} | Emergency drive execution command | Comb | ined | | | | | |
| X94 ^{*1} | Control signal input for main circuit power supply MC | EXT | | | | | | |
| X95 ^{*1} | Converter unit fault input | EXT | | | | | | |
| X96 ^{*1} | Converter unit fault (E.OHT, E.CPU) input | EXT | | | | | | |
| X97 ^{*1} | Cleaning valid | NET | | | EXT | | | |
| X98 ^{*1} | Cleaning trigger | NET | | | EXT | | | |
| RLF ^{*1} | Low-speed forward rotation command | — | | | — | EXT | | |
| RLR ^{*1} | Low-speed reverse rotation command | — | | | — | EXT | | |

*1 Use Pr.178 to Pr.189 (Input terminal function selection) to assign the function to an input terminal. (Refer to page 373.)

*2 When **Pr.77** = "2", **Pr.162** setting can be changed during operation. The new setting is applied after stop. Until the inverter has stopped, the previous setting of the interface for the operation command and the speed command in the Network operation mode is valid.

[Explanation of Terms in Table]

EXT: External terminal only

NET: Communication interface only

Combined: Either external terminal or communication interface

-: Neither external terminal nor communication interface

Compensation: Only commands given via the external terminal are valid when Pr.28 Multi-speed input compensation selection = "1".

- NOTE

- The communication interface selection is determined by the setting of Pr.550 and Pr.551.
- The setting of **Pr.338** and **Pr.339** can be changed during operation when **Pr.77** = "2". Note that the changed setting is applied after the inverter has stopped. Until the inverter has stopped, the previous setting of the interface for the operation command and the speed command in the Network operation mode is valid.

Changing the command interface using a signal input via external terminal (X67 signal)

- In the Network operation mode, the command interface for the operation command and the speed command can be changed using the Command source switchover (X67) signal. This method may be useful to use both external terminal and communication interface by using a different interface according to the command type.
- For the X67 signal, set "67" to any parameter from Pr.178 to Pr.189 (Input terminal function selection) to assign the function to a control terminal.
- When the X67 signal is OFF, the command interface for the operation command and the speed command is the control terminal.

| X67 signal state | Interface for the operation command | Interface for the speed command | | | |
|---------------------|-------------------------------------|-------------------------------------|--|--|--|
| Signal not assigned | Determined by Pr.338 setting | Determined by Pr.339 setting | | | |
| ON | Determined by F1.550 setting | Determined by P1.339 setting | | | |
| OFF | Control terminal only | | | | |

• NOTE

- The ON/OFF state of the X67 signal is applied only during a stop. When the terminals are switched during operation, the ON/ OFF state is reflected after a stop.
- When the X67 is OFF, a reset via communication is disabled.
- · Changing the terminal assignment using Pr.178 to Pr.189 (Input terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to N

Pr.28 Multi-speed input compensation selection F page 263

Pr.59 Remote function selection ☞ page 228 Pr.79 Operation mode selection ☞ page 240

Reverse rotation prevention selection 5.6.4

This function can prevent reverse rotation fault resulting from the incorrect input of the start signal.

| Pr. | Name | Initial value | Setting range | Description |
|------------|--|---------------|---------------|--|
| 70 | Devene e notation | | 0 | Both forward and reverse rotations allowed |
| 78 D020 | Reverse rotation prevention selection | 0 | 1 | Reverse rotation disabled |
| 0020 | prevention selection | | 2 | Forward rotation disabled |

· Set this parameter to limit the motor rotation to only one direction.

· This parameter is valid for all of the reverse rotation and forward rotation keys of the operation panel and of the parameter unit, the start signals (STF, STR signals) via external terminals, and the forward and reverse rotation commands through communication.

5.6.5 Frequency setting using pulse train input

A pulse train input via terminal JOG can be used to set the inverter's speed command.

Moreover, speed synchronized operation of an inverter can be performed by using the pulse train input and output together.

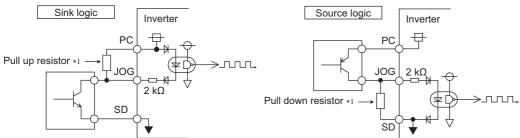
| | | Initial | value | | | Description | |
|-------------|--------------------------------------|---------------------|-------|-------------------|--|---|--------------------------|
| Pr. | Name | FM | CA | Setting range | Pulse train input (Terminal JOG) | Pulse train output (Terminal FM) | |
| | | | | 0 | JOG signal ^{*1} | FM output ^{*2} | |
| | | | | 1 | Pulse train input | FM output ^{*2} | |
| | | ain I/O selection 0 | | 10 ^{*2} | JOG signal ^{*1} | High-speed pulse train output (50% duty) | |
| 291 | | | | 11 ^{*2} | Pulse train input | High-speed pulse train output (50% duty) | |
| D100 | Pulse train I/O selection | | | U | | 20 ^{*2} | JOG signal ^{*1} |
| | | | | 21 ^{*2} | Pulse train input | High-speed pulse train output (ON width fixed) | |
| | | | | 100 ^{*2} | Pulse train input | High-speed pulse train output (ON width fixed). Output the pulse train input without changes. | |
| 384 | Input pulse division | | | 0 | Pulse train input disable | ed | |
| D101 | scaling factor | 0 | | 1 to 250 | Division ratio on the input pulse. The frequency resolution input pulse changes according to this setting. | | |
| 385 D110 | Frequency for zero input pulse | 0 Hz | | 0 to 590 Hz | Set the frequency applic zero (bias). | cable to the time when the input pulse is | |
| 386 D111 | Frequency for maximum input pulse | 60 Hz | 50 Hz | 0 to 590 Hz | Set the frequency applicable to the time when the input pulse is maximum (gain). | | |

*1 Function assigned to **Pr.185 JOG terminal function selection**.

*2 Valid only for the FM type inverters.

Selection of pulse train input (Pr.291)

- Setting **Pr.291 Pulse train I/O selection** = "1, 11, 21, or 100" and **Pr.384 Input pulse division scaling factor** ≠ "0" allows the function of terminal JOG to change into a pulse train input for setting of the inverter frequency. In the initial setting, the JOG signal is assigned to terminal JOG. A maximum pulse train of 100k pulses/s can be input.
- · Connection with an open collector output system pulse generator

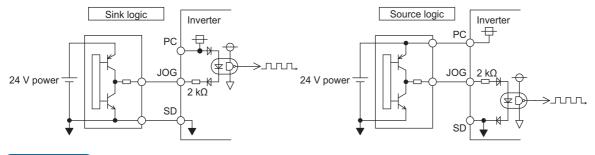


*1 When the wiring length is long with open collector outputs, the influence of stray capacitance causes the pulse to flatten out and prevents the input pulse from being recognized.

When the wiring length is long (10 m or longer of shielded twisted pair cable with a recommended cable gauge of 0.75 mm^2), connect the open collector output signal to the power supply by an external pull-up resistor. The following table shows the reference resistance values for wiring length. The stray capacitance of the wiring changes considerably according to how the cable is laid, thus the above wiring lengths are not guaranteed values. When using a pull-up/down resistor, check the permissible power of the resistor and the permissible load current of the output transistor, and use within the permissible range.

| Wiring length | Less than 10 m | 10 to 50 m | 50 to 100 m |
|--------------------------|----------------|------------|-------------|
| Pull-up/down resistor | Not required | 1 kΩ | 470 Ω |
| Load current (reference) | 10 mA | 35 mA | 65 mA |

· Connection with a complementary output system pulse generator



- ΝΟΤΕ

- When pulse train input is selected, the function assigned to terminal JOG using Pr.185 JOG terminal function selection is disabled.
- **Pr.291** is the selection parameter for pulse train output / FM output. Thus, before changing the setting, check the specifications of the device connected to the terminal FM. (For the pulse train output, refer to page 317.)

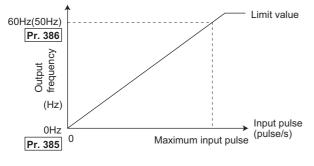
Pulse train input specification

| lt | tem | Specification | | | |
|-------------------------------|------------------------------|---|--|--|--|
| Supported pulse method | | Open collector output / Complementary output (24 V power supply voltage) | | | |
| HIGH input level | | 20 V or more (voltage between JOG and SD) | | | |
| LOW input level | | 5 V or less (voltage between JOG and SD) | | | |
| Maximum input pulse rate | | 100k pulses/s | | | |
| Minimum input pulse width | | 2.5 µs | | | |
| Input resistance/load current | | 2 kΩ (typ) / 10 mA (typ) | | | |
| Maximum wiring length | Open collector output method | 10 m (0.75 mm ² /twisted pair) | | | |
| (reference value) | Complementary output method | 100 m (output resistance 50 Ω) ^{*1} | | | |
| Detection resolution | | 1/3750 | | | |

*1 The wiring length of complementary output is dependent on the output wiring specification of the complementary output unit. The stray capacitance of the wiring changes considerably according to how the cable is laid, so the maximum wiring length is not a guaranteed value.

Adjustment of pulse train and frequency (Pr.385, Pr.386)

• The frequency during zero input pulse and maximum input pulse can be set with **Pr.385 Frequency for zero input pulse** and **Pr.386 Frequency for maximum input pulse**, respectively.



*1 Limit value = (**Pr.386 - Pr.385**) × 1.1 + **Pr.385**

How to calculate the input pulse division scaling factor (Pr.384)

The maximum number of input pulses can be calculated by the following formula with **Pr.384 Input pulse division scaling factor**:

Maximum number of pulses (pulse/s) = Pr.384 × 400 (maximum 100k pulses/s)

(number of detectable pulses = 11.45 pulses/s)

For example, to run the invert at 0 Hz when pulse train input is zero and at 30 Hz when pulse train is 4000 pulses/sec, set the inverter as follows:

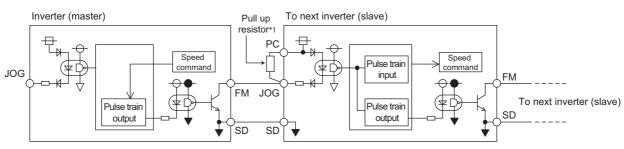
Pr.384 = 10 (maximum number of input pulses 4000 pulses/s)

Pr.385 = 0 Hz, Pr.386 = 30 Hz (pulse train limit value 33 Hz)



• The priority of the frequency command given by the external signals is as follows: JOG operation > multi-speed operation > terminal 4 analog input > pulse train input. When pulse train input is enabled (**Pr.291** = "1, 11, 21, or 100" and **Pr.384** ≠ "0"), terminal 2 analog input becomes disabled.

Speed synchronized operation by pulse input/output



*1 When the wiring length between FM and JOG is long, the influence of stray capacitance causes the pulse to flatten out and prevents the input pulse from being recognized. When the wiring length is long (10 m or longer of shielded twisted pair cable with a recommended cable size of 0.75 mm²), connect between terminal JOG and terminal PC with an external pull-up resistor. The following table shows the reference resistance values for wiring length.

The stray capacitance of the wiring changes considerably according to how the cable is laid, thus the following wiring lengths are not guaranteed values.

When using a pull-up/down resistor, check the permissible power of the resistor and the permissible load current (terminal PC: 100 mA, highspeed pulse train output: 85 mA), and use within the permissible range.

| Wiring length | Less than 10 m | 10 to 50 m | 50 to 100 m |
|--------------------------|----------------|------------|-------------|
| Pull-up resistor | Not required | 1 kΩ | 470 Ω |
| Load current (reference) | 10 mA | 35 mA | 65 mA |

• Setting "100" in **Pr.291** allows the use of the entire pulse train input for the pulse train output (via terminal FM) just as they are.

Connecting in a daisy chain enables speed synchronized operation of multiple inverters.

- Set Pr.384 to "125" for inverters that receive pulse train since the maximum pulse train output is 50k pulses/s.
- The maximum number of input pulses should be 50k pulses/s.
- When performing synchronized operation, wire according to the following procedure. (This is to prevent contact input of 24 V being applied to terminal FM.)
 - **1.** Set pulse train output (setting other than "0 or 1") to **Pr.291** on the master side inverter.
 - 2. Inverter power OFF
 - 3. Wire the slave side terminal JOG-SD to the master side terminal FM-SD.
 - **4.** Turn the inverter power supply ON.

NOTE

- After changing the Pr.291 setting, connect the JOG terminal to the terminal FM-SD. When FM output (voltage output) is taken
 as the pulse train, take caution to prevent voltage from being applied to the terminal FM.
- · Use sink logic (factory setting) for the slave side inverter. The inverter does not operate properly with source logic.

Speed synchronized operation specification

| Item | Specification |
|-------------------------|----------------------------------|
| Output pulse format | Pulse width fixed (10 µs) |
| Pulse rate | 0 to 50k pulses/s |
| Pulse propagation delay | 1 to 2 µs per unit ^{*1} |

*1 A pulse propagation delay of about 1 to 2 μs in the slave occurs and further increases when the wiring length is long.

Parameters referred to

Pr.291 (Pulse train I/O selection) I page 314

5.6.6 JOG operation

The frequency and acceleration/deceleration time for JOG operation can be set. JOG operation is possible in both External operation and PU.

JOG operation can be used for conveyor positioning, test operation, etc.

| Pr. | Name | Initial value | Setting range | Description |
|------------|--|------------------|---------------|--|
| 15 D200 | Jog frequency | 5 Hz | 0 to 590 Hz | Set the frequency for JOG operation. |
| 16 F002 | Jog acceleration/ deceleration time | 0.5 s | 0 to 3600 s | Set the motor acceleration/deceleration time during JOG operation. For the acceleration/deceleration time, set the time until the frequency ^{*1} set in Pr.20 Acceleration/deceleration reference frequency is reached. The acceleration/deceleration times cannot be set separately. |

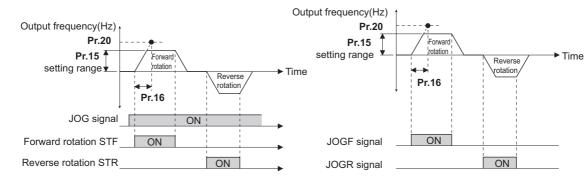
Note that these parameters are categorized as a simple mode parameter when the LCD operation panel (FR-LU08) or the parameter unit (FR-PU07) is used. Setting of this parameter is enabled when the operation panel (FR-DU08) is connected and "0" is set to **Pr.160 User group read selection**. (Refer to page 215.)

*1 The **Pr.20** initial value is set to 60 Hz for the FM type and to 50 Hz for the CA type.

JOG operation using the external signals

- Operation can be started and stopped by the start signals (STF and STR signals) when the Jog operation selection (JOG) signal is ON. (For the operation method, refer to page 136.)
- While the JOGF or JOGR signal is input, Jog frequency setting (**Pr.15**) is used for operation. The rotation is forward while the JOGF signal is input, and the rotation is reverse while the JOGR signal is input. (Direct JOG function)
- Use the JOG acceleration/deceleration time function (Pr.16) to set the acceleration/deceleration time for JOG operation.
- To use each signal, set the corresponding number selected from the following table in any parameter from **Pr.178 to Pr.189 (Input terminal function selection)** to assign the function to an output terminal.

| Input signal | Pr.178 to Pr.189 settings |
|--------------|----------------------------------|
| JOG | 5 (Pr.185 initial value) |
| JOGF | 57 |
| JOGR | 58 |



JOG operation using the PU

• When the operation panel or parameter unit is in the JOG operation mode, the motor jogs only while the start button is pressed. (For the operation method, refer to page 137.)



- The reference frequency during acceleration/deceleration depends on the **Pr.29 Acceleration/deceleration pattern** selection setting. (Refer to page 231.)
- The Pr.15 setting should be equal to or higher than the Pr.13 Starting frequency setting.
- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.
- During JOG operation, the second acceleration/deceleration function using the RT signal is disabled. (Other second functions are enabled (refer to page 377).)
- When the JOGR or STR signal is input while the JOGF signal is input, the motor is decelerated to stop.
- When the JOGF or STF signal is input while the JOGR signal is input, the motor is decelerated to stop.
- The three-wire type connection is not available for the JOGF and JOGR signals.
- When **Pr.79 Operation mode selection** = "4", JOG operation is started by one push of **FWD** / **REV** on the operation panel

and stopped by

- This function is invalid when **Pr.79** = "3".
- To perform the JOG operation using the external signals, select the setting of "JOG signal" for the input via terminal JOG in **Pr.291 Pulse train I/O selection**. (Refer to page 258.)

Parameters referred to

- Pr.13 Starting frequency F page 238
- Pr.20 Acceleration/deceleration reference frequency, Pr.21 Acceleration/deceleration time increments 🖙 page 228
- Pr.29 Acceleration/deceleration pattern selection page 231
- Pr.79 Operation mode selection page 240
- Pr.178 to Pr.189 (Input terminal function selection) 🖙 page 373

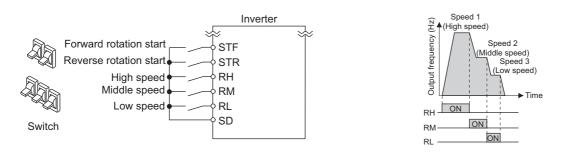
5.6.7 Operation by multi-speed setting

Use these parameters to change among pre-set operation speeds with the terminals. The speeds are pre-set with parameters. Any speed can be selected by simply turning ON/OFF the contact signals (RH, RM, RL, and REX signals).

| Pr. | Name | Initia | value | Cotting rouge | Description |
|-------------|------------------------------------|--------|---------------------|------------------------|---|
| Pr. | Name | FM | CA | Setting range | Description |
| 28 | Multi-speed input compensation | 0 | | 0 | Without compensation |
| D300 | selection | 0 | | 1 | With compensation |
| 4 D301 | Multi-speed setting (high speed) | 60 Hz | 50 Hz | 0 to 590 Hz | Sets the frequency when RH is ON. |
| 5 D302 | Multi-speed setting (middle speed) | 30 Hz | | 0 to 590 Hz | Sets the frequency when RM is ON. |
| 6 D303 | Multi-speed setting (low speed) | 10 Hz | | 0 to 590 Hz | Sets the frequency when RL is ON. |
| 24 D304 | Multi-speed setting (speed 4) | | | | |
| 25 D305 | Multi-speed setting (speed 5) | | | | |
| 26 D306 | Multi-speed setting (speed 6) | | | | |
| 27 D307 | Multi-speed setting (speed 7) | 9999 | | 1999 0 to 590 Hz. 9999 | |
| 232 D308 | Multi-speed setting (speed 8) | | | | |
| 233 D309 | Multi-speed setting (speed 9) | | | | Frequency from 4th speed to 15th speed can be set according to the combination of the RH, |
| 234 D310 | Multi-speed setting (speed 10) | 9999 | 9 0 10 590 HZ, 9999 | 0 10 390 112, 9999 | RM, RL and REX signals. 9999: Not selected |
| 235 D311 | Multi-speed setting (speed 11) | | | | |
| 236 D312 | Multi-speed setting (speed 12) | | | | |
| 237 D313 | Multi-speed setting (speed 13) | | | | |
| 238 D314 | Multi-speed setting (speed 14) | | | | |
| 239 D315 | Multi-speed setting (speed 15) | | | | |

Multi-speed setting (Pr.4 to Pr.6)

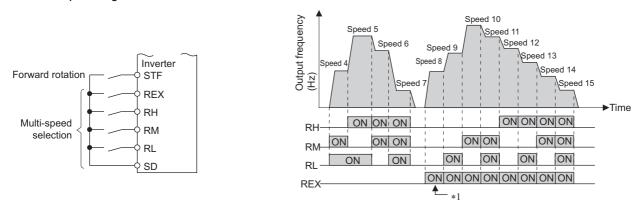
 The inverter operates at frequencies set in Pr.4 when the RH signal is ON, Pr.5 when the RM signal is ON, or Pr.6 when the RL signal is ON.



- In the initial setting, if two or more speed switches (signals) are simultaneously turned ON, priority is given to the switch (signal) for the lower speed. For example, when both RH and RM signals turn ON, the RM signal (**Pr.5**) has the higher priority.
- The RH, RM and RL signals are assigned to the terminals RH, RM and RL, respectively, in the initial status. To assign each signal to a different terminal, set "0" (RL signal), "1" (RM signal), or "2" (RH signal) in any parameter from **Pr.178 to Pr.189** (Input terminal function selection).

Multi-speed setting for 4th speed or more (Pr.24 to Pr.27, Pr.232 to Pr.239)

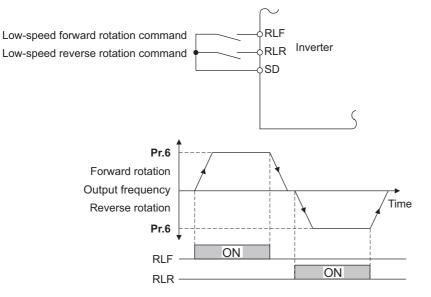
- The frequency from 4th speed to 15th speed can be set according to the combination of the RH, RM, RL, and REX signals. Set the frequencies in **Pr.24 to Pr.27**, **Pr.232 to Pr.239**. (In the initial status, 4th to 15th speeds are invalid.)
- For the terminal used for REX signal input, set "8" in any parameter from **Pr.178 to Pr.189 (Input terminal function** selection) to assign the function.



*1 When the RH, RM and RL signals are OFF and the REX signal is ON while "9999" is set to **Pr.232 Multi-speed setting (speed 8)**, the inverter operates at the frequency set in **Pr.6**.

Direct multi-speed setting

• While the RLF or RLR signal is input, the operation is according to **Pr.6 Multi-speed setting (low-speed)**. The rotation is forward while the RLF signal is input, and the rotation is reverse while the RLR signal is input.



- The Pr.6 setting should be equal to or higher than the Pr.13 Starting frequency setting.
- To assign the RLF and RLR signals to input terminals, set "128 (RLF)" and "129 (RLR)" in any two parameters from **Pr.178 to Pr.189 (Input terminal function selection)**.
- The direct multi-speed operation is enabled when the inverter operates in External operation mode or External/PU combined operation mode 1.
- When the RLR or STR signal is input while the RLF signal is input, the motor is decelerated to stop.
- When the RLF or STF signal is input while the RLR signal is input, the motor is decelerated to stop.
- When **Pr.59 Remote function selection** ≠ "0", the RLF signal is used as the STF signal, and the RLR signal is used as the STR signal.

Input compensation of multi-speed setting (Pr.28)

• Speed (frequency) can be compensated for the multi-speed setting and the remote setting by inputting the frequency setting compensation signal (terminals 1, 2).



- The priority of the frequency commands given by the external signals is as follows: JOG operation > multi-speed operation > terminal 4 analog input > pulse train input > terminal 2 analog input. (For details on frequency commands given by analog input, refer to page 357.)
- · The input compensation of multi-speed setting is enabled when the inverter is in the External operation mode or PU/External combined operation mode (Pr.79 = "3 or 4").
- Multi-speed parameters can also be set during PU operation or External operation.
- The Pr.24 to Pr.27 and Pr.232 to Pr.239 settings have no priority among them.
- When Pr.59 Remote function selection ≠ "0", the multi-speed setting is invalid since the RH, RM, and RL signals are for remote setting.
- · When performing analog input compensation, set Pr.28 Multi-speed input compensation selection to "1".
- Select the terminals (terminals 1, 2) to use for compensation input voltage (0 to ± 5 V, 0 to ± 10 V) at Pr.73 Analog input selection
- When using terminal 1 for compensation input, set Pr.868 Terminal 1 function assignment = "0 (initial value)".
- · Changing the terminal assignment using Pr.178 to Pr.189 (Input terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

- Pr.15 Jog frequency range 261 Pr.59 Remote function selection range 234
- Pr.73 Analog input selection ISP page 349 Pr.79 Operation mode selection ISP page 240
- Pr.178 to Pr.189 (Input terminal function selection) F page 373
- Pr.868 Terminal 1 function assignment F page 352

5.7 (H) Protective function parameter

| Purpose | Pa | rameter to set | | Refer to page |
|--|--|---|---|---------------|
| To protect the motor from overheating | Electronic thermal O/L relay | P.H000, P.H006, P.H010, P.H016, P.H020, P.H021 | Pr.9, Pr.51, Pr.561, Pr.607, Pr.608, Pr.1016 | 266 |
| To set the overheat protection characteristics for the motor | Free thermal O/L relay | P.H001 to P.H005, P.H011 to P.H015 | Pr.600 to Pr.604, Pr.692 to Pr.696 | 272 |
| To extend the life of the cooling fan | Cooling fan operation selection | P.H100 | Pr.244 | 273 |
| To detect an earth (ground) fault at start | Earth (ground) fault detection at start | P.H101 | Pr.249 | 274 |
| To vary the operating level of the undervoltage protective function | Undervoltage level | P.H102 | Pr.598 | 275 |
| To initiate an inverter protective function | Fault initiation | P.H103 | Pr.997 | 275 |
| To disable the I/O phase loss protective function | I/O phase loss protection selection | P.H200, P.H201 | Pr.251, Pr.872 | 276 |
| To restart using the retry function when the protective function is activated | Retry operation | P.H300 to P.H303 | Pr.65, Pr.67 to Pr.69 | 276 |
| To operate without activating protective functions in case of emergency | Emergency drive | P.H320 to P.H324, P.A001, P.A004, P.A702 | Pr.57, Pr.136, Pr.139, Pr.514, Pr.515, Pr.523, Pr.524, Pr.1013 | 279 |
| To check faulty area in the internal storage device | Internal storage device status indication | P.H325 | Pr.890 | 287 |
| To set the upper and lower limits of the output frequency | Maximum/minimum frequency | P.H400 to P.H402 | Pr.1, Pr.2, Pr.18 | 287 |
| To operate avoiding resonance points | Frequency jump | P.H420 to P.H425, P.H429 | Pr.31 to Pr.36, Pr.552 | 289 |
| To limit the output current so that the inverter protective function does not activate | Stall prevention | P.H500, P.H501, P.H600, P.H601, P.H610, P.H611, P.H620, P.H621, P.H631, P.M430, P.T010, P.T040 | Pr.22, Pr.23, Pr.48, Pr.49, Pr.66, Pr.148, Pr.149, Pr.154, Pr.156, Pr.157, Pr.858, Pr.868 | 290 |
| To monitor for load faults | Load characteristics fault detection | P.H520 to P.H527, P.H531 to P.H535 | Pr.1480 to Pr.1492 | 298 |
| To shut off output if the operation panel disconnects | Overspeed detection level | P.H800 | Pr.374 | 302 |

5.7.1 Motor overheat protection (electronic thermal O/L relay)

Set the current of the electronic thermal relay function to protect the motor from overheating. Such settings provide the optimum protective characteristic considering the low cooling capability of the motor during low-speed operation.

| Pr. | Name | Initial value | Setting range | Description |
|------|------------------------------|----------------|---------------------------|--|
| 9 | Electronic thermal O/L relay | Inverter rated | 0 to 500 A ^{*1} | Set the rated motor current. |
| H000 | Electronic thermal O/L relay | current | 0 to 3600 A ^{*2} | |
| 600 | First free thermal reduction | 9999 | 0 to 590 Hz | |
| H001 | frequency 1 | 9999 | 9999 | |
| 601 | First free thermal reduction | 100% | 1% to 100% | The electronic thermal O/L relay operation level can |
| H002 | ratio 1 | 100 /8 | 9999 | be changed to match the motor temperature |
| 602 | First free thermal reduction | 9999 | 0 to 590 Hz | characteristics with the combination of these three |
| H003 | frequency 2 | 3333 | 9999 | points (Pr.600, Pr.601), (Pr.602, Pr.603), (Pr.604, |
| 603 | First free thermal reduction | 100% | 1% to 100% | Pr.9). |
| H004 | ratio 2 | | 9999 | 9999: Free thermal O/L relay invalid |
| 604 | First free thermal reduction | 9999 | 0 to 590 Hz | |
| H005 | frequency 3 | 3333 | 9999 | |

| Pr. | Name | Initial value | Setting range | Description |
|--------------|--|---------------|---------------------------|--|
| 607 H006 | Motor permissible load level | 150% | 110% to 250% | Set the permissible load according to the motor characteristics. |
| -4 | | | 0 to 500 A ^{*1} | Enabled when the RT signal is ON. |
| 51 H010 | Second electronic thermal O/L relay | 9999 | 0 to 3600 A ^{*2} | Set the rated motor current. |
| | | | 9999 | Second electronic thermal O/L relay invalid |
| 692 | Second free thermal reduction | 9999 | 0 to 590 Hz | |
| H011 | frequency 1 | 3333 | 9999 | |
| 693 | Second free thermal reduction | 100% | 1% to 100% | The electronic thermal O/L relay operation level can |
| H012 | ratio 1 | 100 /0 | 9999 | be changed to match the second motor temperature |
| 694 | Second free thermal reduction | 9999 | 0 to 590 Hz | characteristics with the combination of these three |
| H013 | frequency 2 | | 9999 | points (Pr.692, Pr.693), (Pr.694, Pr.695), (Pr.696 , |
| 695 | Second free thermal reduction | 100% | 1% to 100% | Pr.51) when the RT signal is ON. 9999: Second free thermal O/L relay invalid |
| H014 | ratio 2 | | 9999 | |
| 696 | Second free thermal reduction | 9999 | 0 to 590 Hz | |
| H015 | frequency 3 | 3333 | 9999 | |
| 608 | Second motor permissible load | 9999 | 110% to 250% | Set the permissible frequency when the RT signal is ON. |
| H016 | level | 9999 | 9999 | The Pr.607 setting is applied even when the RT signal is ON. |
| 561 | PTC thermistor protection level | 9999 | 0.5 to 30 kΩ | Set the PTC thermistor protection level (resistance). |
| H020 | | 3333 | 9999 | PTC thermistor protection disabled |
| 1016 H021 | PTC thermistor protection detection time | 0 s | 0 to 60 s | Set the time from when the resistance of the PTC thermistor reaches the protection level until the protective function is activated. |

*1 The setting range for the FR-F820-02330(55K) or lower and FR-F840-01160(55K) or lower. The minimum setting increment is 0.01 A. *2 The setting range for the FR-F820-03160(75K) or higher and FR-F840-01800(75K) or higher. The minimum setting increment is 0.1 A.

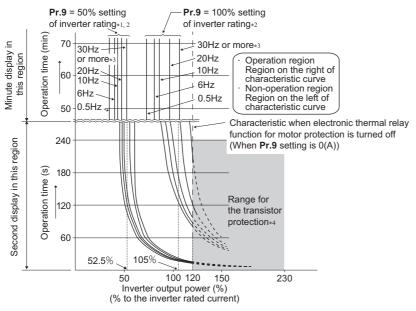
Electronic thermal O/L relay operation characteristic for induction motor

Electronic thermal O/L relay operation characteristic for induction motor (Pr.9)

- This function detects the overload (overheat) of the motor and shut off the inverter output by stopping the operation of the transistor at the inverter output side.
- Set the rated current (A) of the motor in **Pr.9 Electronic thermal O/L relay**. (If the motor has both 50 Hz and 60 Hz ratings and the **Pr.3 Base frequency** is set to 60 Hz, set to 1.1 times the 60 Hz rated motor current.)
- Set "0" in **Pr.9** to avoid activating the electronic thermal relay function; for example, when using an external thermal relay for the motor.

(Note that the output transistor protection of the inverter is activated. (E.THT))

• When using the Mitsubishi Electric constant-torque motor, set **Pr.71 Applied motor** = "1, 13 to 16, 50, 53, or 54". (This setting enables the 100% constant-torque characteristic in the low-speed range.)



*1 When setting **Pr.9** to a value (current value) of 50% of the inverter rated current

5

- *2 The % value denotes the percentage to the rated inverter current. It is not the percentage to the rated motor current.
- *3 When the electronic thermal O/L relay of the Mitsubishi Electric constant-torque motor is set, the characteristic curve is as shown in this diagram at 6 Hz or higher. (For selection of the operation characteristic, refer to page 379.)
- *4 Transistor protection is activated depending on the temperature of the heat sink. The protection may be activated even with less than 120% depending on the operating conditions.

- NOTE

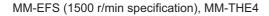
- The internal accumulated heat value of the electronic thermal relay function is reset to the initial value by the inverter's power reset or reset signal input. Avoid unnecessary reset and power-OFF.
- Install an external thermal relay (OCR) between the inverter and motors to operate several motors, a multi-pole motor or a
 dedicated motor with one inverter. When setting an external thermal relay, note that the current indicated on the motor rating
 plate is affected by the line-to-line leakage current. (Refer to page 90.) The cooling effect of the motor drops during low-speed
 operation. Use a thermal protector or a motor with built-in thermistor.
- The protective characteristic of the electronic thermal O/L relay is degraded when there is a large difference in capacity between the inverter and motor, and when the set value is small. In such case, use an external thermal relay.
- · A dedicated motor cannot be protected by an electronic thermal O/L relay. Use an external thermal relay.
- The transistor protection thermal O/L relay is activated early when the Pr.72 PWM frequency selection setting is increased.

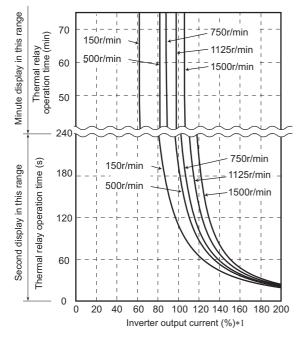
Electronic thermal O/L relay when using IPM motor (Pr.9)

- This function detects the overload (overheat) of the motor and shut off the inverter output by stopping the operation of the transistor at the inverter output side.
- Set the rated current (A) of the motor in **Pr.9 Electronic thermal O/L relay**. Performing IPM parameter initialization automatically sets the rated current of the IPM motor. (Refer to page 185.)
- Set "0" in **Pr.9** to avoid activating the electronic thermal relay function; for example, when using an external thermal relay for the motor.

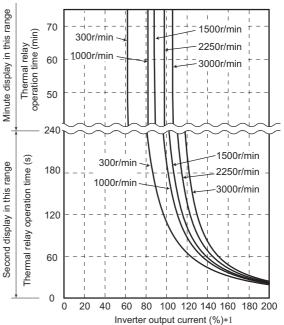
(Note that the output transistor protection of the inverter is activated. (E.THT))

• The following figures show the electronic thermal O/L relay operation characteristics when Mitsubishi Electric IPM motors are used. The area left of the characteristic curve is the normal operation area, and the area right of the characteristic curve is the protective function activated area.







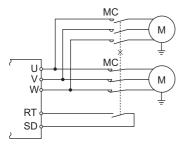


*1 The % value denotes the percentage to the rated motor current.



- The internal accumulated heat value of the electronic thermal relay function is reset to the initial value by the inverter's power reset or reset signal input. Avoid unnecessary reset and power-OFF.
- When using a PM motor other than MM-CF, set the free thermal parameters (**Pr.600 to Pr.604**) in accordance with the motor characteristic.
- The transistor protection thermal O/L relay is activated early when the Pr.72 PWM frequency selection setting is increased.

◆ Set two types of electronic thermal O/L relays (Pr.51)



- These settings are used when rotating two motors with different rated current separately by a single inverter. (When rotating two motors together, use an external thermal relay.)
- Set the rated motor current for the second motor in Pr.51 Second electronic thermal O/L relay.
- While the RT signal is ON, the setting values of Pr.51 is referred to provide thermal protection.

| Pr.450 | Pr.9 | Pr.51 | RT sigi | nal OFF | RT signal ON | |
|-------------------------|---------------------------------|--|-------------|-------------------|--------------|-------------------|
| Second applied motor | Electronic thermal O/L relay | Second electronic thermal O/L relay | First motor | Second monitor | First motor | Second monitor |
| | | 9999 | × | × | × | × |
| 9999 | 0 | 0 | × | × | × | × |
| | | 0.01 to 500 (0.1 to 3600) | × | Δ | × | 0 |
| | | 9999 | 0 | × | 0 | × |
| 9999 | Other than 0 | 0 | 0 | × | Δ | × |
| | | 0.01 to 500 (0.1 to 3600) | 0 | Δ | Δ | 0 |
| | | 9999 | × | × | × | × |
| Other than 9999 | 0 | 0 | × | × | × | × |
| | | 0.01 to 500 (0.1 to 3600) | × | Δ | × | 0 |
| | | 9999 | 0 | Δ | Δ | 0 |
| Other than 9999 | Other than 0 | 0 | 0 | × | Δ | × |
| | | 0.01 to 500 (0.1 to 3600) | 0 | Δ | Δ | 0 |

 \circ : Values are accumulated by using the output current. Δ : Values are accumulated by assuming the output

current is "0 A" (cooling processing).

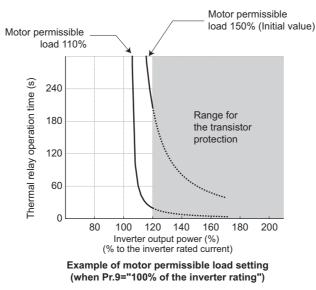
×: Electronic thermal O/L relay does not operate.



- The RT signal is the Second function selection signal. The RT signal also enables other second functions. (Refer to page 377.)
- The RT signal is assigned to the terminal RT in the initial status. Set "3" in one of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the RT signal to another terminal.

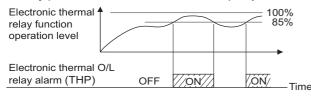
◆ Acceleration time setting (Pr.607, Pr.608)

The electronic thermal O/L relay operation characteristic can be changed by setting the permissible load level according to the motor characteristics.



Electronic thermal O/L relay pre-alarm (TH) and warning signal (THP signal)

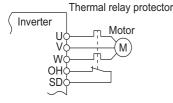
- If the accumulated electronic thermal value reaches 85% of the Pr.9 or Pr.51 setting, electronic thermal O/L relay function pre-alarm (TH) is displayed and the electronic thermal O/L relay pre-alarm (THP) signal is output. If the value reaches 100% of the Pr.9 setting, the motor thermal protection (E.THM/E.THT) is activated to shut off the inverter output. The inverter output is not shut off with the TH display.
- For the terminal used for the THP signal output, assign the function by setting "8 (positive logic) or 108 (negative logic)" in any parameter from Pr.190 to Pr.196 (Output terminal function selection).



- NOTE

• Changing the terminal assignment using **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

External thermal relay input (OH signal, E.OHT)



External thermal relay input connection diagram

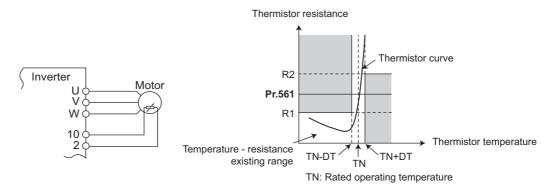
- The External thermal relay input (OH) signal is used when using the external thermal relay or the thermal protector built into the motor to protect the motor from overheating.
- When the thermal relay is activated, the inverter output is shut off by the external thermal relay (E.OHT).
- For the terminal used for the OH signal input, set "7" in any parameter from **Pr.178 to Pr.189 (Input terminal function** selection) to assign the function.



 Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

◆ PTC thermistor input (Pr.561, Pr.1016, E.PTC)

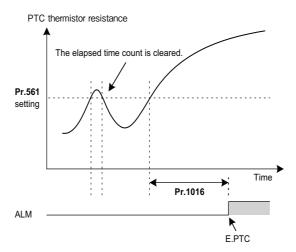
This function is used to protect the motor from overheating by inputting outputs from the motor's built-in PTC thermistor to the inverter. It is recommended that a PTC thermistor whose resistance increases most rapidly around the rated activating temperature (TN±DT) is used.



PTC thermistor input connection diagram

Example of PTC thermistor characteristics

- Output from the PTC thermistor, which is built into the motor, can be input to terminals 2 and 10. If the input from the PTC thermistor reaches the resistor value set in Pr.561 PTC thermistor protection level, the PTC thermistor operation (E.PTC) shuts off the inverter output.
- To use the PTC thermistor input function, select voltage input (initial setting) for terminal 2 using the voltage/current input selection switch. (For details on the voltage/current input switch assembly, refer to page 349.)
- Confirm the characteristic of the PTC thermistor to be used, and set the resistance for Pr.561 around the center of the R1 and R2 values shown on the figure above so that it does not deviate from the protective function activating temperature TN. If the Pr.561 setting becomes too close to R1 or R2, the protective function activating temperature may be too hot (protection is delayed), or too cold (too much protection).
- When the PTC thermistor protection is enabled (**Pr.561** ≠ "9999"), the resistance value for the PTC thermistor can be displayed on the operation panel or via RS-485 communication. (Refer to page 305.)
- When the PTC thermistor protection level setting is used, use Pr.1016 PTC thermistor protection detection time to set the time from when the resistance of the PTC thermistor reaches the protection level until the protective function (E.PTC) is activated.
- If the resistance of the PTC thermistor falls below the protection level within the protection detection time, the elapsed time count is cleared.

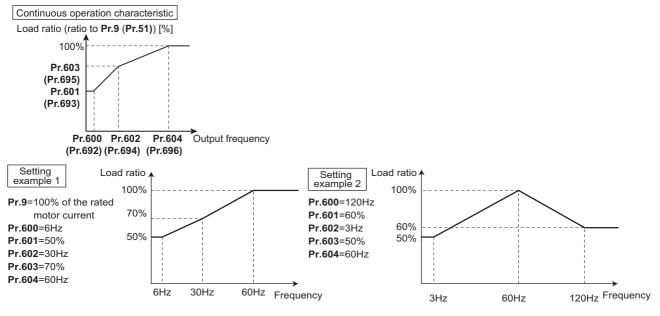




- When using terminal 2 for PTC thermistor input (**Pr.561** ≠ "9999"), the terminal 2 does not operate as an analog frequency command terminal. The PID and dancer control functions assigned to the terminal 2 is also disabled. Use **Pr.133 PID action** set point to set the set point for the PID function.
- To input power to the PTC thermistor power supply, always use the terminal 10 and do not use any other terminals or an external power supply. Otherwise, the PTC thermistor protection (E.PTC) does not operate properly.
- When E.PTC is activated, the alarm display, "External protection (AU terminal)", may appear on the parameter unit (FRPU07), but it is not a fault.

Overheat protection to match the characteristic of the motor (Pr.600 to Pr.604, Pr.692 to Pr.696)

- The activation level of the electronic thermal O/L relay can be varied to match the motor temperature characteristic.
- The electronic thermal O/L relay operation level can be set with the combination of three points (Pr.600, Pr.601), (Pr.602, Pr.603), (Pr.604, Pr.9). Two or more points are required for setting.
- The electronic thermal O/L relay operation level can be set with the combination of three points (Pr.692, Pr.693), (Pr.694, Pr.695), (Pr.696, Pr.51) when the RT signal is ON.



• When setting Pr.600, Pr.602, and Pr.604 (Pr.692, Pr.694, and Pr.696) to the same frequency, the graph shows a step plat

| plot. | |
|------------------------------------|----|
| Load ratio [%] | |
| 100 | |
| Pr.600 = 101 | Ηz |
| 80 Pr.601 = 80 ^o | % |
| Pr.602 = 10 | Ηz |
| 50 Pr.603 = 50 ^o | % |
| Pr.604 = 10 | Ηz |
| | |
| 10 Output frequency[Hz] | |
| | |



• Make sure to set the parameters according to the temperature characteristic of the motor used.

Parameters referred to X

Pr.71 Applied motor 🖙 page 379

- Pr.72 PWM frequency selection Frage 218
- Pr.178 to Pr.189 (Input terminal function selection) = page 373 Pr.190 to Pr.196 (Output terminal function selection) = page 330

5.7.2 Cooling fan operation selection

A cooling fan is built into the inverter and its operation can be controlled.

| Pr. | Name | Initial value | Setting range | Description | | | |
|-------|------------------------------------|---------------|---------------|---|--|--|--|
| | | | | 0 Cooling fan ON/OFF control disabled. (The cooling fan is always power ON.) 0 A cooling fan operates at power ON. | | | |
| | | | 1 | Cooling fan ON/OFF control enabled. The fan is always ON while the inverter is r inverter status is monitored and the fan swit the temperature. | | | |
| | | | 101 to 105 | Cooling fan ON/OFF control enabled. Set the cooling fan stop delay time within 1 | to 5 s. | | |
| 244 | Cooling fan operation selection | 1 | 1000 | Cooling fan ON/OFF control disabled. (The cooling fan is always ON at power ON.) A cooling fan operates at power ON. | | | |
| | | 1001 | 1001 | Cooling fan ON/OFF control enabled. The fan is always ON while the inverter is running. During a stop, the inverter status is monitored and the fan switches ON/OFF according to the temperature. | The cooling fan can be set to always OFF during PM motor test operation. | | |
| | | | 1101 to 1105 | Cooling fan ON/OFF control enabled. Set the cooling fan stop delay time within 1 to 5 seconds. | | | |
| | | | 0 | Cooling fan ON/OFF control disabled. (The power ON.) A cooling fan operates at power ON. | cooling fan is always ON at | | |
| H100 | Cooling fan operation selection | 1 | 1 | Cooling fan ON/OFF control enabled. The fan is always ON while the inverter is running. During a stop, the inverter status is monitored and the fan switches ON/OFF according the temperature. | | | |
| | | | 101 to 105 | Cooling fan ON/OFF control enabled. Set the cooling fan stop delay time within 1 to 5 s. | | | |
| H106 | Cooling fan operation selection | 0 | 0 | The cooling fan operates according to the I motor test operation. | 1100 setting during PM | | |
| 11100 | during the test operation | 0 | 1 | The cooling fan can be set to always OFF during PM motor test operation. | | | |

Cooling fan always ON (Pr.244 (P.H100) = "0")

- For the terminal used for the FAN signal output, set "25 (positive logic)" or "125 (negative logic)" in any parameter from Pr.190 to Pr.196 (Output terminal function selection) and for LF signal, set "98 (positive logic)" or "198 (negative logic)".

Cooling fan operation control (Pr.244 (P.H100) = "1" (initial value), "101 to 105")

- The cooling fan operation is controlled when Pr.244 = "1". When the inverter is running, the cooling fan operates constantly. When the inverter is stopped, the cooling fan operates depending on the temperature of the inverter heat sink. If the fan stops although it meets the conditions for running, fan operation is regarded as faulty, [FN] is displayed on the operation panel, and the fan signal and LF signals are output.
- To prevent the cooling fan from turning ON and OFF repeatedly during frequent starts/stops (inching), the cooling fan stop waiting time can be set. The waiting time when Pr.244 = "101 to 105" is Pr.244 100 (or 1 second, if the Pr.244 = "101").

Cooling fan operation command (Y206) signal

- The Cooling fan operation command (Y206) signal can be output when the inverter cooling fan meets the conditions for running. The function can be used when the fan installed on the enclosure is synchronized with the inverter cooling fan.
- The Y206 signal indicates the operating command condition of the inverter cooling fan depending on the power supply ON/ OFF or the **Pr.244** settings. The signal does not indicate the actual operation of the cooling fan. (The signal is output even if the cooling fan is stopped due to a fault.)
- To use the Y206 signal, set "206 (positive logic) or 306 (negative logic)" in one of **Pr.190 to Pr.196 (Output terminal function selection)** to assign function to an output terminal.

Cooling fan operation selection during the test operation (Pr.244 = "1000, 1001, 1101 to 1105" (P.H106 = "1"))

• When **P.H106** = "1" or **Pr.244** = "1000, 1001, or 1101 to 1105", the cooling fan can be set to always OFF during PM motor test operation.

• ΝΟΤΕ

- The cooling fan is installed on the FR-F820-00105(2.2K) or higher and the FR-F840-00083(3.7K) or higher.
- Changing the terminal assignment using **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.190 to Pr.196 (Output terminal function selection) 330

5.7.3 Earth (ground) fault detection at start

Magneticiflux

Select whether to make earth (ground) fault detection at start. When enabled, earth (ground) fault detection is performed immediately after a start signal input to the inverter.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|-----------------------------------|---------------|---------------|---|
| 249 H101 | Earth (ground) fault detection at | 0 | 0 | Without the earth (ground) fault detection at start |
| H101 start | | - | 1 | With the earth (ground) fault detection at start |

- If a ground fault is detected at start while **Pr.249** = "1", the output-side earth (ground) fault overcurrent (E.GF) is displayed and the outputs are shut off. (Refer to page 605.)
- Pr.249 setting is enabled during V/F control and Advanced magnetic flux vector control.
- · When the Pr.72 PWM frequency selection setting is high, enable the ground fault detection at start.

• NOTE

- Because the detection is performed at start, output is delayed for approx. 20 ms every start.
- Use **Pr.249** to enable/disable ground fault detection at operation start. Ground faults are detected always during operation regardless of the **Pr.249** setting.

5.7.4 Varying the activation level of the undervoltage protective function

If the undervoltage protection (E.UVT) activates due to unstable voltage in the power supply, the undervoltage level (DC bus voltage value) can be changed.

| Pr. | Name | Initial value | Setting range | Description | | | |
|------|-----------------------------|----------------------|-----------------------|---|--|--|--|
| | | | 175 to 215 VDC*1 | Set the DC voltage value at which E.UVT occurs. | | | |
| 598 | Undervoltage level | 9999 | 350 to 430 VDC*2 | Set the DC voltage value at which E.OVT occurs. | | | |
| H102 | j | | 9999 | E.UVT occurs at 215 VDC (200 V class) / 430 VDC (400 | | | |
| | | | 0000 | V class). | | | |
| *1 | For the 200 V class | | | | | | |
| *2 | For the 400 V class | | | | | | |
| NOTE | | | | | | | |
| | Do not use this function wh | en switching to an e | external battery sind | ce the inrush current when power is restored increases as | | | |

Do not use this function when switching to an external battery, since the inrush current when power is restored increases, as the undervoltage level is decreased.

- For the 200 V class inverters, the setting is available for the FR-F820-02330(55K) or lower.
- The **Pr.598** setting is valid for induction motors. When either of the first or second motor is a PM motor, the **Pr.598** setting is invalid.

5.7.5 Initiating a protective function

A fault (protective function) is initiated by setting the parameter.

This function can be used to check how the system operates at activation of a protective function.

| Pr. | Name | Initial value | Setting range | Description |
|-------------------------|------|---------------|---------------|--|
| 997 Fault initiation | | 9999 | 16 to 253 | The setting range is same with the one for fault data codes of the inverter (which can be read through communication). Written data is not stored in EEPROM. |
| H103 | | | 9999 | The read value is always "9999". The protective function is not activated with this setting. |

- To initiate a fault (protective function), set the assigned number of the protective function to be initiated in **Pr.997**.
- The value set in **Pr.997** is not stored in EEPROM.
- When a protective function activates, the inverter output is shut off, a fault is displayed, and a fault signal (ALM, ALM2) is output.
- The latest fault in the fault history is displayed while the fault initiation function is in operation. After a reset, the fault history goes back to the previous status. (The protective function generated by the fault is not saved in the fault history.)
- · Perform inverter reset to cancel the protective function.
- For the selectable parameter by Pr.997 and the corresponding protective functions, refer to page 592.

- If a protective function is already operating, no fault can be activated by Pr.997.
- The retry function is disabled when a protective function has been initiated by the fault initiation function.
- If a fault occurs after a protective function has been activated, the protective function indication does not change. The fault is not saved in the fault history either.

5.7.6 I/O phase loss protection selection

The output phase loss protection function, which stops the inverter output if one of the three phases (U, V, W) on the inverter's output side (load side) is lost, can be disabled.

The input phase loss protective function on the inverter input side (R/L1, S/L2, T/L3) can be enabled.

| Pr. | Name | Initial value | Setting range | Description | |
|---------------------------|----------------------|-----------------|--------------------------------------|---------------------------------------|--|
| 251 | Output phase loss | phase loss | | Output phase loss protection disabled | |
| H200 protection selection | 1 | 1 | Output phase loss protection enabled | | |
| 872 | Input phase loss | iput phase loss | | Input phase loss protection disabled | |
| H201 ^{*1} | protection selection | 0 | 1 | Input phase loss protection enabled | |

*1 The setting is available for the standard structure model and the IP55 compatible model.

Output phase loss protection selection (Pr.251)

• When Pr.251 is set to "0", output phase loss protection (E.LF) becomes invalid.

Input phase loss protection selection (Pr.872) (Standard models and IP55 compatible models)

• When **Pr.872** is set to "1", Input phase loss (E.ILF) protection is activated if one of three phases is continuously lost for 1 second.

NOTE

- When several motors are connected, output phase loss cannot be detected even if the wiring to one motor loses phase.
- If an input phase is lost while **Pr.872** = "1" (with input phase loss protection), **Pr.261 Power failure stop selection** ≠ "0" (power failure stop function enabled), the motor decelerates to stop without outputting E.ILF.
- In the case of R/L1, S/L2 phase loss, the input phase loss protection does not operate, and the inverter output is shut off.
- If an input phase loss continues for a long time, the lives of converter section and capacitor of the inverter become shorter.

Parameters referred to

Pr.261 Power failure stop selection Spage 478

5.7.7 Retry function

This function allows the inverter to reset itself and restart at activation of the protective function (fault indication). The retry generating protective functions can also be selected.

When the automatic restart after instantaneous power failure function is selected (**Pr.57 Restart coasting time** \neq 9999), the restart operation is also performed after a retry operation as well as after an instantaneous power failure. (For restart operation, refer to page 466 and page 472 for selection.)

| Pr. | Name | Initial value | Setting range | Description | |
|------------|--|------------------|---------------|--|--|
| 65 H300 | Retry selection | ection 0 0 to 5 | | Faults which trigger the retry operation can be selected. | |
| | | | 0 | The retry function disabled. | |
| 67 | 67 Number of retries at fault H301 occurrence | | 1 to 10 | Set the number of retries at a fault occurrence. A fault output is not provided during the retry operation. | |
| H301 | | | 101 to 110 | Set the number of retries at a fault occurrence. (The setting value minus 100 is the number of retries.) A fault output is provided during the retry operation. | |
| 68 H302 | Retry waiting time | 1 s | 0.1 to 600 s | Set the time delay from when an inverter fault occurs until the retry operation starts. | |
| 69 H303 | Retry count display erase | 0 | 0 | Setting "0" clears the retry success counter ("retry success" means that the inverter successfully restarts). | |

Setting the retry function (Pr.67, Pr.68)

• When the inverter protective function is operating (fault indication), the retry function automatically cancels (resets) the protective function after the time set in **Pr.68**. The retry function then restarts the operation from the starting frequency.

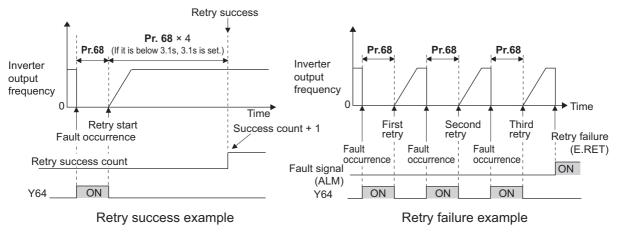
• The retry function is enabled when the **Pr.67** setting is other than "0". Set the number of retries at activation of the protective function in **Pr.67**.

| Pr.67 setting | Fault output during retry operation | Retry count |
|---------------|--|-------------------|
| 0 | — | No retry function |
| 1 to 10 | Not available | 1 to 10 times |
| 101 to 110 | Available | 1 to 10 times |

- When retries fail consecutively more than the number of times set in **Pr.67**, a retry count excess (E.RET) occurs, resulting in an inverter retries. (Refer to the Retry failure example.)
- Use Pr.68 to set the waiting time from a protective function activation to a retry in the range of 0.1 to 600 seconds.
- During retry operation, the During retry (Y64) signal is ON. For the Y64 signal, set "64 (positive logic)" or "164 (negative logic)" in any parameter from **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function.

Retry count check (Pr.69)

- Reading the Pr.69 value provides the cumulative number of successful restart times made by retries. The cumulative count in Pr.69 increases by 1 when a retry is successful. Retry is regarded as successful when normal operation continues without a fault for the Pr.68 setting multiplied by four or longer (3.1 seconds at the shortest). (When retry is successful, the cumulative number of retry failures is cleared.)
- · Writing "0" in Pr.69 clears the cumulative count.



Selecting retry generating faults (Pr.65)

• Using **Pr.65**, the fault that causes a retry is selectable. No retry is made for the fault not indicated. (For the fault details, refer to page 594.) ● indicates the faults selected for retry.

| Retry-making | | Pr.65 setting | | | | | |
|--------------|---|---------------|---|---|---|---|--|
| fault | 0 | 1 | 2 | 3 | 4 | 5 | |
| E.OC1 | • | • | | • | • | • | |
| E.OC2 | • | • | | • | • | | |
| E.OC3 | • | • | | • | • | • | |
| E.OV1 | • | | • | • | • | | |
| E.OV2 | • | | • | • | • | | |
| E.OV3 | • | | • | • | • | | |
| E.THM | • | | | | | | |
| E.THT | • | | | | | | |
| E.IPF | • | | | | • | | |
| E.UVT | • | | | | • | | |
| E. BE | • | | | | • | | |
| E. GF | • | | | | • | | |
| E.OHT | • | | | | | | |
| E.OLT | • | | | | • | | |
| E.OPT | • | | | | • | | |

| Retry-making | | Pr.65 setting | | | | | |
|--------------|---|---------------|---|---|---|---|--|
| fault | 0 | 1 | 2 | 3 | 4 | 5 | |
| E.OP1 | • | | | | • | | |
| E. PE | • | | | | • | | |
| E.OS | • | | | | • | | |
| E.PTC | • | | | | | | |
| E.CDO | • | | | | • | | |
| E.SER | • | | | | • | | |
| E.USB | • | | | | • | | |
| E.ILF | • | | | | • | | |
| E.PID | • | | | | • | | |
| E.PCH | • | | | | • | | |
| E.SOT | • | • | | • | • | • | |
| E.LCI | • | | | | • | | |
| E.LUP | • | | | | • | | |
| E.LDN | • | | | | • | | |

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5. PARAMETERS

5.7 (H) Protective function parameter



- Use the retry function only when the operation can be resumed after resetting a protective function activation. Making a retry against the protective function, which is activated by an unknown condition, will lead the inverter and motor to be faulty. Identify and remove the cause of the protective function activation before restarting the operation.
- If the retry function operates during PU operations, the operating conditions (forward/reverse rotation) are stored; and operations resume after retry reset.
- Only the fault details for the first fault that occurred during retry are stored in the fault history.
- The reset by the retry function does not clear the accumulated data of the electronic thermal O/L relay. (This is different from power supply reset or reset by RES signal.)
- When the parameter storage device fault (control circuit board) (E.PE) is occurring and reading of the retry-function-related parameters is not possible, retry cannot be operated.
- Changing the terminal assignment using **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

• When the retry function is set enabled, stay away from the motor and machine in the case of an output shutoff. The motor and machine will start suddenly (after the reset time has elapsed) after the shutoff. When the retry function is selected, apply the supplied CAUTION stickers to easily visible places.

Parameters referred to

Pr.57 Restart coasting time 🖙 page 466, page 472

5.7.8 Emergency drive (Fire mode)

This function is used in case of emergency such as a fire to forcibly continue inverter operation to drive a motor without activating protective functions even if the inverter detects a fault. Using this function may cause damage of the motor or the inverter because driving the motor is given the highest priority. Use this function for emergency operation only. When the inverter is damaged by a fault, the motor operation can be continued by switching to the commercial power supply operation. The emergency drive function is available only for standard structure models and IP55 compatible models.

| 523 H320 ⁻¹¹ Emergency drive mode selection FM CA 100, 111, 112, 121, 122, 123, 124, 230, 114, 112, 122, 123, 124, 230, 311, 312, 322, 323, 324, 400, 411, 412, 422, 423, 423, 424 524 H320 ⁻¹¹ Emergency drive mode selection 9999 Emergency drive disabled. Select the operation mode of the emergency drive. 524 H321 ⁻¹¹⁻² Emergency drive running speed 9999 Emergency drive disabled. Set the running frequency in the fixed frequency mode is selected in Pr.523) 524 H321 ⁻¹¹⁻² Emergency drive running speed 9999 Set the running frequency in the fixed frequency mode is selected in Pr.523) 515 H322 ⁻¹¹ Emergency drive reset 1 1000 Set the PID set point in the PID control mode is selected in Pr.523) 514 H322 ⁻¹¹ Running speed after emergency drive disabled. 1 1000 Set the frequency for operation. 514 H322 ⁺¹¹ Running speed after emergency drive retry reset 60 Hz 50 Hz 0 to 590 Hz Set the frequency for operation. 514 H324 ⁺¹¹ Emergency drive dedicated retry waiting ime 9999 The Pr.68 setting is applied to the operation. 514 H324 ⁺¹¹ Emergency drive dedicated retry waiting ime 9999 The Pr.68 setting is applied to the operation. 513 H336 H336 H336 H339 H336 H337 H336 H339 H336 H | _ | | Initia | l value | 0 /// | _ | | |
|---|-----------------------------|------------------------------|--------|---------|---------------------------|---|---|--|
| 523 H320 ⁻¹¹ Emergency drive mode selection 9999 Image: selection Select the operation mode of the emergency drive. 524 H320 ⁻¹¹ Selection 9999 Emergency drive disabled. Select the operation mode of the emergency drive. 524 H321 ⁻¹¹ Emergency drive running speed 9999 Emergency drive disabled. Set the running frequency in the fixed frequency mode of the emergency drive (when the fixed frequency mode is selected in Pr.523) 515 H322 ⁻¹¹ Emergency drive dedicated retry count 1 10 to 590 Hz ⁻³ Set the running frequency in the PID control mode is selected in Pr.523) 516 H322 ⁻¹¹ Emergency drive dedicated retry waiting ime 10 to 200 Set the frequency on the number of retries). 514 H323 ⁻¹¹ Running speed after emergency drive retry reset 60 Hz 50 Hz 0 to 590 Hz Set the frequency for operation after a retry when any of E.CPU, E.1 to E.3, and E.5 to E.7 occurs during emergency drive operation. 514 H324 ⁻¹¹ Emergency drive dedicated retry waiting ime 9999 The Pr.68 setting is applied to the operation. 513 H336 Automatic switchover interlock time 1 s 0 to 100 s Set the frequency at which the inverter-driven operation. 547 H347 Automatic switchover interlock time 1 s 0 to 60 Hz Set the frequency at which the inverter- | Pr. | Name | FM | CA | Setting range | Description | | |
| 524 H321*1*2 Emergency drive running speed 9999 9999 Set the running frequency in the fixed frequency mode of the emergency drive (when the fixed frequency mode is selected in PF.523) 515 H322*1 Emergency drive dedicated retry count 1 Set the PID set point in the PID control mode of the emergency drive (when the PID control mode is selected in Pr.523) 515 H322*1 Emergency drive dedicated retry count 1 1 to 200 Set the retry count during emergency drive operation. 1013 H323*1 Running speed after emergency drive retry reset 60 Hz 50 Hz 0 to 590 Hz Set the frequency for operation after a retry when any of E.C.PU.E.1 to E.3, and E.5 to E.7 occurs during emergency drive operation. 514 H324*1 Emergency drive dedicated retry waiting time 9999 0 to 590 Hz Set the retry waiting time during emergency drive operation. 514 H324*1 MC switchover interlock time 1 s 0 to 100 s Set the retry waiting time during emergency drive operation. 513 A001 MC switchover interlock time 1 s 0 to 100 s Set the frequency at which the inverter-driven operation is switched over to the commercial power supply operation when the condition for the electronic bypass is established during emergency drive operation. 537 A702 Restart coasting time 9999 0 to 60 Hz Set the frequency at which the inverter capacity. (Re | 523 H320 ^{*1} | | 9999 | | e 9999 | | 121, 122, 123, 124, 200, 211, 212, 221, 222, 223, 224, 300, 311, 312, 321, 322, 323, 324, 400, 411, 412, 421, 422, 423, 424 | |
| 524 H321 ⁺¹⁺² Emergency drive running speed 9999 0 to 590 Hz ⁻³ emergency drive (when the fixed frequency mode is selected in Pr.523) 515 H322 ⁺¹ Emergency drive dedicated retry count 1 50 Hz ⁻³ Set the PID set point in the PID control mode is selected in Pr.523) 515 H322 ⁺¹ Emergency drive dedicated retry count 1 1 to 200 Set the retry count during emergency drive operation. 514 H323 ⁻¹¹ Running speed after emergency drive retry reset 60 Hz 50 Hz 0 to 590 Hz Set the frequency for operation after a retry when any of E.C.P.U.E. 1 to E.3, and E.5 to E.7 occurs during emergency drive operation. 514 H324 ⁻¹¹ Emergency drive dedicated retry waiting time 9999 50 Hz 0 to 590 Hz Set the retry waiting time during emergency drive operation. 514 H324 ⁻¹¹ Emergency drive dedicated retry waiting time 9999 1 to 600 s Set the retry waiting time during emergency drive operation. 514 H324 ⁻¹¹ Emergency drive dedicated retry waiting time 9999 1 to 600 s Set the retry waiting time during emergency drive operation. 514 H324 ⁻¹¹ Emergency drive dedicated retry waiting time 9999 1 to 100 s Set the peration interlock time for MC2 and MC3. 513 H326 A001 MC switchover interlock time 1 s 0 to 60 Hz Set the frequency at which the inverter-driven operation is switched over to the commercial power supply ope | | | | | 9999 | | | |
| H321 ¹¹² Image of y arrow running speed 9999 0% to 100% ⁵³ Set the PID set point in the PID control mode of the emergency drive (when the PID control mode of the emergency drive (when the PID control mode is selected in pr.523) 515 Emergency drive dedicated retry count 1 1 to 200 Set the retry count during emergency drive operation. 613 Running speed after emergency drive retry reset 60 Hz 50 Hz 0 to 590 Hz Set the frequency for operation after a retry when any of E.CPU, E.1 to E.3, and E.5 to E.7 occurs during emergency drive operation. 614 Emergency drive dedicated retry waiting time during emergency drive operation. 0.1 to 600 s Set the retry waiting time during emergency drive operation. 614 Emergency drive retry ime 9999 0.1 to 600 s Set the retry waiting is applied to the operation. 613 MC switchover interlock time 1 s 0 to 100 s Set the frequency at which the inverter-driven operation is switched ver to the commercial power supply operation when the condition for the electronic bypass is established during emergency drive operation. 67 Restart coasting time 9999 9999 Electronic bypass during emergency drive is disabled. 67 Restart coasting time 9999 9999 Electronic bypass during emergency drive is disabled. 67 Restart | | | | | 0 to 590 Hz ^{*3} | emergency drive (when the fixed frequency mode is selected | | |
| 515 H322 ^{*1} Emergency drive dedicated retry count 1 1 to 200 Set the retry count during emergency drive operation. 1013 H323 ^{*1} Running speed after emergency drive retry reset 60 Hz 50 Hz 0 to 590 Hz Set the retry count excess (no restriction on the number of retries). 514 H323 ^{*1} Emergency drive reset 60 Hz 50 Hz 0 to 590 Hz Set the frequency for operation after a retry when any of E.CPU, E.1 to E.3, and E.5 to E.7 occurs during emergency drive operation. 514 H324 ^{*1} Emergency drive dedicated retry waiting time 9999 0.1 to 600 s Set the retry waiting time during emergency drive operation. 136 A001 MC switchover interlock time 1 s 0 to 100 s Set the frequency at which the inverter-driven operation is switched over to the commercial power supply operation when the condition for the electronic bypass is established during emergency drive operation. 139 A004 Automatic switchover frequency from inverter to bypass operation 9999 0 to 60 Hz Set the frequency at which the inverter-driven operation is switched over to the commercial power supply operation when the condition for the electronic bypass is established during emergency drive operation. 57 A702 Restart coasting time 9999 0 Coasting time differs according to the inverter capacity. (Refer to page 466.) 60 .1 to 30 s Set | 524 H321 ^{*1*2} | | | | 0% to 100% ^{*3} | emergency drive (when the PID control mode is selected in | | |
| 515 Emergency drive dedicated retry count 1 Without retry count excess (no restriction on the number of retries). 1013 Running speed after emergency drive retry reset 60 Hz 50 Hz 0 to 590 Hz Set the frequency for operation after a retry when any of E.CPU, E.1 to E.3, and E.5 to E.7 occurs during emergency drive operation. 514 Emergency drive dedicated retry waiting time 9999 0.1 to 600 s Set the retry waiting time during emergency drive operation. 136 MC switchover interlock time 1 s 0 to 100 s Set the frequency at which the inverter-driven operation is switched over to the commercial power supply operation when the condition for the electronic bypass is established during emergency drive operation. 139 Automatic switchover frequency from inverter to bypass operation 9999 0 to 60 Hz Set the frequency at which the inverter-driven operation is switched over to the commercial power supply operation when the condition for the electronic bypass is established during emergency drive operation. 57 Restart coasting time 9999 0 Coasting time differs according to the inverter capacity. (Refer to page 466.) 0.1 to 30 s 57 0.1 to 30 s Set the waiting time for the inverter to perform a restart after restoring power due to an instantaneous power failure. | | | | | 9999 ^{*3} | Emergency drive disabled. | | |
| H322*1dedicated retry count19999*3Without retry count excess (no restriction on the number of retries).1013 H323*1Running speed after emergency drive retry reset60 Hz50 Hz0 to 590 HzSet the frequency for operation after a retry when any of E.CPU, E.1 to E.3, and E.5 to E.7 occurs during emergency drive operation.514 H324*1Emergency drive dedicated retry waiting time99990 to 590 HzSet the retry waiting time during emergency drive operation.514 H324*1Emergency drive dedicated retry waiting time99990 to 100 sSet the retry waiting is applied to the operation.136 A001MC switchover interlock time1 s0 to 100 sSet the frequency at which the inverter-driven operation is switched over to the commercial power supply operation when the condition for the electronic bypass is established during emergency drive operation.139 A004Automatic switchover frequency from inverter to bypass operation99990 to 60 HzSet the frequency at which the inverter-driven operation is switched over to the commercial power supply operation when the condition for the electronic bypass is established during emergency drive operation.57 A702Restart coasting time99999999Electronic bypass during emergency drive is disabled.57 A702Restart coasting time99990Coasting time differs according to the inverter capacity. (Refer to page 466.)57 A702No 30 sSet the waiting time for the inverter to perform a restart after restoring power due to an instantaneous power failure. <td>515</td> <td>Emergence and deliver</td> <td></td> <td></td> <td>1 to 200</td> <td>Set the retry count during emergency drive operation.</td> | 515 | Emergence and deliver | | | 1 to 200 | Set the retry count during emergency drive operation. | | |
| H1013 H323*1 emergency drive retry reset 60 Hz 50 Hz 0 to 590 Hz E.CPU, E.1 to E.3, and E.5 to E.7 occurs during emergency drive operation. 514 H324*1 Emergency drive dedicated retry waiting time 9999 0 to 500 Hz Set the retry waiting time during emergency drive operation. 136 A001 MC switchover interlock time 1 s 0 to 100 s Set the operation interlock time for MC2 and MC3. 139 A004 Automatic switchover frequency from inverter to bypass operation 9999 0 to 60 Hz Set the frequency at which the inverter-driven operation is switched over to the commercial power supply operation when the condition for the electronic bypass is established during emergency drive operation. 57 A702 Restart coasting time 9999 0 0 Coasting time differs according to the inverter capacity. (Refer to page 466.) 0.1 to 30 s Set the waiting time for the inverter to perform a restart after restoring power due to an instantaneous power failure. | H322 ^{*1} | | 1 | | 9999 ^{*3} | | | |
| dedicated retry waiting time99999999The Pr.68 setting is applied to the operation.136 A001MC switchover interlock time1 s0 to 100 sSet the operation interlock time for MC2 and MC3.139 A004Automatic switchover frequency from inverter to bypass operation1 s0 to 100 sSet the frequency at which the inverter-driven operation is switched over to the commercial power supply operation when the condition for the electronic bypass is established during emergency drive operation.57 A702Restart coasting time999900Coasting time differs according to the inverter capacity. (Refer to page 466.)57 A7020.1 to 30 sSet the waiting time for the inverter to perform a restart after restoring power due to an instantaneous power failure. | 1013 H323 ^{*1} | emergency drive retry | 60 Hz | 50 Hz | 0 to 590 Hz | E.CPU, E.1 to E.3, and E.5 to E.7 occurs during emergency | | |
| H324*1dedicated retry waiting time99999999The Pr.68 setting is applied to the operation.136 A001MC switchover interlock time1 s0 to 100 sSet the operation interlock time for MC2 and MC3.139 A004Automatic switchover frequency from inverter to bypass operation1 s0 to 100 sSet the frequency at which the inverter-driven operation is switched over to the commercial power supply operation when the condition for the electronic bypass is established during emergency drive operation.57 A702Restart coasting time999900Coasting time differs according to the inverter capacity. (Refer to page 466.)57 A7020.1 to 30 sSet the waiting time for the inverter to perform a restart after restoring power due to an instantaneous power failure. | 514 | Emergency drive | | | 0.1 to 600 s | Set the retry waiting time during emergency drive operation. | | |
| A001interlock time1 s0 to 100 sSet the operation interlock time for MC2 and MC3.139 A004Automatic switchover frequency from inverter to bypass operation99990 to 60 HzSet the frequency at which the inverter-driven operation when the condition for the electronic bypass is established during emergency drive operation.57 A702Restart coasting time999900Coasting time differs according to the inverter capacity. (Refer to page 466.)57 A7020.1 to 30 sSet the waiting time for the inverter to perform a restart after restoring power due to an instantaneous power failure. | H324 ^{*1} | | 9999 | | 9999 | The Pr.68 setting is applied to the operation. | | |
| 139 A004Automatic switchover frequency from inverter to bypass operation99990 to 60 Hzswitched over to the commercial power supply operation when the condition for the electronic bypass is established during emergency drive operation.57 A702Restart coasting time999900Coasting time differs according to the inverter capacity. (Refer to page 466.)57 A7020.1 to 30 sSet the waiting time for the inverter to perform a restart after restoring power due to an instantaneous power failure. | 136 A001 | | 1 s | | 0 to 100 s | Set the operation interlock time for MC2 and MC3. | | |
| 57 A702 Restart coasting time 9999 0 Coasting time differs according to the inverter capacity. (Refer to page 466.) 0.1 to 30 s Set the waiting time for the inverter to perform a restart after restoring power due to an instantaneous power failure. | 139 A004 | frequency from inverter 9999 | | | 0 to 60 Hz | switched over to the commercial power supply operation when the condition for the electronic bypass is established during | | |
| 57 A702 9999 0 (Refer to page 466.) 0.1 to 30 s Set the waiting time for the inverter to perform a restart after restoring power due to an instantaneous power failure. | | | | | 8888, 9999 | Electronic bypass during emergency drive is disabled. | | |
| A702 Restart coasting time 9999 0.1 to 30 s Set the waiting time for the inverter to perform a restart after restoring power due to an instantaneous power failure. | 67 | | | | 0 | | | |
| 9999 No restart | 57 A702 | Restart coasting time | 9999 | | 0.1 to 30 s | S . | | |
| | | | | | 9999 | No restart | | |

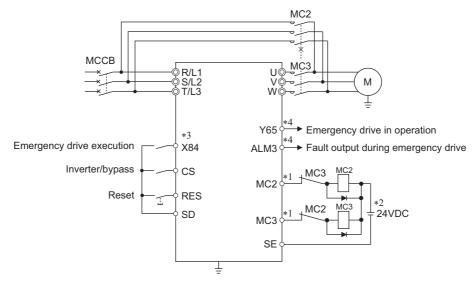
*1 The setting is available for the standard structure model and the IP55 compatible model.

*2 Set Pr.524 after setting Pr.523.

*3 When Pr.523 = "100, 200, 300, or 400", the emergency drive is activated regardless of the Pr.524 setting.

Connection diagram

• The following diagram shows a connection example for emergency drive operation (in the commercial mode).



*1 Be careful of the capacity of the sequence output terminals. The applied terminals differ by the settings of **Pr.190 to Pr.196 (Output terminal function selection)**.

| Output terminal capacity | Output terminal permissible load |
|---|----------------------------------|
| Open collector output of inverter (RUN, SU, IPF, OL, FU) | 24 VDC 0.1 A |
| Inverter relay output (A1-C1, B1-C1, A2-B2, B2-C2) Relay output option (FR-A8AR) | 230 VAC 0.3 A 30 VDC 0.3 A |

- *2 When connecting a DC power supply, insert a protective diode.
- When connecting an AC power supply, use relay output terminals of the inverter or contact output terminals of the relay output option (FR-A8AR).
- *3 The applied terminals differ by the settings of **Pr.180 to Pr.189 (Input terminal function selection)**
- *4 The applied terminals differ by the settings of Pr.190 to Pr.196 (Output terminal function selection).

NOTE

• Be sure to provide a mechanical interlock for MC2 and MC3.

Emergency drive execution sequence

Point P

- When the X84 signal is ON for 3 seconds, the emergency drive is activated.
- · The Y65 signal turns ON during emergency drive operation.
- "ED" appears on the operation panel during emergency drive operation.
- The ALM3 signal turns ON when a fault occurs during emergency drive operation.
- To activate the emergency drive, the X84 signal needs to be ON for three seconds while all the following conditions are satisfied.

| Item | Condition |
|------------------------------------|--|
| Emergency drive parameter settings | Pr.523 ≠ "9999" Pr.524 ≠ "9999" (Setting is not required when Pr.523 = "100, 200, 300, or 400".) |
| Contradictory condition | None of the following conditions are satisfied. Enabling the electronic bypass sequence function During offline auto tuning Supplying power through terminals R1 and S1 Pr.30 = "2 or 102" |

• When the "retry" (**Pr.523** = "2[]], 3[][]") is selected, it is recommended to use the automatic restart after instantaneous power failure function at the same time.

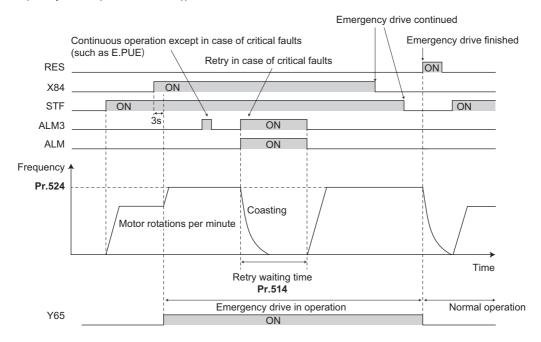
• Parameter setting is not available during emergency drive operation.

• To return to the normal operation during emergency drive operation, do the following. (The operation will not be returned to normal only by turning OFF the X84 signal.)

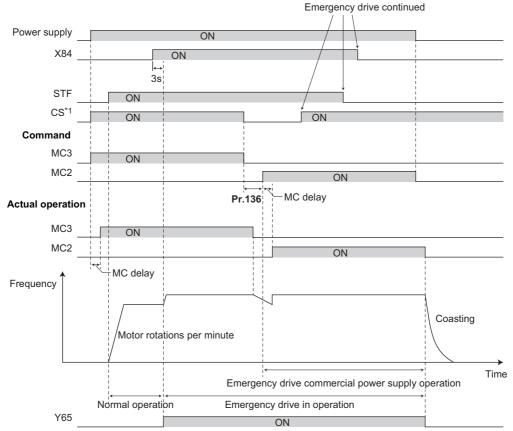
Reset the inverter, or turn OFF the power supply.

Clear a fault by turning ON the X51 signal while the sequence function is enabled (when the protective function is activated).

- The operation is switched over to the commercial power supply operation in case of the following during emergency drive operation while the commercial mode or the retry / commercial mode is selected.
 24 V external power supply operation, power failure status or operation with the power supplied through R1/S1 (except when the DC feeding mode 1 or 2 is selected), undervoltage
- To input the X84 signal, set "84" in any of Pr.178 to Pr.189 (Input terminal function selection) to assign the function.
- To output the Y65 signal, set "65 (positive logic)" or "165 (negative logic)" in any of **Pr.190 to Pr.196 (Output terminal** function selection) to assign the function. To output the ALM3 signal, set "66 (positive logic)" or "166 (negative logic)" in any of **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function.
- The X84 signal input is valid either through the external terminal or via network regardless of the **Pr.338** and **Pr.339** settings (Selection of control source in Network operation mode).
- During emergency drive operation, the operation is performed as Pr.502 Stop mode selection at communication error
 = "0 (initial value)" and communication errors (such as E.SER) do not occur. (A protective function is performed according to its operation during emergency drive operation.)
- The following diagram shows the operation of the emergency drive function (in the retry / output shutoff mode or in the fixed frequency mode (**Pr.523** = "211")).



• The following diagram shows the operation of switching over to the commercial power supply operation during emergency drive operation by using the CS signal (when the electronic bypass during emergency drive operation is enabled) (in the commercial mode or in the fixed frequency mode (**Pr.523** = "411")).



*1 Input the CS signal via an external terminal.

Emergency drive operation selection (Pr.523, Pr.524)

• Use **Pr.523 Emergency drive mode selection** to select the emergency drive operation. Set a value in the hundreds place to select the operation when a valid protective function is activated (critical fault) during emergency drive. Set values in the ones and tens places to select the operation method.

| Pr.523 setting | Emerge | ency drive operation | on mode | Description | | |
|---------------------|---|----------------------|---|--|--|--|
| 1[][] | Output shutoff mode | е | | Output shutoff when a critical fault occurs. | | |
| 2[[] | Retry / output shuto | ff mode | | Retry operation when a critical fault occurs. (Output shutoff when a fault for which retry is not permitted occurs.) Output shutoff when a critical fault for which retry is not permitted occurs or when the retry count is exceeded. | | |
| 300*1 | Retry / commercial mode Commercial mode | | Selecting operation when a critical fault occurs during emergency drive operation | Retry operation when a critical fault occurs. (Electronic bypass when a fault for which retry is not permitted occurs. The operation is switched over to the commercial power supply operation when a critical fault for which retry is no permitted occurs or when the retry count is exceeded. While Pr.515 = "9999", the operation is switched over to the commercial power supply operation when the retry count reaches 200. | | |
| 4[][] ^{*1} | | | | The operation is switched over to the commercial power supply operation when a critical fault occurs. | | |
| []00 | Normal operation | | | The operation is performed with the same set frequency and by the same starting command as those in the normal operation. Use this mode to avoid output shutoff due to a fault. | | |
| []11 | | Forward rotation |] | The operation is forcibly performed with the frequency set | | |
| []12 | Fixed frequency mode | Reverse rotation | O de ations that | in Pr.524 . Even when the motor is stopped, the operation is started by the emergency drive operation. | | |
| []21 | | Forward rotation | Selecting the operation method | The operation is performed under PID control using the | | |
| []22 | | Reverse rotation | | Pr.524 setting as a set point. The measured values are input in the method set in Pr.128 . | | |
| []23 | PID control mode PID control mode PID control mode PID control mode PID control mode PID PID control mode PID Reverse rotation (Second PID measured value input) | | | The operation is performed under PID control using the Pr.524 setting as a set point. The measured values are | | |
| []24 | | | | input in the method set in Pr.753 . | | |
| 9999 | Emergency drive di | sabled. | | | | |

*1 Under PM motor control, the operation is not switched over to the commercial power supply operation and the output is shut off.

NOTE

• When the emergency drive is activated in the fixed frequency mode or in the PID control mode, the operation is automatically switched from the PU operation mode or External/PU combined operation mode to the External operation mode.

Retry operation during emergency drive (Pr.515, Pr.514)

- Set the retry operation during emergency drive operation. Use **Pr.515 Emergency drive dedicated retry count** to set the retry count, and use **Pr.514 Emergency drive dedicated retry waiting time** to set the retry waiting time.
- The ALM signal output conditions depend on the **Pr.67 Number of retries at fault occurrence** setting. (Refer to page 276.)
- For the protective functions (critical faults) for which a retry is performed during emergency drive operation, refer to page 285.

NOTE

• During emergency drive operation, Pr.65 Retry selection is not available.

Electronic bypass during emergency drive (Pr.136, Pr.139, Pr.57)

 For selecting the commercial mode (Pr.523 = "3[][], 4[][]"), setting is required as follows. Set Pr.136 MC switchover interlock time and Pr.139 Automatic switchover frequency from inverter to bypass operation and assign MC2 and MC3 signals to output terminals. When the CS signal is assigned to an input terminal, set Pr.57 Restart coasting time ≠ "9999" and input the CS signal

through the terminal. (In the initial setting, the CS signal is assigned to the terminal CS.) Select V/F control or Advanced magnetic flux vector control (Under PM motor control, the operation is not switched over to the commercial power supply operation and the output is shut off.)

• During emergency drive operation, the operation is switched over to the commercial power supply operation when any of the following conditions is satisfied.

CS signal turns OFF.

A critical fault for which retry is not permitted occurs while Pr.523 = "3[][]".

A critical fault occurs while Pr.523 = "4[][]".

- While the motor is driven by the inverter during emergency drive operation, if a condition for electronic bypass is satisfied, the output frequency is accelerated/decelerated to the **Pr.139** setting. When the frequency reaches the set frequency, the operation is switched over to the commercial power supply operation. (The operation is immediately switched over to the commercial power supply operation during output shutoff due to a critical fault occurrence.)
- If the parameter for electronic bypass is not set while the commercial mode is set (**Pr.523** = "3[][], 4[][]"), the operation is not switched over to the commercial power supply operation even when a condition for switchover is satisfied, and the output is shut off.
- To assign the MC2 and MC3 signals to output terminals, use any two of **Pr.190 to Pr.196 (Output terminal function selection)** and set "18 (positive logic)" for the MC2 signal and set "19 (positive logic)" for the MC3 signal.
- Operation of magnetic contactor (MC2, MC3)

| | | Operation | | |
|--------------------|--|--|---------------------------|--|
| Magnetic contactor | Installation location | During commercial power supply operation | During inverter operation | |
| MC2 | Between power supply and motor | Shorted | Open | |
| MC3 | Between inverter output side and motor | Open | Shorted | |

• The input signals are as shown below.

| Signal | Function | Operation | MC operation ^{*4} | |
|------------------|-------------------------------|---------------------------------------|----------------------------|-----------|
| Signai | Function | Operation | MC2 | MC3 |
| | | ON: Inverter operation | × | 0 |
| CS ^{*1} | Inverter/bypass | OFF: Emergency drive commercial power | 0 | × |
| | | supply operation ^{*2} | 0 | |
| NO4 | Fuerenza en eleire en enetien | ON: Emergency drive operation | — | — |
| X84 | Emergency drive operation | OFF: Normal operation ^{*3} | × | 0 |
| RES | Operation status reset | ON: Reset | × | No change |
| RES | Operation status leset | OFF: Normal operation | — | — |

*1 Input the CS signal via an external terminal. (Set **Pr.162** = "0 to 3, 10 to 13" or **Pr.338** = "1".)

*2 If the signal is turned ON after switchover to the emergency drive commercial power supply operation, the operation will not be returned to the inverter-driven operation.

*3 If the signal is turned OFF during the emergency drive operation, the operation will not be returned to normal.

*4 MC operation is as shown below.

| Notation | MC operation | | | | |
|-----------|---|--|--|--|--|
| 0 | ON | | | | |
| × | DFF | | | | |
| _ | During inverter operation: MC2-OFF, MC3-ON During commercial power supply operation: MC2-ON, MC3-OFF | | | | |
| No change | The operation status before changing the signal state to ON or OFF is held. | | | | |

- NOTE

• During electronic bypass operation while the electronic bypass sequence is enabled (**Pr.135** = "1"), the emergency drive function is not available.

PID control during emergency drive operation

- The **Pr.524** setting is used as a set point for operation during emergency drive operation in the PID control mode. Input the measured values in the method set in **Pr.128** or **Pr.753**.
- When the PID control mode is selected for emergency drive, the PID action during emergency drive operation is as follows depending on the PID control setting.

| | PID control action | | | | |
|---|---|--------------------------|-----------------------------|--|--|
| Item | Set point / measured value input setting | Deviation input setting | Without PID control setting | | |
| Measured value input selection (Pr.128 and Pr.753) | Held | Terminal 4 input | Terminal 4 input | | |
| Forward action / reverse action selection (Pr.128 and Pr.753) | Held | Held | Reverse action | | |
| Proportional band (Pr.129 and Pr.756) | Held | Held | 100% (initial value) | | |
| Integral time (Pr.130 and Pr.757) | Held | Held | 1 s (initial setting) | | |
| Differential time (Pr.134 and Pr.758) | Held | Held | Not used (initial setting) | | |
| Applied to the frequency / calculation only (Pr.128 and Pr.753) | Applied to the frequency | Applied to the frequency | Applied to the frequency | | |
| Other PID-related settings | Held | Held | Held | | |

• While the "retry" (**Pr.523** = "22[], 32[]") is selected in the PID control mode, if a retry occurs at an occurrence of E.CPU, E.1 to E.3, or E.5 to E.7 during emergency drive operation, the operation is performed not under PID control but with the fixed frequency.

Use Pr.1013 Running speed after emergency drive retry reset to set the fixed frequency.

| NOTE |
|------|
| Def |

• Refer to page 419 for details of PID control.

Operation of protective functions during emergency drive

· Operation of protective functions during emergency drive is as follows.

| Protective function | Operation during emergency drive | Protective function | Operation during emergency drive | Protective function | Operation during emergency drive |
|------------------------|-------------------------------------|------------------------|-------------------------------------|------------------------|-------------------------------------|
| E.OC1 | Retry | E.OHT | Retry | E.CDO | Retry |
| E.OC2 | Retry | E.PTC | Retry | E.IOH | Output shutoff |
| E.OC3 | Retry | E.OPT | The function is disabled. | E.SER | The function is disabled |
| E.OV1 | Retry | E.OP1 | The function is disabled. | E.AIE | The function is disabled |
| E.OV2 | Retry | E.OP2 | The function is disabled. | E.USB | The function is disabled |
| E.OV3 | Retry | E.OP3 | The function is disabled. | E.SAF | Retry ^{*1} |
| E.THT | Retry | E.16 | The function is disabled. | E.PBT | Retry ^{*1} |
| E.THM | Retry | E.17 | The function is disabled. | E.OS | The function is disabled |
| E.FIN | Retry | E.18 | The function is disabled. | E.LCI | The function is disabled |
| E.IPF | The function is disabled. | E.19 | The function is disabled. | E.PCH | The function is disabled |
| E.UVT | The function is disabled. | E.20 | The function is disabled. | E.PID | The function is disabled |
| E.ILF | The function is disabled. | E.PE6 | The function is disabled. | E.1 | Retry ^{*2} |
| E.OLT | Retry | E.PE | Output shutoff | E.2 | Retry ^{*2} |
| E.SOT | Retry | E.PUE | The function is disabled. | E.3 | Retry ^{*2} |
| E.LUP | The function is disabled. | E.RET | Output shutoff | E.5 | Retry ^{*2} |
| E.LDN | The function is disabled. | E.PE2 | Output shutoff | E.6 | Retry ^{*1*2} |
| E.BE | Retry ^{*1} | E.CPU | Retry | E.7 | Retry ^{*1*2} |
| E.GF | Retry | E.CTE | The function is disabled. | F 12 | Output abutoff |
| E.LF | The function is disabled. | E.P24 | The function is disabled. | E.13 | Output shutoff |

*1 While the switchover to the commercial power supply operation during emergency drive operation is enabled, when the same protective function is activated twice consecutively, the retry is attempted up to twice.

*2 In normal operation (**Pr.523** = "200 or 300"), the start signal is turned OFF at the same time the retry function resets the protective function. Input the start signal again to resume the operation.

• The fault output during emergency drive operation is as follows.

| | Pr.190 to Pr.196 setting | | | |
|--------|--------------------------|-------------------|---|--|
| Signal | Positive logic | Negative logic | Description | |
| ALM | 99 | 199 | Turns ON at the occurrence of a fault that causes the above-mentioned "retry" or "output shutoff" during emergency drive operation. | |
| ALM3 | 66 | 166 | Output when a fault occurs during emergency drive operation. When a fault which does not activate protective functions occurs during emergency drive operation, the signal is ON for three seconds and then turned OFF. | |

Input signal operation

- During emergency drive operation in the fixed frequency mode or in the PID control mode, input signals unrelated to the emergency drive become invalid with some exceptions.
- The following table shows functions of the signals that do not become invalid during emergency drive operation in the fixed frequency mode or in the PID control mode.

| Input signal status Fixed frequency mode | | PID control mode |
|--|----------------------------------|--|
| Valid | OH, TRG, TRC, X51, RES, X70, X71 | OH, TRG, TRC, X51, RES, X70, X71 |
| Held | RT, X18, SQ, X84 | RT, X18, SQ, X64, X65, X66, X67, X79, X84 |
| Always-ON | — | X14, X77, X78, X80 |

Emergency drive status monitor

- Set "68" in Pr.52, Pr.774 to Pr.776, Pr.992 to monitor the status of the emergency drive on the operation panel.
- Description of the status monitor

| Operation | Description | | | | |
|---------------------|--|---|---|--|--|
| panel indication | Emergency drive setting | Emergency drive operating status | | | |
| 0 | Emergency drive function setting is not available. | — | | | |
| 1 | | During normal operation | | | |
| 2 |] | | Operating properly | | |
| 3 | Electronic bypass during | | A certain alarm is occurring.*2 | | |
| 4 | emergency drive operation is disabled. | Emergency drive in operation | A critical fault is occurring. The operation is being continued by the retry. | | |
| 5 | | | A critical fault is occurring. The continuous operation is not allowed due to output shutoff. | | |
| 11 | | During normal operation | | | |
| 12 |] | | Operating properly | | |
| 13 | | | A certain alarm is occurring.*2 | | |
| 14 | Electronic bypass during | Emergency drive in operation | A critical fault is occurring. The operation is being continued by the retry. | | |
| 15 | emergency drive operation is enabled. | | A critical fault is occurring. The continuous operation is not allowed due to output shutoff. | | |
| 2[] ^{*1} | | Electronic bypass is started during emergency drive (during acceleration/deceleration to the switchover frequency). | | | |
| 3[] ^{*1} | | During electronic bypass during emergency drive (waiting during the interlock time). | | | |
| 4[] ^{*1} | 1 | During commercial power supply operation during emergency drive | | | |

*1 The first digit remains the same as the previous numerical value (fault condition).

*2 "A certain alarm" means a protective function disabled during emergency drive shown in the tables on page 285.

AUTION

 When the emergency drive operation is performed, the operation is continued or the retry is repeated even when a fault occurs, which may damage or burn the inverter and motor. Before restarting the normal operation after using this function, make sure that the inverter and motor have no fault. Any damage of the inverter or the motor caused by using the emergency drive function is not covered by the warranty even within the guarantee period.

5.7.9 Checking faulty area in the internal storage device

When E.PE6 (Internal storage device fault) occurs, faulty area in the internal storage device can be checked by reading **Pr.890**. When the read value of **Pr.890** is "7" or smaller, an inverter reset after All parameter clear can return the operation to normal. (The parameters that had been changed before All parameter clear must be set again.)

| Pr. | Name | Initial value | Setting range | Description |
|-------------|--|---------------|---------------|---|
| 890 H325 | Internal storage device status indication | 0 | (() to 9999) | A detected faulty area can be indicated in the internal storage device. |



• Use the read value of Pr.890 to check the faulty area.

The following table shows faulty areas indicated by the read value of **Pr.890**. Some read values indicate that there are multiple faulty areas. (For example, the read value "7" indicates that all the areas described in No. 1 to No. 3 are faulty.)

| No. | Read value | Description | | | | |
|-----|------------|---|--|--|--|--|
| 1 | 1, 3, 5, 7 | Storage area other than the area for parameter settings is faulty (such as area for the set frequency). (When All parameter clear is performed, the set frequency, remotely-set frequency, host name for Ethernet communication, and offline auto tuning data are cleared.) | | | | |
| 2 | 2, 3, 6, 7 | Storage area for standard parameter settings is faulty. | | | | |
| 3 | 4, 5, 6, 7 | Storage area for communication parameter settings is faulty. | | | | |
| 4 | 8 to 9999 | Area for manufacturer setting | | | | |

5.7.10 Limiting the output frequency (maximum/minimum frequency)

Motor speed can be limited. Clamp the upper and lower limits of the output frequency.

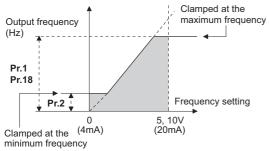
| Pr. | Name | Initial value | Setting range | Description |
|-----------|--------------------|----------------------|---------------|--|
| 1 | Maximum frequency | 120 Hz ^{*1} | 0 to 120 Hz | Set the upper limit of the output frequency. |
| H400 | Maximum nequency | 60 Hz ^{*2} | | Get the upper limit of the output frequency. |
| 2 H401 | Minimum frequency | 0 Hz | 0 to 120 Hz | Set the lower limit of the output frequency. |
| 18 | High speed maximum | 120 Hz ^{*1} | 0 to 590 Hz | Set when operating at 120 Hz or higher. |
| H402 | frequency | 60 Hz ^{*2} | 010 390 112 | Set when operating at 120 Hz of higher. |

*1 For the FR-F820-02330(55K) or lower, and FR-F840-01160(55K) or lower.

*2 For the FR-F820-03160(75K) or higher, and FR-F840-01800(75K) or higher.

Setting the maximum frequency (Pr.1, Pr.18)

- Set **Pr.1 Maximum frequency** to the upper limit of the output frequency. If the value of the frequency command given is higher than the setting, the output frequency is clamped at the maximum frequency.
- To operate at a frequency higher than the 120 Hz, adjust the upper output frequency limit with **Pr.18 High speed maximum frequency**. (When setting a frequency in **Pr.18**, the **Pr.1** setting automatically changes to the frequency set in **Pr.18**. Also, when setting a frequency in **Pr.18**, the **Pr.18** setting automatically changes to the frequency set in **Pr.1**.)



5

Setting the minimum frequency (Pr.2)

- Set Pr.2 Minimum frequency to the lower limit of the output frequency.
- If the set frequency is Pr.2 or less, the output frequency is clamped at Pr.2 (does not fall below Pr.2).

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• NOTE
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- To operate with a frequency higher than 60 Hz using frequency-setting analog signals, change the Pr.125 (Pr.126) (frequency setting gain) setting. Simply changing the Pr.1 and Pr.18 settings does not enable the operation at a frequency higher than 60 Hz.
- Under PM motor control, the upper and lower limits are for the commanded frequency. The final output frequency that is decided by each control may exceed the lower or upper limits.
- When Pr.15 Jog frequency is equal to or less than Pr.2, the Pr.15 setting takes precedence.
- If a jump frequency that exceeds **Pr.1 (Pr.18)** is set for the 3-point frequency jump, the maximum frequency setting is the set frequency. If the jump frequency is less than the setting of **Pr.2**, the jump frequency is the set frequency. (The set frequency can be equal to or less than the frequency lower limit.) When stall prevention is activated to decrease the output frequency, the output frequency may drop to **Pr.2** or below.

Note that when **Pr.2** is set to any value equal to or higher than **Pr.13 Starting frequency**, simply turning ON the start signal runs the motor at the frequency set in **Pr.2** even if the command frequency is not given.

W Parameters referred to

Pr.13 Starting frequency Page 238, page 239

Pr.15 Jog frequency rage 261

Pr.125 Terminal 2 frequency setting gain frequency, Pr.126 Terminal 4 frequency setting gain frequency 🖙 page 357

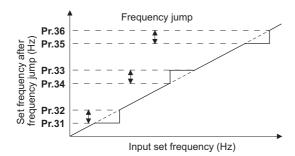
5.7.11 Avoiding machine resonance points (frequency jump)

When it is desired to avoid resonance attributable to the natural frequency of a mechanical system, these parameters allow resonant frequencies to be jumped.

| Pr. | Name | Initial value | Setting range | Description | | |
|------------|----------------------|---------------|----------------------|---|--|--|
| 31 H420 | Frequency jump 1A | qqqq | 0 to 590 Hz, 9999 | | | |
| 32 H421 | Frequency jump 1B | | | | | |
| 33 H422 | Frequency jump 2A | | | 1A to 1B, 2A to 2B, 3A to 3B are frequency jumps (3-point jump) | | |
| 34 H423 | Frequency jump 2B | | | 9999: Function disabled | | |
| 35 H424 | Frequency jump 3A | | | | | |
| 36 H425 | Frequency jump 3B | | | | | |
| 552 | Frequency jump range | 9999 | 0 to 30 Hz | Set the jump range for the frequency jumps (6-point jump). | | |
| H429 | | 3333 | 9999 | 3-point jump | | |

◆ 3-point frequency jump (Pr.31 to Pr.36)

- Up to three areas may be set, with the jump frequencies set to either the top or bottom point of each area.
- The settings of frequency jumps 1A, 2A, 3A are jump points, and operation is performed at these frequencies in the jump areas.



Example 1) To fix the frequency to 30 Hz in the range of 30 Hz to 35 Hz, set 35 Hz in Pr.34 and 30 Hz in Pr.33.

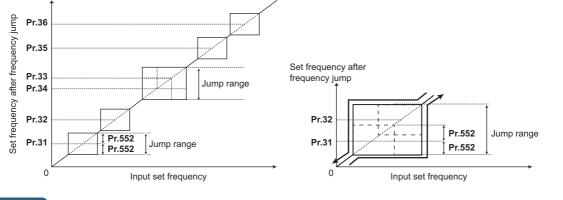
Pr.34: 35 Hz ------Pr.33: 30 Hz ----

Example 2) To jump the frequency to 35 Hz in the range of 30 Hz to 35 Hz, set 35 Hz in Pr.33 and 30 Hz in Pr.34.

Pr.33: 35 Hz ···· Pr.34: 30 Hz ····

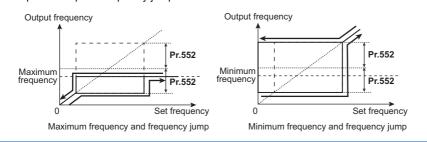
♦ 6-point frequency jump (Pr.552)

- A total of six jump areas can be set by setting the common jump range for the frequencies set in Pr.31 to Pr.36.
- When frequency jump ranges overlap, the lower limit of the lower jump range and the upper limit of the upper jump range are used.
- When the set frequency decreases and falls within the jump range, the upper limit of the jump range is the set frequency. When the set frequency increases and falls within the jump range, the lower limit of the jump range is the set frequency.



- NOTE

- During acceleration/deceleration, the frequency within the set area is valid.
- If the setting ranges of individual groups (1A and 1B, 2A and 2B, 3A and 3B) overlap, Parameter write error (Er1) occurs.
- Setting Pr.552 = "0" disables frequency jumps.
- If a jump frequency that exceeds Pr.1 (Pr.18) Maximum frequency is set for the 3-point frequency jump, the maximum frequency setting is the set frequency. If the jump frequency is less than the setting of Pr.2 Minimum frequency, the jump frequency is the set frequency. (The set frequency can be equal to or lower than the frequency lower limit.)
 Example with 6-point frequency jump



Parameters referred to

Pr.1 Maximum frequency, Pr.2 Minimum frequency, Pr.18 High speed maximum frequency 🖙 page 287

5.7.12 Stall prevention operation

This function monitors the output current and automatically changes the output frequency to prevent the inverter from shutting off due to overcurrent, overvoltage, etc. It can also limit the stall prevention and fast-response current limit operation during acceleration/deceleration and power/regenerative driving.

Stall prevention

If the output current exceeds the stall prevention operation level, the output frequency of the inverter is automatically changed to reduce the output current.

Also, the second stall prevention function can limit the output frequency range in which the stall prevention function is enabled.

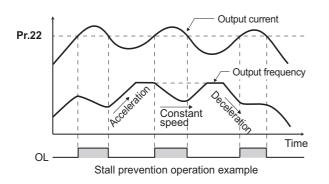
· Fast-response current limit

If the current exceeds the limit value, the output of the inverter is shut off to prevent an overcurrent.

| Dr | Nama | Initial | value | Cotting ronge | | Description |
|------------------------------|---|---------|-------|----------------------------|--|--|
| Pr. | Name | FM | CA | Setting range | | Description |
| 22 | Stall prevention | 120% | 110% | 0 | Stall prevention operation | |
| H500 | operation level | 12070 | 11070 | 0.1% to 400% ^{*1} | Set the current limit at which the stall prevention operation starts. | |
| 156 H501 | Stall prevention operation selection | 0 | | 0 to 31, 100, 101 | Enable/disable the sta response current limit | Il prevention operation and the fast- operation. |
| 48 | | | | 0 | Second stall preventio | n operation disabled. |
| H600 Magneticiflux | Second stall prevention operation level | 120% | 110% | 0.1% to 400% ^{*1} | The stall prevention or RT signal. | peration level can be changed using the |
| 49 | Second stall | | | 0 | Second stall preventio | n operation disabled. |
| H601 | prevention | 0 Hz | | 0.01 to 590 Hz | Set the frequency at w starts. | hich the Pr.48 stall prevention operation |
| Magneticiflux | frequency | | | 9999 | Pr.48 is enabled when | the RT signal is ON. |
| 23 H610 | Stall prevention operation level | | | 0% to 200% | The stall operation leve rated frequency can be | el when running at high speeds above the e reduced. |
| Magnetic; flux | compensation factor at double speed | 9999 | | 9999 | Stall prevention operation disabled at double speed. | |
| 66 H611 Magneticiflux | Stall prevention operation reduction starting frequency | 60 Hz | 50 Hz | 0 to 590 Hz | Set the frequency at w starts. | hich the stall operation level reduction |
| 148 H620 Magneticiflux | Stall prevention level at 0 V input | 120% | 110% | 0% to 400% ^{*1} | The stall prevention operation level can be changed by th analog signal input to the terminal 1 (terminal 4). | |
| 149 H621 Magneticiflux | Stall prevention level at 10 V input | 150% | 120% | 0% to 400% ^{*1} | | |
| | | | I | 0 | Output voltage reduction enabled | Enable/disable the output voltage |
| 154 H631 | Voltage reduction selection during | 1 | | 1 | Output voltage reduction disabled. | reduction during stall prevention operation. |
| Magnetic; flux | stall prevention operation | 1 | | 10 | | Use this setting when the overvoltage protective function (E.OV[]) is activated |
| | | | | 11 | Output voltage reduction disabled. | during stall prevention operation in an application with large load inertia. |
| 157 M430 | OL signal output timer | 0 s | | 0 to 25 s | Set the OL signal output start time when stall prevention is activated. | |
| | | | | 9999 | No OL signal output. | |
| 858 T040 | Terminal 4 function assignment | 0 | | 0, 4, 9999 | "4" and the signal to te | |
| 868 T010 | Terminal 1 function assignment | 0 | | 0, 4, 9999 | The stall prevention lev "4" and the signal to te | vel can be changed with the setting value erminal 1. |
| 874 H730 | OLT level setting | 120% | 110% | 0% to 400% | | et to trip at activation of stall prevention or. Set the output to be shut off. |

*1 The upper limit of stall prevention operation is limited internally to the following. 120% (SLD rating), 150% (LD rating)

Setting of stall prevention operation level (Pr.22)



- For Pr.22 Stall prevention operation level, set the ratio of the output current to the inverter's rated current at which the stall prevention operation is activated. Normally, use this parameter in the initial setting.
- Stall prevention operation stops acceleration (makes deceleration) during acceleration, makes deceleration during constant speed, and stops deceleration during deceleration.
- When the stall prevention operation is performed, the Overload warning (OL) signal is output.

NOTE

- A continuous overloaded condition may activate a protective function such as motor overload trip (electronic thermal O/L relay function) (E.THM).
- When **Pr.156** has been set to activate the fast response current limit (initial value), the **Pr.22** setting should not be higher than 140%. Such setting prevents torque generation.
- Under PM motor control, the stall prevention operation level is reduced inversely proportional to the output frequency in the constant output range of the rated motor frequency or higher.

Disabling the stall prevention operation and fast-response current limit according to operating conditions (Pr.156)

• Referring to the following table, enable/disable the stall prevention operation and the fast-response current limit operation, and also set the operation at OL signal output.

| Pr.156 setting | | Fast-response current limit o: enabled | Stall p | OL signal output o: enabled | | |
|-------------------|----------------------|--|--------------|--------------------------------|---------------------------|----|
| | | •: disabled | Acceleration | Deceleration | •: disabled ^{*1} | |
| 0 (initia | al value) | 0 | 0 | 0 | 0 | 0 |
| 1 | | • | 0 | 0 | 0 | 0 |
| 2 | | 0 | • | 0 | 0 | 0 |
| 3 | | • | • | 0 | 0 | 0 |
| 4 | | 0 | 0 | • | 0 | 0 |
| 5 | | • | 0 | • | 0 | 0 |
| 6 | | 0 | • | • | 0 | 0 |
| 7 | | • | • | • | 0 | 0 |
| 8 | | 0 | 0 | 0 | • | 0 |
| 9 | | • | 0 | 0 | • | 0 |
| 10 | | 0 | • | 0 | • | 0 |
| 11 | | • | • | 0 | • | 0 |
| 12 | | 0 | 0 | • | • | 0 |
| 13 | | • | 0 | • | • | 0 |
| 14 | | 0 | • | • | • | 0 |
| 15 | | • | • | • | • | *2 |
| 16 | | 0 | 0 | 0 | 0 | • |
| 17 | | • | 0 | 0 | 0 | • |
| 18 | | 0 | • | 0 | 0 | • |
| 19 | | • | • | 0 | 0 | • |
| 20 | | 0 | 0 | • | 0 | • |
| 21 | | • | 0 | • | 0 | • |
| 22 | | 0 | • | • | 0 | • |
| 23 | | • | • | • | 0 | • |
| 24 | | 0 | 0 | 0 | • | • |
| 25 | | • | 0 | 0 | • | • |
| 26 | | 0 | • | 0 | • | • |
| 27 | | • | • | 0 | • | • |
| 28 | | 0 | 0 | • | • | • |
| 29 | | • | 0 | • | • | • |
| 30 | | 0 | • | • | • | • |
| 31 | | • | • | • | • | *2 |
| | Power driving | 0 | 0 | 0 | 0 | 0 |
| 100 ^{*3} | Regenerative driving | • | • | • | • | *2 |
| | Power driving | • | 0 | 0 | 0 | 0 |
| 101 ^{*3} | Regenerative driving | • | • | • | • | *2 |

*1 When "operation stop at OL signal output" is selected, the fault output "

*2 The OL signal and E.OLT are not output because fast-response current limit and stall prevention are not operating.

*3 Setting values "100, 101" can be individually set for power driving and regenerative driving. The setting value "101" disables the fast-response current limit during power driving.

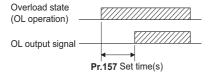
• NOTE

- When the load is heavy or the acceleration/deceleration time is short, stall prevention operates and acceleration/deceleration may not be performed according to the time set. Set **Pr.156** and stall prevention operation level to the optimum values.
- For lift applications, make settings to disable the fast-response current limit. Otherwise, the torque may be insufficient, causing the load to drop.

Adjusting the stall prevention operation signal and output timing (OL signal, Pr.157)

- If the output current exceeds the stall prevention operation level and stall prevention is activated, Overload warning (OL) signal turns ON for 100 ms or more. The output signal turns OFF when the output current falls to the stall prevention operation level or less.
- **Pr.157 OL signal output timer** can be used to set whether to output the OL signal immediately, or whether to output it after a certain time period has elapsed.
- This function also operates during regeneration avoidance operation "

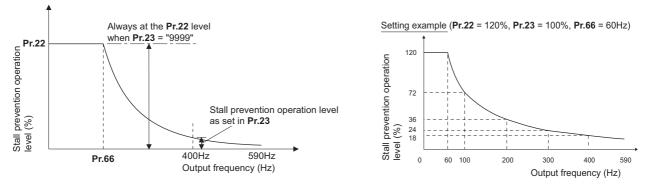
| Pr.157 setting | Description |
|-------------------|--------------------------------|
| 0 (initial value) | Output immediately. |
| 0.1 to 25 | Output after the set time (s). |
| 9999 | Not output. |
| 9999 | Νοι ουιραι. |



NOTE

- OL signal is assigned to the terminal OL in the initial status. The OL signal can be assigned to other terminals by setting "3(positive logic) or 103 (negative logic)" in any parameter from **Pr.190 to Pr.196 (Output terminal function selection)**.
- If the stall prevention operation has lowered the output frequency to 0.5 Hz and kept the level for 3 seconds, the stall prevention stop (E.OLT) is activated to shut off the inverter output.
- Changing the terminal assignment using **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Setting for stall prevention operation in the high-frequency range (Pr.22, Pr.23, Pr.66) Magneticified



- When operating at the rated motor frequency or higher, acceleration may not be made because the motor current does not increase. Also, when operating in the high-frequency range, the current flowing to the locked motor becomes less than the rated output current of the inverter; and even if the motor is stopped, the protective function does not operate (OL). In a case like this, the stall prevention level can be reduced in the high-frequency range to improve the motor's operating characteristics. This is useful when operating up to the high speed range, such as when using a centrifuge. Normally, set Pr.66 Stall prevention operation reduction starting frequency to 60 Hz, and Pr.23 Stall prevention operation level compensation factor at double speed to 100%.
- Calculation formula for stall prevention operation level

Stall prevention operation level (%) in the high-frequency range = A + B × $\begin{bmatrix} \frac{Pr.22 - A}{Pr.22 - B} \end{bmatrix} \times \begin{bmatrix} \frac{Pr.23 - 100}{100} \end{bmatrix}$ Where, A = $\frac{Pr.66 (Hz) \times Pr.22 (\%)}{Output frequency (Hz)}$, B = $\frac{Pr.66 (Hz) \times Pr.22 (\%)}{400 Hz}$

When Pr.23 = "9999" (initial value), the stall prevention operation level is constant at the Pr.22 level up to 590 Hz.

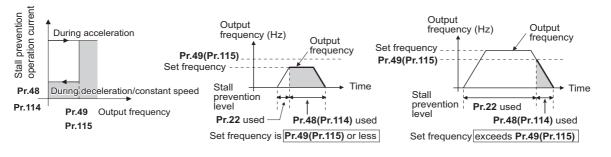
Setting multiple stall prevention operation levels (Pr.48, Pr.49) Magneticitux

- Setting Pr.49 Second stall prevention operation frequency = "9999" and turning ON the RT signal enables Pr.48 Second stall prevention operation level.
- For Pr.48, set the stall prevention operation level that is effective in the output frequency range between 0 Hz and Pr.49.
 However, the operation level is Pr.22 during acceleration.
- Stop-on-contact operation can be used by decreasing the **Pr.48** setting and loosening the reduction torque.

| Pr.49 setting | Operation | | |
|--------------------|--|--|--|
| 0 (initial value) | The second stall prevention function disabled. | | |
| 0.01 Hz to 590 Hz | The second stall prevention function operates according to the frequency.*1 | | |
| 9999 ^{*2} | The second stall prevention function operates according to the RT signal. RT signal ON: stall level set in Pr.48 RT signal OFF: stall level set in Pr.22 | | |

*1 For the stall prevention operation level, the smaller of Pr.22 and Pr.48 has precedence.

*2 When Pr.858 = "4" (analog input to terminal 4 for stall prevention operation level) or Pr.868 = "4" (analog input to terminal 1 for stall prevention operation level), turning ON the RT signal does not enable the second stall prevention function. (Input to the terminal 4 or terminal 1 is valid.)

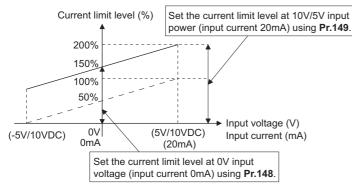


• NOTE

- When **Pr.49** ≠ "9999" (level change according to frequency) and **Pr.48** = 0%, the stall prevention function is disabled at or lower than the frequency set in **Pr.49**.
- The RT signal is assigned to the terminal RT in the initial status. Set "3" in one of **Pr.178 to Pr.189 (Input terminal function** selection) to assign the RT signal to another terminal.
- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.
- The RT signal is the Second function selection signal. The RT signal also enables other second functions. (Refer to page 377.)

Stall prevention operation level setting (analog variable) from terminal 1 (terminal 4) (Pr.148, Pr.149, Pr.858, Pr.868) Magnetic flux

- To use the terminal 1 (analog voltage input) to set the stall prevention operation level, set Pr.868 Terminal 1 function assignment = "4". Then, input a 0 to 5 V (or 0 to 10 V) to the terminal 1. To choose whether 5 V or 10 V, use Pr.73 Analog input selection. In the initial status, Pr.73 = "1 (initial value)" is set to choose 0 to ±10 V input.
- When setting the stall prevention operation level from terminal 4 (analog current input), set **Pr.858 Terminal 4 function assignment** = "4". Input a 0 to 20 mA to the terminal 4. There is no need to turn ON the AU signal.
- Set Pr.148 Stall prevention level at 0 V input to the current limit level when input voltage is 0 V (0 mA).
- Set Pr.149 Stall prevention level at 0 V input to the current limit level when input voltage is 10 V/5 V (20 mA).



| Pr.858 setting | Pr.868 setting | V/F control, Advanced magnetic flux vector control | | | |
|-------------------|-------------------|--|---------------------|--|--|
| F1.000 Setting | F1.000 Setting | Terminal 4 function | Terminal 1 function | | |
| | 0 (initial value) | | Auxiliary frequency | | |
| 0 (initial value) | 4 ^{*1} | Frequency command (AU signal-ON) | Stall prevention | | |
| | 9999 | | — | | |
| | 0 (initial value) | Stall prevention | Auxiliary frequency | | |
| 4 ^{*2} | 4 ^{*1} | *3 | Stall prevention | | |
| | 9999 | Stall prevention | — | | |
| 9999 | — | — | — | | |

*1 When **Pr.868** = "4" (analog stall prevention), the other functions of terminal 1 (auxiliary input, override function, PID control) do not operate.

*2 When **Pr.858** = "4" (analog stall prevention), PID control and speed commands via terminal 4 do not operate even when the AU signal is ON.

*3 When both **Pr.858** and **Pr.868** are set to "4" (stall prevention), terminal 1 functions take priority and terminal 4 has no function.

NOTE

• To change the stall prevention operation level with the analog signal under PM motor control, set C16 to C19 or C38 to C41 to calibrate terminal 1 or terminal 4. (Refer to page 363.)

◆ Further prevention of a trip (Pr.154) <u>▼∕</u> F Magnetic flux

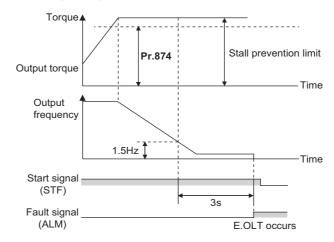
- Pr.154 Voltage reduction selection during stall prevention operation = "0 or 10", the output voltage is reduced during stall prevention operation. By making this setting, an overcurrent trip becomes less likely to occur. Use this setting when torque reduction does not pose a problem. (Under V/F control, the output voltage is reduced only during the stall prevention operation is activated.)
- Set **Pr.154** = "10 or 11" when the overvoltage protective function (E.OV[]) is activated during stall prevention operation in an application with large load inertia. Note that turning OFF the start signal (STF/STR) or varying the frequency command during stall prevention operation may delay the acceleration/deceleration start.

| Pr.154 | E.OC[] countermeasure | E.OV[] countermeasure |
|-------------------|-----------------------|-----------------------|
| 0 | Enabled | — |
| 1 (initial value) | — | — |
| 10 | Enabled | Enabled |
| 11 | — | Enabled |

The fast-response current limit cannot be set.

Trip during stall prevention operation (Pr.874)

- The inverter can be set to trip at activation of stall prevention and stalling of the motor.
- When a high load is applied and the stall prevention is activated, the motor stalls. At this time, if a state where the motor rotation speed is lower than 1.5 Hz and the output torque exceeds the level set in Pr.874 OLT level setting continues for 3 seconds, the stall prevention stop (E.OLT) is activated and the inverter output is shut off.



NOTE

 Under V/F control or Advanced magnetic flux vector control, if the output frequency drops to 0.5 Hz due to the stall prevention operation and this state continues for 3 seconds, a fault indication (E.OLT) appears, and the inverter output is shut off. This operation is activated regardless of the Pr.874 setting.

- Do not set the stall prevention operation current too low.
 Doing so will reduce the generated torgue.
- Be sure to perform the test operation.
 - Stall prevention operation during acceleration may extend the acceleration time.
 - Stall prevention operation during constant-speed operation may cause sudden speed changes.

Stall prevention operation during deceleration may extend the deceleration time.

≪ Parameters referred to 🚿

Pr.73 Analog input selection 🖙 page 349

- Pr.178 to Pr.189 (Input terminal function selection) 🖅 page 373 Pr.190 to Pr.196 (Output terminal function selection) 🖅 page 330
- Pr.858 Terminal 4 function assignment, Pr.868 Terminal 1 function assignment 3 page 352

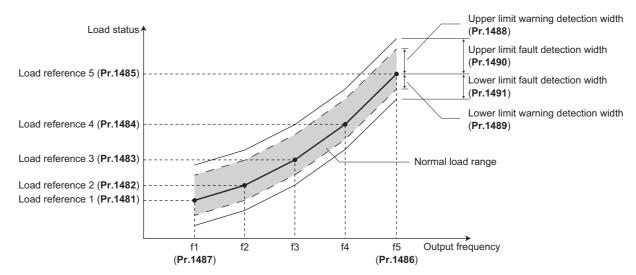
5.7.13 Load characteristics fault detection

This function is used to monitor whether the load is operating in normal condition by storing the speed/torque relationship in the inverter to detect mechanical faults or for maintenance. When the load operating condition deviates from the normal range, the protective function is activated or the warning is output to protect the inverter or the motor.

| Pr. | Name | Initia | value | Setting | Description |
|--------------|---|--------------|-------|--------------------------------------|---|
| Pr. | Name | FM | CA | range | Description |
| | | | | 0 | Load characteristics measurement mode does not start. (Load |
| | | | | | characteristics measurement completes normally.) |
| 1480 | Load characteristics | 0 | | 1 | Load characteristics measurement mode starts. |
| H520 | H520 measurement mode | | | 2, 3, 4, 5, 81, 82, 83, 84, 85 | The load characteristics measurement status is displayed. (Read-only) |
| 1481 H521 | Load characteristics load reference 1 | 9999 | | | |
| 1482 H522 | Load characteristics load reference 2 | 9999 | | - | |
| 1483 H523 | Load characteristics load reference 3 | 9999 | | 0% to 400% | Set the reference value of normal load characteristics. 8888: The present load status is written as reference status. 9999: The load reference is invalid. |
| 1484 H524 | Load characteristics load reference 4 | 9999 9999 | | | |
| 1485 H525 | Load characteristics load reference 5 | | | | |
| 1486 H526 | Load characteristics maximum frequency | 60 Hz | 50 Hz | 0 to 590 Hz | Set the maximum frequency of the load characteristics fault detection range. |
| 1487 H527 | Load characteristics minimum frequency | 6 Hz | | 0 to 590 Hz | Set the minimum frequency of the load characteristics fault detection range. |
| 1488 | Upper limit warning | 20% | | 0% to 400% | Set the detection width when the upper limit load fault warning is output. |
| H531 | detection width | 20% | | 9999 | Function disabled |
| 1489 | Lower limit warning | 20% | | 0% to 400% | Set the detection width when the lower limit load fault warning is output. |
| H532 | detection width | 2070 | | 9999 | Function disabled |
| 1490 H533 | Upper limit fault detection width | 9999 | | 0% to 400% | Set the detection width when output is shut off when the upper limit load fault occurs. |
| 11000 | | | | 9999 | Function disabled |
| 1491 H534 | Lower limit fault detection width | 9999 | | 0% to 400% | Set the detection width when output is shut off when the lower limit load fault occurs. |
| 11004 | | | | 9999 | Function disabled |
| 1492 H535 | Load status detection signal delay time / load reference measurement waiting time | 1 s | | 0 to 60 s | Set the waiting time after the load fault is detected until warning output or output shutoff. In the load characteristics measurement mode, set the waiting time after the load measurement frequency is reached until the load reference is set. |

◆ Load characteristics reference setting (Pr.1481 to Pr.1487)

- Use Pr.1481 to Pr.1485 to set the reference value of load characteristics.
- Use **Pr.1486 Load characteristics maximum frequency** and **Pr.1487 Load characteristics minimum frequency** to set the output frequency range for load fault detection.



Automatic measurement of the load characteristics reference (Load characteristics measurement mode) (Pr.1480)

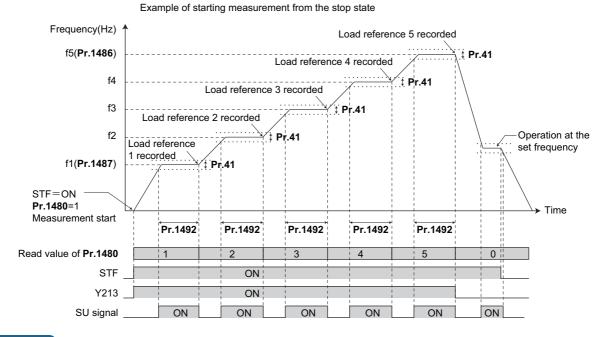
Point P

- · Perform measurement under actual environment with the motor connected.
- Set Pr.1487 Load characteristics minimum frequency to a value higher than the Pr.13 Starting frequency setting.
- Setting **Pr.1480 Load characteristics measurement mode** = "1" enables automatic measurement of the load characteristics reference. (Load characteristics measurement mode)
- Use Pr.1486 and Pr.1487 to set the frequency band for the measurement, and set Pr.1480 = "1". After setting, when the inverter is started, the measurement starts. (If the setting of Pr.1486 is lower than the setting of Pr.1487, measurement will not start.)
- The automatically measured load characteristics reference is written in Pr.1481 to Pr.1485.
- After the measurement is started, read Pr.1480 to display the status of the measurement. If "8" appears in the tens place, the measurement has not properly completed.

| Read value | e of Pr.1480 | Status | | | | | | |
|------------|--------------|---|--|--|--|--|--|--|
| Tens place | Ones place | Status | | | | | | |
| — | 1 | During measurement from the starting point to Point 1 | | | | | | |
| — | 2 | During measurement from Point 1 to Point 2 | | | | | | |
| — | 3 | During measurement from Point 2 to Point 3 | | | | | | |
| — | 4 | During measurement from Point 3 to Point 4 | | | | | | |
| — | 5 | During measurement from Point 4 to Point 5 | | | | | | |
| — | 0 | Normal completion | | | | | | |
| 8 | 1 to 5 | Termination of measurement by an activation of a protective function, Inverter reset, turning ON of MRS signal, turning OFF of the start command, or timeout. (The value in the ones place represents the above-mentioned measurement point.) | | | | | | |

While measuring automatically, the During load characteristics measurement (Y213) signal is output. For the Y213 signal, assign the function by setting "213 (positive logic)" or "313 (negative logic)" in any of in any parameter from Pr.190 to Pr.196 (Output terminal function selection).

• Setting "8888" in **Pr.1481 to Pr.1485** enables fine adjustment of load characteristics. When "8888" is set to **Pr.1481 to Pr.1485** during operation, the load status at that point is set in the parameter. (Only when the set frequency is within ±2 Hz of the frequency of the measurement point, and SU signal is in the ON state.)



NOTE

- Even if the load measurement is not properly completed, the load characteristics fault is detected based on the load characteristics found by the already-completed portion of the measurement.
- During the load characteristics measurement, the load characteristics fault detection is not performed.
- During the load characteristics measurement, linear acceleration/deceleration is performed even if the S-pattern acceleration/ deceleration is set.
- Changing the terminal assignment using **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Setting the load characteristics reference manually (Pr.1481 to Pr.1485)

- Set Pr.1480 Load characteristics measurement mode = "0" (initial value).
- Set **Pr.1486** and **Pr.1487** to specify the frequency band for the measurement, and calculate the frequency as the load characteristics reference (f2 to f4) using the following table.
- Start the inverter operation, and set **Pr.1481** = "8888" during operation at the frequency of the load characteristics reference 1 (f1). The load status at that point is set in **Pr.1481** (only when the set frequency is within ±2 Hz of the frequency of the measurement point, and the SU signal is ON).

| Reference | Frequency | Load reference |
|----------------------------------|--|----------------|
| Load characteristics reference 1 | f1: load characteristics minimum frequency (Pr.1487) | Pr.1481 |
| Load characteristics reference 2 | f2 = (f5 - f1)/4 + f1 | Pr.1482 |
| Load characteristics reference 3 | f3 = (f5 - f1)/2 + f1 | Pr.1483 |
| Load characteristics reference 4 | $f4 = (f5 - f1) \times 3/4 + f1$ | Pr.1484 |
| Load characteristics reference 5 | f5: load characteristics maximum frequency (Pr.1486) | Pr.1485 |

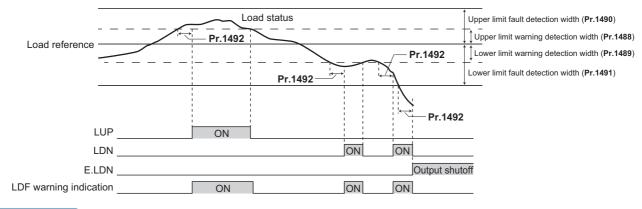
• Set load references in Pr.1482 to Pr.1485 in the same way as Pr.1481.

NOTE

• When inputting values directly in Pr.1481 to Pr.1485, input the load meter value monitored at each reference frequency.

Load fault detection setting (Pr.1488 to Pr.1491)

- When the load is deviated from the detection width set in Pr.1488 Upper limit warning detection width, the Upper limit warning detection (LUP) signal is output. When the load is deviated from the detection width set in Pr.1489 Lower limit warning detection width, the Lower limit warning detection (LDN) signal is output. At the same time, the Load fault warning (LDF) appears on the operation panel.
- For the LUP signal, assign the function by setting "211 (positive logic)" or "311 (negative logic)" in any parameter from Pr.190 to Pr.196 (Output terminal function selection). For the LDN signal, assign the function by setting "212 (positive logic)" or "312 (negative logic)" in any parameter from Pr.190 to Pr.196 (Output terminal function selection).
- When the load is deviated from the detection width set in Pr.1490 Upper limit fault detection width, the protective function (E.LUP) is activated and the inverter output is shut off. When the load is deviated from the detection width set in Pr.1491 Lower limit fault detection width, the protective function (E.LDN) is activated and the inverter output is shut off.
- To prevent the repetitive on/off operation of the signal due to load fluctuation near the detection range, **Pr.1492 Load** status detection signal delay time / load reference measurement waiting time can be used to set the delay time. Even when a fault is detected out of the detection range once, the warning is not output if the characteristics value returns to the normal range from a fault state within the output delay time.



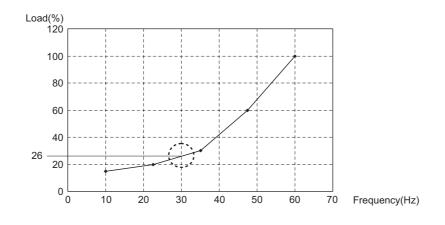
- NOTE

• Changing the terminal assignment using **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Setting example

- The load characteristics are calculated from the parameter setting and the output frequency.
- A setting example is as follows. The reference value is linearly interpolated from the parameter settings. For example, the reference when the output frequency is 30 Hz is 26%, which is linearly interpolated from values of the reference 2 and the reference 3.

| Reference | Frequency | Load reference |
|----------------------------------|---|----------------------|
| Load characteristics reference 1 | f1: Load characteristics minimum frequency (Pr.1487) = 10 Hz | Pr.1481 = 15% |
| Load characteristics reference 2 | f2 = (f5 - f1)/4 + f1 = 22.5 Hz | Pr.1482 = 20% |
| Load characteristics reference 3 | f3 = (f5 - f1)/2 + f1 = 35 Hz | Pr.1483 = 30% |
| Load characteristics reference 4 | f4 = (f5 - f1) × 3/4 + f1 = 47.5 Hz | Pr.1484 = 60% |
| Load characteristics reference 5 | f5: Load characteristics maximum frequency (Pr.1486) = 60 Hz | Pr.1485 = 100% |



NOTE

 When the load reference is not set for five points, the load characteristics value is determined by linear interpolation of the set load reference values only. If there is only one load reference setting, the set load reference is used as the load reference all through the range.

Parameters referred to

Pr.41 Up-to-frequency sensitivity 🖙 page 337 Pr.190 to Pr.196 (Output terminal function selection) 🖙 page 330

5.7.14 Motor overspeeding detection

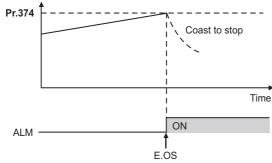
PM

The Overspeed occurrence (E.OS) is activated when the motor speed exceeds the overspeed detection level. This function prevents the motor from accidentally speeding over the specified value, due to an error in parameter setting, etc.

| Pr. | Name | Initial value | Setting range | Description |
|------|------------------------------|-----------------------|---------------|---|
| 374 | Overspeed detection level | 9999 0 to 590 9999 | 0 to 590 Hz | If the motor rotation speed exceeds the speed set in Pr.374 during PM motor control, overspeed (E.OS) occurs, and the inverter output is shut off. |
| H800 | | | 9999 | During PM motor control, E.OS occurs when the speed exceeds the "maximum motor frequency + 10 Hz" ^{*1} . |

*1 The motor maximum frequency is set in **Pr.702 Maximum motor frequency**. When **Pr.702** = "9999 (initial value)", the **Pr.84 Rated motor frequency** is used as the maximum motor frequency.

Motor speed



5.8

(M) Item and output signal for monitoring

| Purpose | | Parameter to set | | Refer to page |
|--|--|--|--|------------------|
| To display the motor speed (the number of rotations per minute) To switch the unit of measure to set the operation speed from frequency to motor speed | Speed indication and its setting change to rotations per minute | P.M000 to P.M002 | Pr.37, Pr.144, Pr.505 | 303 |
| To change the item monitored on the operation panel and parameter unit | Operation panel monitor item selection Cumulative monitor value clear | P.M020 to P.M023, P.M030, P.M031, P.M044, P.M045, P.M050 to P.M052, P.M100 to P.M104 | Pr.52, Pr.170, Pr.171, Pr.268, Pr.290, Pr.563, Pr.564, Pr.774 to Pr.776, Pr.891, Pr.992, Pr.1018, Pr.1106 to Pr.1108 | 305 |
| To change the monitor item whose data is output via terminal FM (CA) or AM | Terminal FM (CA) function selection | P.M040 to P.M042, P.M044, P.M300, P.M301, P.D100 | Pr.54, Pr.55, Pr.56, Pr.158, Pr.290, Pr.291, Pr.866 | 314 |
| To adjust the output via terminal FM (CA) or AM | Terminal FM (CA)/AM calibration | P.M310, P.M320, P.M321, P.M330 to P.M334 | Pr.867, Pr.869, C0 (Pr.900), C1 (Pr.901), C8 (Pr.930) to C11 (Pr.931) | 319 |
| To check the effects of energy saving | Energy saving monitoring | P.M023, P.M100, P.M200 to P.M207, P.M300, P.M301 | Pr.52, Pr.54, Pr.158, Pr.891 to Pr.899 | 324 |
| To assign functions to the output terminals | Output terminal function assignment | P.M400 to P.M406, P.M410 to P.M416, P.M420 to P.M422, P.M431 | Pr.190 to Pr.196, Pr.289, Pr.313 to Pr.322 | 330 |
| To detect the output frequency | Up-to-frequency sensitivity Output frequency detection Low speed detection | P.M440 to P.M444 | Pr.41 to Pr.43, Pr.50, Pr.870 | 337 |
| To detect the output current | Output current detection Zero current detection | P.M433, P.M460 to P.M464 | Pr.150 to Pr.153, Pr.166, Pr.167 | 339 |
| To detect the output torque | Output torque detection | P.M470 | Pr.864 | 341 |
| To use the remote output function | Remote output | P.M500 to P.M502 | Pr.495 to Pr.497 | 341 |
| To use the analog remote output function | Analog remote output | P.M530 to P.M534 | Pr.655 to Pr.659 | 343 |
| To output the fault code via a terminal | Fault code output function | P.M510 | Pr.76 | 345 |
| To detect the specified output power | Pulse train output of output power | P.M520 | Pr.799 | 346 |
| To detect the control circuit temperature | Control circuit temperature monitoring | P.M060 | Pr.663 | 347 |

5.8.1 Speed indication and its setting change to rotations per minute

The frequency monitored or set on the operation panel can be changed to the motor speed or the machine speed.

| Pr. | Name | Initial | value | Setting range | Description |
|-------------|-----------------------------|---------|-------|--|--|
| F1. | Indille | FM | CA | Setting range | Description |
| 37 | | | | 0 | Monitoring and setting of frequency |
| M000 | Speed display | 0 | | 1 to 9998 ^{*1} | Set a number for the speed of machine operated at the speed (frequency) set in Pr.505 . |
| 505 M001 | Speed setting reference | 60 Hz | 50 Hz | 1 to 590 Hz | Set the reference speed (frequency) for Pr.37. |
| 144 M002 | Speed setting switchover | 4 | | 0, 2, 4, 6, 8, 10, 12, 102, 104, 106, 108, 110, 112 | Set the number of motor poles for the indication of the motor speed. |

*1 The maximum value of the setting range differs according to the **Pr.1 Maximum frequency**, **Pr.505 Speed setting reference**, and it can be calculated from the following formula.

The maximum value of **Pr.37** < 65535 × **Pr.505** / **Pr.1** setting value (Hz).

The maximum setting value of $\ensuremath{\text{Pr.37}}$ is 9998 if the result of the above formula exceeds 9998.

Indication of motor speed (Pr.37, Pr.144)

- To change the indication to the motor speed, set the number of motor poles (2, 4, 6, 8, 10, or 12) or the number of motor poles with the addition of 100 (102, 104, 106, 108, 110, or 112) in **Pr.144**.
- Whenever the number of motor poles set in **Pr.81 Number of motor poles** is changed, the **Pr.144** setting changes automatically in conjunction with **Pr.81**. However, the **Pr.81** setting does not automatically change when the **Pr.144** setting is changed.

Example 1) Changing the initial value of **Pr.81** to "2" will change the **Pr.144** setting from "4" to "2".

Example 2) Changing the **Pr.81** setting to "2" while **Pr.144** = "104" will change the **Pr.144** setting from "104" to "102".

Indication of machine speed (Pr.37, Pr.505)

- To change the indication to the machine speed, set a number in **Pr.37** which corresponds to the speed of machine operated at the frequency set in **Pr.505**.
- For example, when **Pr.505** is set to 60 Hz and **Pr.37** is set to "1000", the operation panel indicates "1000" as the monitor value of machine speed while the output frequency is 60 Hz. "500" is displayed while the output frequency is 30 Hz.

Monitoring/setting items and its increments

• When both settings of **Pr.37** and **Pr.144** are changed from the initial values, a precedence order for these settings is as follows:

Pr.144 = 102 to 112 > **Pr.37** = 1 to 9998 > **Pr.144** = 2 to 12.

• The monitoring/setting items and its increments are listed with the following matrix to show the combination of the **Pr.37** and **Pr.144** settings.

| Pr.37 setting | Pr.144 setting | Output frequency indication | Set frequency indication | Running speed indication | Indication of frequency setting parameter |
|----------------------|----------------|----------------------------------|----------------------------------|---|--|
| | 0 | 0.01 Hz | 0.01 Hz | 1 r/min ^{*1} | 0.01 Hz |
| 0 (initial value) | 2 to 12 | 0.01 Hz (initial setting) | 0.01 Hz (initial setting) | 1 r/min ^{*1} (initial setting) | 0.01 Hz (initial setting) |
| | 102 to 112 | 1 r/min ^{*1} | 1 r/min ^{*1} | 1 r/min ^{*1} | 1 r/min ^{*1} |
| | 0 | 0.01 Hz | 0.01 Hz | 1 (machine speed ^{*1}) | 0.01 Hz |
| 1 to 9998 | 2 to 12 | 1 (machine speed ^{*1}) | 1 (machine speed ^{*1}) | 1 (machine speed ^{*1}) | 1 (machine speed ^{*1}) |
| | 102 to 112 | 0.01 Hz | 0.01 Hz | 1 r/min ^{*1} | 0.01 Hz |

*1 Motor speed r/min conversion formula: frequency × 120 / number of motor poles (Pr.144)

Machine speed conversion formula: Pr.37 × frequency / Pr.505

The **Pr.144** value in the above formula is "**Pr.144** - 100" when any of "102 to 112" is set in **Pr.144**. The value is "4" when **Pr.37** = 0 and **Pr.144** = 0. The item set in **Pr.505** is consistently a frequency (Hz).



- The inverter's output frequency is displayed as synchronous speed under V/F control. The displayed value is "actual motor speed" + "motor slip". When Advanced magnetic flux vector control or PM motor control is selected, the actual motor speed (estimated value by motor slip calculation) is used.
- When **Pr.37** = "0" and **Pr.144** = "0", the running speed monitor is displayed with the number of motor poles 4. (Displays 1800 r/min at 60 Hz)
- To change the PU main monitor (PU main display), refer to **Pr.52**.
- When using the machine speed display for the parameter unit (FR-PU07), do not change the speed with the up/down key if a set speed above 65535 is displayed. The set speed may become an undetermined value.
- When a certain type of communication option is used, the frequency display (setting) is used regardless of the **Pr.37 and Pr.144** settings. Refer to the Instruction Manual of each communication option for details. (The frequency display (setting) is always used for HMS network options.)

Make sure to set the running speed and the number of motor poles. Otherwise, the motor might run at extremely high speed, damaging the machine.

5.8.2 Monitor item selection on operation panel or via communication

The monitor item to be displayed on the operation panel or the parameter unit can be selected.

| Pr. | Name | Initial value | Setting range | Description |
|--------------|--|-------------------------|---|--|
| 52 M100 | Operation panel main monitor selection | 0 (output frequency) | 0, 5 to 14, 17, 18, 20, 23 to 25, 34, 38, 40 to 45, 50 to 57, 61, 62, 64, 67 to 69, 81 to 96, 98, 100 | Select the item monitored on the operation panel or parameter unit. Refer to page 306 for the monitor item selection. |
| 774 M101 | Operation panel monitor selection 1 | | 1 to 3, 5 to 14, 17, 18, 20, 23 to 25, 34, | Each of the initial items monitored on the operation panel or parameter unit in the monitor mode (output frequency, |
| 775 M102 | Operation panel monitor selection 2 | 9999 | 38, 40 to 45, 50 to 57, 61, 62, 64, 67 to | output current, and output voltage) can be switched to a user-designated item. |
| 776 M103 | Operation panel monitor selection 3 | | 69, 81 to 96, 98, 100, 9999 | 9999: Follows the Pr.52 setting. |
| 992 M104 | Operation panel setting dial push monitor selection | 0 (set frequency) | 0 to 3, 5 to 14, 17, 18, 20, 23 to 25, 34, 38, 40 to 45, 50 to 57, 61, 62, 64, 67 to 69, 81 to 96, 98, 100 | Select the monitor item displayed on the operation panel at the time when the setting dial is pressed. |
| | | | 0 | Set "0" to clear the watt-hour meter. |
| 170 M020 | Watt-hour meter clear | 9999 | 10 | Set "10" to monitor the cumulative power in the range of 0 to 9999 kWh via communication. |
| | | | 9999 | Set "9999" to monitor the cumulative power in the range of 0 to 65535 kWh via communication. |
| 563 M021 | Energization time carrying- over times | 0 | (0 to 65535) (Read-only) | The number of times that the cumulative energization time exceeded 65535 hours is displayed (read-only). |
| 268 | Monitor decimal digits | | 0 | Value is displayed in 1 increments (an integer). |
| M022 | selection | 9999 | 1 | Value is displayed in 0.1 increments. |
| 891 M023 | Cumulative power monitor digit shifted times | 9999 | 9999 0 to 4 | No function Set the number of digits to move the decimal point of the cumulative energy monitored value to the left. The readout peaks out at the upper limit of readout. |
| MOLO | aight officed times | | 9999 | The function of moving the decimal point is not available. The readout is reset to 0 when it exceeds the upper limit. |
| 171 | | | 0 | Set "0" to clear the operation hour meter. |
| M030 | Operation hour meter clear | 9999 | 9999 | The readout is always 9999. Nothing changes when "9999" is set. |
| 564 M031 | Operating time carrying- over times | 0 | (0 to 65535) (Read-only) | The number of times that the operating time reaches 65535 hours is displayed. Read-only. |
| 290 M044 | Monitor negative output selection | 0 | 0 to 7 | Set the availability of negative signals output via terminal AM, to the operation panel, and through communication. |
| 1018 M045 | Monitor with sign selection | 9999 | 0, 1, 9999 | Select the item group to enable the indication of negative signed numbers. |
| 1106 M050 | Torque monitor filter | 9999 | 0 to 5 s | The filter time constant is selectable for monitoring of the torque. A larger setting results in slower response. |
| | | | 9999 | 0.3 s filter |
| 1107 M051 | Running speed monitor filter | 9999 | 0 to 5 s | The filter time constant is selectable for monitoring of the running speed. A larger setting results in slower response. |
| | | | 9999 | 0.08 s filter |
| 1108 M052 | Excitation current monitor filter | 9999 | 0 to 5 s | The filter time constant is selectable for monitoring of the motor excitation current. A larger setting results in slower response. |
| | | | 9999 | 0.3 s filter |
| | | | | |

◆ Monitor item list (Pr.52, Pr.774 to Pr.776, Pr.992)

- Use Pr.52, Pr.774 to Pr.776, or Pr.992 to select the item to monitor on the operation panel or the parameter unit.
- Refer to the following table to find the setting value for each monitoring. The value in the Pr. setting column is set in each of the parameters for monitoring (Pr.52, Pr.774 to Pr.776, and Pr.992) to determine the monitored item. The value in the RS-485 column is used for the RS-485 communication special monitor selection. The value in the MODBUS RTU column is used for the MODBUS RTU real time monitor. (The items marked with "—" cannot be selected. The circle in the negative indication (-) column indicates that the indication of negative signed numbers is available.)

| Monitor item | Increment and unit | Pr. setting | RS-485 | MODBUS RTU | Negative indication (-) ^{*1} | Description |
|--|---------------------------------|------------------|--------|---------------|---|--|
| Output frequency (speed) ^{*17} | 0.01 Hz ^{*16} | 1/0/100 | H01 | 40201 | o ^{*19} | The inverter output frequency is displayed. |
| Output current*7*9*17 | 0.01/0.1 A ^{*6} | 2/0/100 | H02 | 40202 | | The inverter output current effective value is displayed. |
| Output voltage ^{*7*17} | 0.1 V | 3/0/100 | H03 | 40203 | | The inverter output voltage is displayed. |
| Fault indication | — | 0/100 | — | — | | Each of the last 8 faults is displayed individually. |
| Set frequency / motor speed setting | 0.01 Hz ^{*16} | 5 ^{*2} | H05 | 40205 | | The set frequency is displayed. |
| Operation speed | 1 (r/min) | 6 ^{*2} | H06 | 40206 | °*19 | The motor speed is displayed (depending on the settings of Pr.37 and Pr.144). (Refer to page 303.) |
| Motor torque | 0.1% | 7 ^{*2} | H07 | 40207 | 0 | The motor torque is displayed as a percentage (0% under V/F control), considering the rated torque as 100%. |
| Converter output voltage ^{*7} | 0.1 V | 8 ^{*2} | H08 | 40208 | | The DC bus voltage value is displayed. |
| — | — | 9 ^{*8} | H09 | 40209 | | For manufacturer setting. Do not set. |
| Electronic thermal O/ L relay load factor | 0.1% | 10 ^{*2} | H0A | 40210 | | The motor thermal cumulative value is displayed, considering the thermal operation level as 100%. |
| Output current peak value ^{*7} | 0.01/0.1 A ^{*6} | 11 ^{*2} | H0B | 40211 | | The peak value of output current, which is constantly stored, is displayed. (It is reset with every startup of the inverter.) |
| Converter output voltage peak value ^{*7} | 0.1 V | 12 ^{*2} | H0C | 40212 | | The DC bus voltage peak value, which is constantly stored, is displayed. (It is reset with every startup of the inverter.) |
| Input power | 0.01/0.1 kW ^{*6} | 13 ^{*2} | H0D | 40213 | | The power at the inverter input side is displayed. |
| Output power ^{*9} | 0.01/0.1 kW ^{*6} | 14 ^{*2} | H0E | 40214 | | The power at the inverter output side is displayed. |
| Load meter | 0.1% | 17 | H11 | 40217 | | Torque current is displayed as a percentage, considering Pr.56 setting value as 100%. |
| Motor excitation current ^{*7} | 0.01 A/0.1 A ^{*6} | 18 | H12 | 40218 | | The motor excitation current is displayed. |
| Cumulative energization time ^{*3} | 1 h | 20 | H14 | 40220 | | The cumulative operation time is displayed. The number of times an integrated value has reached the maximum value of 65535 hours can be checked in Pr.563 . |
| Actual operation time ^{*3*4} | 1 h | 23 | H17 | 40223 | | The cumulative operation time is displayed. The number of times an integrated value has reached the maximum value of 65535 hours can be checked in Pr.564 . Use Pr.171 to reset it. (Refer to page 312.) |
| Motor load factor | 0.1% | 24 | H18 | 40224 | | The output current value is displayed as a percentage, considering the inverter rated current value as 100%. Readout (%) = present output current value / inverter rated current value × 100 |
| Cumulative energy ^{*7} | 0.01/0.1 kWh ^{*5*6} | 25 | H19 | 40225 | | The cumulative energy based on the monitored output power is displayed. Use Pr.170 to reset it. (Refer to page 311.) |
| Motor output | 0.01/0.1 kW ^{*6} | 34 | H22 | 40234 | | The output of a machine connected to the motor shaft is displayed. It is determined by multiplying the present output torque with the present motor speed. |
| Trace status | 1 | 38 | H26 | 40238 | | The trace status is displayed. (Refer to page 486.) |

| Monitor item | Increment and unit | Pr. setting | RS-485 | MODBUS RTU | Negative indication (-) ^{*1} | Description |
|---|---|-------------------|--------------------|----------------------|---|--|
| PLC function user monitor 1 | | 40 | H28 | 40240 | | The user-designated monitor item is displayed using the PLC function. |
| PLC function user monitor 2 | Increment set in the register | 41 | H29 | 40241 | | Each value of the following special registers is displayed. SD1216: displayed with the setting value "40" |
| PLC function user monitor 3 | SD1215 | 42 | H2A | 40242 | | SD1217: displayed with the setting value "41" SD1218: displayed with the setting value "42" (Refer to the PLC Function Programming Manual.) |
| Station number (RS- 485 terminals) | 1 | 43 | H2B | 40243 | | The station number (0 to 31) of the inverter enabling communication via the RS-485 terminals is displayed. |
| Station number (PU) | 1 | 44 | H2C | 40244 | | The station number (0 to 31) of the inverter enabling communication via the PU connector is displayed. |
| Station number (CC- Link) | 1 | 45 | H2D | 40245 | | The station number of the inverter enabling CC-Link communication is displayed. ("0" is displayed when the FR-A8NS is not installed.) |
| Power saving effect | Increment | 50 | H32 | 40250 | | The energy saving effect monitoring is enabled. The item |
| Cumulative energy saving | and unit vary depending on the parameter settings. | 51 | Н33 | 40251 | | to monitor is selectable from among the saved power, the average energy saving, and the energy cost savings. Some of them can be displayed as a percentage according to the parameter settings. (Refer to page 324.) |
| PID set point | 0.1% | 52 | H34 | 40252 | | |
| PID measured value | 0.1% | 53 | H35 | 40253 | | The set point, measured value, and deviation during PID |
| PID deviation | 0.1% | 54 | H36 | 40254 | 0 | control operation is displayed. (Refer to page 432.) |
| Input terminal status | _ | 55 ^{*18} | H0F ^{*11} | 40215 ^{*11} | | The ON/OFF state of the input terminals on the inverter is displayed. (Refer to page 310 for details of indication on the DU.) |
| Output terminal status | _ | 55 10 | H10 ^{*12} | 40216 ^{*12} | | The ON/OFF state of the output terminals on the inverter is displayed. (Refer to page 310 for details of indication on the DU.) |
| Option input terminal status ^{*10} | _ | 56 | _ | _ | | The ON/OFF state of the input terminals on the digital input option (FR-A8AX) is displayed on the DU. (Refer to page 310 for details.) |
| Option output terminal status ^{*10} | _ | 57 | _ | — | | The ON/OFF state of the output terminals on the digital output option (FR-A8AY) or the relay output option (FR-A8AR) is displayed on the DU. (Refer to page 310 for details.) |
| Option input terminal status 1 (for communication) ^{*10} | _ | _ | H3A ^{*13} | 40258 ^{*13} | | The ON/OFF state of the input terminals X0 to X15 on the digital input option (FR-A8AX) is monitored via RS-485 communication or other communication when the communication option is installed. |
| Option input terminal status 2 (for communication) ^{*10} | _ | _ | H3B ^{*14} | 40259 ^{*14} | | The ON/OFF state of the input terminal DY on the digital input option (FR-A8AX) is monitored via RS-485 communication or other communication when the communication option is installed. |
| Option output terminal status (for communication) ^{*10} | _ | _ | H3C ^{*15} | 40260 ^{*15} | | The ON/OFF state of the output terminals on the digital output option (FR-A8AY) or the relay output option (FR- A8AR) is monitored via RS-485 communication or other communication when the communication option is installed. |
| Motor thermal load factor | 0.1% | 61 | H3D | 40261 | | The accumulated heat value of the motor thermal O/L relay is displayed. The motor overload trip (electronic thermal relay function) (E.THM) occurs at 100%. |
| Inverter thermal load factor | 0.1% | 62 | H3E | 40262 | | The accumulated heat value of the inverter thermal O/L relay is displayed. The inverter overload trip (electronic thermal relay function) (E.THT) occurs at 100%. |
| PTC thermistor resistance | 0.01 kΩ | 64 | H40 | 40264 | | The PTC thermistor resistance is displayed when Pr.561 PTC thermistor protection level ≠ 9999. (The output voltage is displayed when Pr.561 = 9999.) |
| PID measured value 2 | 0.1% | 67 | H43 | 40267 | | The PID measured value is displayed while the PID control is enabled (Pr.128 \neq "0"), even if PID control operating conditions are not satisfied. (Refer to page 432.) |
| Emergency drive status ^{*8} | 1 | 68 | H44 | 40268 | | Displays the emergency drive status. (Refer to page 279.) |

| Monitor item | Increment and unit | Pr. setting | RS-485 | MODBUS RTU | Negative indication (-) ^{*1} | Description |
|---|-------------------------------|----------------|--------|---------------|---|---|
| PID input pressure value | 0.1% | 69 | H45 | 40269 | | Displays the input pressure value of the PID input pressure control function. |
| 32-bit cumulative energy (lower 16 bits) | 1 kWh | — | H4D | 40277 | | The upper or lower 16 bits of the 32-bit cumulative |
| 32-bit cumulative energy (upper 16 bits) | 1 kWh | — | H4E | 40278 | | energy is displayed on each indication. It is monitored via RS-485 communication or other |
| 32-bit cumulative energy (lower 16 bits) | 0.01/0.1 kWh ^{*6} | — | H4F | 40279 | | communication with a communication option installed. (To find the monitor codes for each communication option, refer to the Instruction Manual of each |
| 32-bit cumulative energy (upper 16 bits) | 0.01/0.1 kWh ^{*6} | _ | H50 | 40280 | | communication option.) |
| BACnet reception status | 1 | 81 | H51 | 40281 | | Displays the BACnet reception status. |
| BACnet token pass counter | 1 | 82 | H52 | 40282 | | Displays the count of received token. |
| BACnet valid APDU counter | 1 | 83 | H53 | 40283 | | Displays the count of valid APDU detection. |
| BACnet communication error counter | 1 | 84 | H54 | 40284 | | Displays the count of communication error detection. |
| BACnet terminal FM/ CA output level | 0.1% | 85 | H55 | 40285 | | Displays the value set in the Analog Output object (ID=0: Terminal FM/CA) for BACnet communication. |
| BACnet terminal AM output level | 0.1% | 86 | H56 | 40286 | 0 | Displays the value set in the Analog Output object (ID=1: Terminal AM) for BACnet communication. (A display without signs displays negative values as absolute values.) |
| Remote output value 1 | 0.1% | 87 | H57 | 40287 | | |
| Remote output value 2 | 0.1% | 88 | H58 | 40288 | · 0 | Displays the value set in Pr.656 to Pr.659 (analog |
| Remote output value 3 | 0.1% | 89 | H59 | 40289 | Ť | remote output). (Refer to page 343.) |
| Remote output value 4 | 0.1% | 90 | H5A | 40290 | | |
| PID manipulated amount | 0.1% | 91 | H5B | 40291 | 0 | The PID control manipulated amount is displayed. (Refer to page 432.) |
| Second PID set point | 0.1% | 92 | H5C | 40292 | | The set point, measured value, or deviation is displayed |
| Second PID measured value | 0.1% | 93 | H5D | 40293 | | during the second PID control operation. (Refer to page 432.) |
| Second PID deviation | 0.1% | 94 | H5E | 40294 | 0 | , |
| Second PID measured value 2 | 0.1% | 95 | H5F | 40295 | | The PID measured value is displayed while the second PID control is enabled (Pr.753 \neq "0"), even if PID control operating conditions are not satisfied. (Refer to page 432.) |
| Second PID manipulated amount | 0.1% | 96 | H60 | 40296 | 0 | The second PID control manipulated amount is displayed. (Refer to page 432.) |
| Control circuit temperature | 1°C | 98 | H62 | 40298 | 0 | The temperature of the control circuit board is displayed. (Refer to page 347.) When negative number not displayed: 0 to 100°C When negative number displayed: -20 to 100°C |

*1 Indication with a minus sign is not possible via RS-485 or MODBUS RTU communication.

*2 To monitor the item on the LCD operation panel (FR-LU08) or the parameter unit (FR-PU07) in the monitor mode, use **Pr.774 to Pr.776** or the monitor function of the FR-LU08 or the FR-PU07 for setting.

*3 The cumulative energization time and actual operation time are accumulated from 0 to 65535 hours, then cleared, and accumulated again from 0.

*4 The actual operation time does not increase if the cumulative running time before power OFF is less than an hour.

*5 On the parameter unit (FR-PU07), the unit "kW" is displayed.

*6 The increment differs according to the inverter capacity. (FR-F820-02330(55K) or lower, FR-F840-01160(55K)or lower / FR-F820-03160(75K) or higher, FR-F840-01800(75K) or higher)

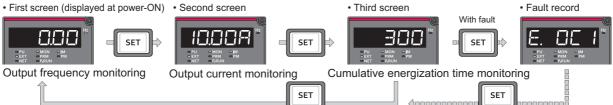
*7 Since each readout of the output voltage and output current displayed on the operation panel (FR-DU08) is a four-digit number, a value of more than 9999 is displayed as "----".

*8 The setting is available for the standard model.

*9 The inverter regards the output current which is less than the specified current level (5% of the rated inverter current) as 0 A. Therefore, each readout of an output current and output power may show "0" if a too small-capacity motor is used as contrasted with the inverter capacity and the output current falls below the specified value.

*10 Available when the plug-in option is connected.

| b1 | 15 | | | | | | | | | | | | | | | b0 |
|---|--|---|--|---|--|--|---|---|---|--|---|---|---|---|--|--|
| S | | S2 | - | - | CS | RES | STP (STOP) | MRS | JOG | RH | RM | RL | RT | AU | STR | STF |
| | (null) v | letails of value.) | bits for t | he output | terminal | status ar | e as follov | ws. (1: OI | N state, 0 | : OFF sta | ite of a ter | minal on | the invert | ter. "—" d | lenotes a | |
| b1 | 15 | _ | | _ | _ | _ | _ | _ | So (SO) | ABC2 | ABC1 | FU | OL | IPF | SU | b0 RUN |
| *13 | The de | - letails of | f bits for | - the optior | input ter | minal sta | atus 1 are | as follow | , | | | _ | - | | | |
| 10 | | | | is not in | | innar oa | | | . (1. 01 | 0.000 | | 0 01 0 10 | | | (0, 0 t.) E | ory bit i |
| b1 | 15 | | • | | | | | | | | | | | | | b0 |
| X1 | | X14 | X13 | X12 | X11 | X10 | X9 | X8 | X7 | X6 | X5 | X4 | X3 | X2 | X1 | X0 |
| | | | | | | | tus 1 are a | | 1 | - | | | | 1 | | - |
| | | | | | | | the option | | | 01110, 01 | | | initial off a | | | |
| b1 | 15 | | | | | | | | | | | | | | | b0 |
| | - | - | - | - | - | _ | - | _ | - | _ | _ | - | - | - | - | |
| *15 | The de | etails of | bits for t | ne ontion | | minal eta | atus are as | follows | (1: ON et | l ate 0: OE | E state of | a termin | l on the F | | /A8AR "- | |
| 15 | | | | | | | en the opt | | | | i state oi | aternin | aron men | N-AOAT/ | AOAN | |
| | | | , | ,, | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | b0 |
| b1 | 15 | | | | | | | | | Ve | VE | V/A | V2 | V2 | V1 | 1 |
| *16 *17 *18 | - The in The m Param PU07) Setting | nonitore neter se). Use th ig of Pr. | d values tting is n ne monite 1018 Mo | are retair ot availab or functior nitor wit t | ned even le for sett n of the F h sign se | if an inve ing the it R-LU08 o election i | RA3 hen Pr.14 erter fault of em as the or the FR- is required | occurs. R main mo PU07 for | esetting onitor item setting. | clears the on the L0 | retained CD operat | values. ion pane | l (FR-LUC | · | - | Y0 |
| *16 *17 *18 *19 | The in The m Param PU07) Setting rotatio | nonitore neter se). Use th og of Pr. on direct | d values tting is n ne monito 1018 Mo tion with | are retair ot availab or functior nitor wit the [FWD | ned even le for sett n of the F h sign se] or [REV | if an inve ing the it R-LU08 (election i] indicato | hen Pr.14 erter fault o em as the or the FR- is required or. | 4 = "2 to occurs. R main mo PU07 for d. Also, it | 12" or "10 esetting o nitor item setting. will be di | 02 to 112 clears the on the L0 | ". (Refer t retained CD operat without a | o page 3 values. ion pane minus się | 03.) I (FR-LUC |)8) or the operatior | paramete | Y0 |
| *16 *17 *18 *19 | The in The m Param PU07) Setting rotatio | nonitore neter se). Use th g of Pr. on direct disp | d values tting is no ne monite 1018 Mo tion with DIAY | are retair ot availab or functior nitor wit the [FWD for c | ned even le for sett n of the F h sign se] or [REV) DEL | if an inve ting the it R-LU08 o election i indicato | hen Pr.14 erter fault c em as the or the FR- is required or. D DAD | 4 = "2 to occurs. R main mo PU07 for d. Also, it | 12" or "10 esetting o nitor item setting. will be di | 02 to 112 clears the on the L0 isplayed v | ". (Refer t retained CD operat without a 774 t | o page 3 values. ion pane minus siç o Pr | 03.) I (FR-LUC gn on the |)8) or the operatior | paramete 1 panel. C | Y0 |
| *16 *17 *18 *19 | The in The m Param PU07) Setting rotatio | nonitore neter se). Use th g of Pr. on direct disp | d values tting is no ne monite 1018 Mo tion with DIAY | are retair ot availab or functior nitor wit the [FWD for c | ned even le for sett n of the F h sign se] or [REV) DEL | if an inve ting the it R-LU08 o election i indicato | hen Pr.14 erter fault o em as the or the FR- is required or. | 4 = "2 to occurs. R main mo PU07 for d. Also, it | 12" or "10 esetting o nitor item setting. will be di | 02 to 112 clears the on the L0 isplayed v | ". (Refer t retained CD operat without a 774 t | o page 3 values. ion pane minus siç o Pr | 03.) I (FR-LUC gn on the |)8) or the operatior | paramete 1 panel. C | Y0 |
| | The in The m Param PU07) Setting rotatio | nonitore neter se). Use th g of Pr. on direct disp = "0" (ir | d values tting is non- ne monito 1018 Mo tion with DIAY nitial va | are retair of availab or functior nitor wit t the [FWD for c nlue), th | ned even le for sett n of the F h sign se] or [REV) DEL | if an inve ting the it R-LU08 o election i indicato | hen Pr.14 erter fault c em as the or the FR- is required or. D DAD | 4 = "2 to occurs. R main mo PU07 for d. Also, it | 12" or "10 esetting o nitor item setting. will be di | 02 to 112 clears the on the L0 isplayed v | ". (Refer t retained CD operat without a 774 t | o page 3 values. ion pane minus siç o Pr | 03.) I (FR-LUC gn on the |)8) or the operatior | paramete 1 panel. C | Y0 |
| | The in The m Param PU07) Setting rotatio tor (r.52 = in set | nonitore neter se). Use ti g of Pr. on direct dist = "0" (ir equence | d values tting is n ne monite 1018 Mo tion with Dlay nitial va se by pt | are retair of availab or functior nitor with the [FWD for c nlue), th ressing | e monit | if an inve ing the it R-LU08 (election i) indicato ation toring c | hen Pr.14 erter fault c em as the or the FR- is required or. D DAD of output | 4 = "2 to occurs. R main mo PU07 for d. Also, it eel (F t freque | 12" or "11 esetting o nitor item setting. will be di Pr.52 ency, ou | 02 to 112 clears the on the LC isplayed v , Pr. Itput cu | ". (Refer t retained CD operat without a 774 t rrrent, of | o page 3 values. ion pane minus sig o Pr utput vo | 03.) I (FR-LUC gn on the 2.776) Diltage a |)8) or the operatior) nd faul | parameten n panel. C t displa | Y0 er unit (F Confirm † y can |
| | The in The in Param PU07) Setting rotatio tOT (r.52 = in set he ite | nonitore neter se). Use th g of Pr. on direct disk : "0" (in equence ems se | d values tting is n he monito 1018 Mo tion with Dlay hitial va ce by po et in Pr . | are retain of availab or function nitor wit the [FWD for C Ilue), th ressing 52 , the | ned even le for sett n of the F h sign se] or [REV) PER e monit | if an inve ing the it R-LU08 of election i I indicato ation toring of toring of | hen Pr.14 erter fault d erter fault d erter fault d erter fault d erter fault d is required or. 1 pan of output | 4 = "2 to occurs. R main mo PU07 for d. Also, it nel (F t freque citation | 12" or "11 esetting on intor item setting. will be di Pr.52 ency, ou curren | t, and n | ". (Refer t retained CD operat without a 774 t rrent, or | o page 3 values. ion pane minus sig o Pr utput vo | 03.) I (FR-LUC gn on the 7.776) Diltage a |)8) or the operatior) nd faul [:] isplaye | parameten panel. C t displa d in the | Y0 er unit (F Confirm 1 y can 1 |
| | The in The m Param PU07) Setting rotatio tOT (r.52 = in set he ite | nonitore neter se g of Pr. on direct dist cuence erms se ly set t | d values tting is n he monito 1018 Mo tion with Dlay hitial va ce by po et in Pr . | are retain of availab or function nitor wit the [FWD for C Ilue), th ressing 52 , the | ned even le for sett n of the F h sign se] or [REV) PER e monit | if an inve ing the it R-LU08 of election i I indicato ation toring of toring of | hen Pr.14 erter fault c em as the or the FR- is required or. D DAD of output | 4 = "2 to occurs. R main mo PU07 for d. Also, it nel (F t freque citation | 12" or "11 esetting on intor item setting. will be di Pr.52 ency, ou curren | t, and n | ". (Refer t retained CD operat without a 774 t rrent, or | o page 3 values. ion pane minus sig o Pr utput vo | 03.) I (FR-LUC gn on the 7.776) Diltage a |)8) or the operatior) nd faul [:] isplaye | parameten panel. C t displa d in the | Y0 er unit (F Confirm y can |
| | The in The m Param PU07) Setting rotatio tOT (r.52 = in set he ite | nonitore neter se g of Pr. on direct dist cuence erms se ly set t | d values tting is n he monito 1018 Mo tion with Dlay hitial va ce by po et in Pr . | are retain of availab or function nitor wit the [FWD for C Ilue), th ressing 52 , the | ned even le for sett n of the F h sign se] or [REV) PER e monit | if an inve ing the it R-LU08 of election i I indicato ation toring of toring of | hen Pr.14 erter fault d erter fault d erter fault d erter fault d erter fault d is required or. 1 pan of output | 4 = "2 to occurs. R main mo PU07 for d. Also, it nel (F t freque citation | 12" or "11 esetting on intor item setting. will be di Pr.52 ency, ou curren | t, and n | ". (Refer t retained CD operat without a 774 t rrent, or | o page 3 values. ion pane minus sig o Pr utput vo | 03.) I (FR-LUC gn on the 7.776) Diltage a |)8) or the operatior) nd faul [:] isplaye | parameten panel. C t displa d in the | Y0 er unit (F Confirm 1 y can 1 |
| | The in The in Param PU07) Setting rotatio tOT (r.52 = in set he ite initially obtage | nonitore neter se g of Pr . on direct disk curve equence erms se ly set 1 e). | d values tting is n- ne monito 1018 Mo tion with Dlay nitial va te by pre- te in Pr . | are retain of availab or function nitor witi the [FWD for c alue), th ressing 52 , the itor the | ned even le for sett n of the F h sign se] or [REV) DET e monit [SET] load m output | if an inve ing the it R-LU08 (election i) indicato ation toring c | hen Pr.14 erter fault d erter fault d erter fault d erter fault d erter fault d is required or. 1 pan of output | 4 = "2 to boccurs. R main mo PU07 for d. Also, it tel (F t freque citation | 12" or "11 esetting on nitor item setting. will be di Pr.52 ency, ou curren are disp | 2 to 112 clears the o on the LO isplayed v , Pr. Itput cu t, and n olayed i | ". (Refer t retained CD operat without a 774 t rrent, or notor loa | o page 3 values. ion pane minus sig o Pr utput vo ad facto | 03.) I (FR-LUC gn on the 7.776) Diltage a Dr are d een (init |)8) or the operatior) Ind faul isplaye tially se | paramete n panel. C t displa d in the et to mo | Y0 er unit (F Confirm y can e seco nitor t |
| +16 *17 *18 *19 Onit hen Pr lected nong th reen (in tput vo he first s | The in The m Param PU07) Setting rotatio tOT (r.52 = in set he ite initially oltage scree | nonitore neter se ig of Pr. on direct dist = "0" (ir equence with set ly set t e). en (init | d values tting is n- ne monito 1018 Mo tion with Dlay nitial va te by pr te in Pr . to moni ially se | are retain of availab or function nitor witi the [FWD for c alue), th ressing 52 , the itor the | ned even le for sett n of the F h sign se] or [REV)) Derra e monit [SET] load m output nitor the | if an inve ing the it R-LU08 (election i] indicato ation toring c | hen Pr.14 rter fault dem as the or the FR- is required or. D PAI of output hotor exe b). Other | 4 = "2 to boccurs. R main mo PU07 for d. Also, it ency (F t freque citation r items ency) is | 12" or "11 esetting on nitor item setting. will be di Pr.52 ency, ou current are disp display | 22 to 112 clears the o on the L0 isplayed v , Pr. t, and n blayed i yed at p | ". (Refer t retained CD operat without a 774 t rrrent, or notor loa notor loa notor loa | o page 3 values. ion pane minus sig o Pr utput vo ad facto ird scro N in th | 03.) I (FR-LUC gn on the 7.776) Ditage a Ditage a or are d een (init e initial | ^{)8) or the} operatior) isplaye tially se setting. | paramete n panel. C t displa d in the et to mo | Y0 er unit (F Confirm t y can l e secol |
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| +16 *17 *18 *19 IONIT hen Pr elected mong th reen (ii tput vo ne first to reen di orent to monit | The in The in Param PU07) Setting rotatio tOT (r.52 = in set he ite initially oltage scree lisplay tor the | nonitore neter se). Use the g of Pr. on direct disp = "0" (in equence erms se ly set the). en (init eyed at e outp | d values tting is none monitor 1018 Mo tion with Dlay mitial va te by pro- te in Pr. to moni- ially se power ut freq | are retain of availab or function nitor witi the (FWD for c llue), th ressing 52 , the itor the to mo -ON, dia | ned even le for sett n of the F h sign se] or [REV) PER e monit [SET] load m output nitor the splay th at powe | if an inve ing the it R-LU08 (election i g indicato ation toring o toring o to toring o toring o to toring o toring o toring o t | then Pr.14 hen Pr.14 erter fault dent as the erter as the born the FR is required or. D PAN D PAN of output notor execution the frequence of the frequence o | 4 = "2 to boccurs. R main mo PU07 for d. Also, it tel (F t freque citation r items ency) is want to splay th | 12" or "11 esetting on nitor item setting. will be di Pr.52 ency, ou current are display display | t, and n played i root the LO played v Pr. t, and n played i yed at p y at pov en of o | ". (Refer t retained CD operat without a 774 t rrrent, or notor loa in the th power-ON | o page 3 values. ion pane minus sig o Pr utput vo ad facto ird scro N in th , and h | 03.) I (FR-LUC gn on the 7.776) Ditage a Dor are d een (init e initial old dow sy, and I |)8) or the operatior nd faul isplaye tially se setting. /n | paramete n panel. C t displa d in the et to mo . To cha for 1 for 1 | Y0 er unit (F Confirm f y can l e secol unitor tl ange tl secor |
| | The in The in Param PU07) Setting rotatio tOT (r.52 = in set he ite initially oltage scree lisplay tor the | nonitore neter se). Use the g of Pr. on direct disp = "0" (in equence erms se ly set the e). en (init yed at red at pole red at pole | d values tting is none monitor 1018 Mo tion with Dlay nitial va tion with Day tially se power ut freq | are retain of availab or function nitor witi the [FWD for c ulue), th ressing 52 , the itor the tor the -ON, dis uency a | ned even le for sett n of the F h sign se] or [REV) PER e monit [SET] load m output nitor the splay th at powe | if an inve ing the it R-LU08 (election i g indicato ation toring o toring o to toring o toring o to toring o toring o toring o t | hen Pr.14 erter fault of ern as the or the FR- is required or th | 4 = "2 to boccurs. R main mo PU07 for d. Also, it ency) is citation citation citation r items ency) is want to splay th | 212" or "11 esetting on nitor item setting. will be di Pr.52 ency, ou current are display display display he scre | t, and n played i root the LO played v Pr. t, and n played i yed at p y at pov en of o | ". (Refer t retained CD operat without a 774 t rrrent, of notor loa in the th nower-O wer-ON utput fro | o page 3 values. ion pane minus sig o Pr utput vo ad facto ird scro N in th , and h equenc | 03.) I (FR-LUC gn on the 7.776) Ditage a Dor are d een (init e initial old dow sy, and I | DB) or the operatior and faul isplaye tially se setting. n SET hold do | paramete n panel. C t displa d in the et to mo . To cha for 1 for 1 | Y0 er unit (F Confirm f y can l e secol unitor tl ange tl secor |
| | The in The in Param PU07) Setting rotatio tor (r.52 = in set he ite initially oltage scree lisplay tor the | nonitore neter se). Use the g of Pr. on direct disp = "0" (in equence erms se ly set the example at yed at red at pole red at pole | d values tting is none monitor 1018 Mo tion with Dlay nitial va te by pr te in Pr. to moni- tially se power ut freq | are retain of availab or function nitor witi the (FWD for c alue), the ressing 52 , the itor the itor the . ON, dia uency a) • Secco | ned even le for sett n of the F h sign se] or [REV) PER e monit [SET] load m output nitor the splay th at powe | if an inve ing the it R-LU08 (election i g indicate ation toring c heter, m current e outpu he scre er-ON a en | then Pr.14 hen Pr.14 erter fault dent as the erter as the born the FR is required or. D PAN D PAN of output notor execution the frequence of the frequence o | 4 = "2 to boccurs. R main mo PU07 for d. Also, it ency) is ency) is want to splay th | 12" or "11 esetting on nitor item setting. will be di Pr.52 Pr.52 oncy, ou current are display o display be scre Third sc | 2 to 112 clears the o on the LC isplayed v , Pr. itput cui t, and n played i yed at p y at pov en of o creen | ". (Refer t retained CD operat without a 774 t rrrent, or notor loa in the th nower-O wer-ON utput fro | o page 3 values. ion pane minus sig o Pr utput vo ad facto ird scru N in th , and h equenc | 03.) I (FR-LUC gn on the 7.776) Ditage a Dor are d een (init e initial old dow sy, and I | DB) or the operatior and faul isplaye tially se setting. n SET hold do | paramete n panel. C t displa d in the et to mo . To cha for 1 for 1 | Y0 er unit (F Confirm f y can l e secol unitor tl ange tl secor |



• The monitor item to be displayed is set using Pr.774 for the first screen, Pr.775 for the second screen, and Pr.776 for the third screen. When Pr.774 to Pr.776 = "9999" (initial value), the Pr.52 setting value is used.

5



• On the operation panel (FR-DU08), the "Hz" unit indicator is lit while displaying the output frequency, the "Hz" blinks when displaying the set frequency.

Displaying the set frequency during stop (Pr.52)

When Pr.52 = "100", the set frequency is displayed during stop, and output frequency is displayed during running. (LED of Hz blinks during stop and is lit during operation.)

| Pr.52 setting | Status | Output frequency | Output current | Output voltage | Fault monitor |
|---------------|-------------------------|-----------------------------|----------------|----------------|---------------|
| 0 | During running/ stop | Output frequency | | | |
| 100 | During stop | Set frequency ^{*1} | Output current | Output voltage | Fault monitor |
| 100 | During running | Output frequency | | | |

*1 Displays the frequency that is output when the start command is ON. The value considers the maximum/minimum frequency and frequency jumps. It is different from the frequency setting displayed when **Pr.52** = "5".

- NOTE

- During an error, the output frequency at error occurrence appears.
- During output shutoff by the MRS signal, the values displayed are the same as during a stop.
- · During offline auto tuning, the tuning state monitor takes priority.

Operation panel setting dial push display (Pr.992)

- Use Pr.992 to select the monitor that appears when the setting dial on the operation panel (FR-DU08) is pushed.
- When **Pr.992** = "0 (initial value)", keep pressing the setting dial when in PU operation mode or External/PU combined operation mode 1 (**Pr.79 Operation mode selection** = "3") to show the presently set frequency.
- When **Pr.992** = "100", the set frequency is displayed during stop, and output frequency is displayed during running.

| Pr.992 setting | Status | Monitor displayed by the setting dial push |
|----------------|---------------------|--|
| 0 | During running/stop | Set frequency (PU direct-in frequency) |
| 100 | During stop | Set frequency ^{*1} |
| 100 | During running | Output frequency |

*1 Displays the frequency that is output when the start command is ON. The value considers the maximum/minimum frequency and frequency jumps. It is different from the frequency setting displayed when **Pr.992** = "5".

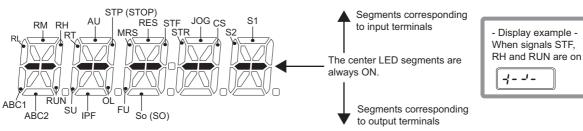
Monitoring I/O terminals on the operation panel (FR-DU08) (Pr.52, Pr.774 to Pr.776, Pr.992)

- When Pr.52 (Pr.774 to Pr.776, Pr.992) = "55 to 57", the I/O terminal state can be monitored on the operation panel (FR-DU08).
- · When a terminal is ON, the corresponding LED segment is ON. The center LED segments are always ON.

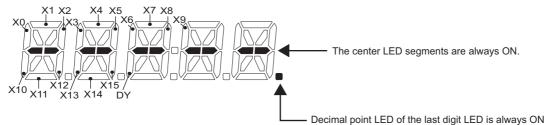
| Pr.52, Pr.774 to Pr.776, Pr.992 setting | Monitor item | Monitor description |
|--|-------------------------------|--|
| 55 | I/O terminal status | Displays the I/O terminal ON/OFF state of the inverter. |
| 56 ^{*1} | Option input terminal status | Displays input terminal ON/OFF state of the digital input option (FR-A8AX) |
| 57 ^{*1} | Option output terminal status | Displays output terminal ON/OFF state of the digital output option (FR-A8AY) or the relay output option (FR-A8AR). |

*1 The setting value "56 or 57" can be set even if the option is not installed. All are OFF when the option is not connected.

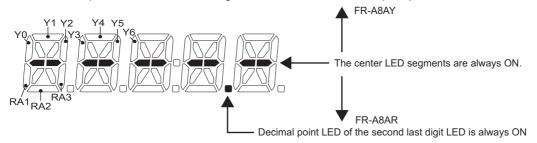
• On the I/O terminal monitor, the upper LEDs indicate the input terminal status, and the lower LEDs indicate the output terminal status.



• The decimal point of the last digit on the LED is lit for the input option terminal monitor.



• The decimal point of the second last digit on the LED is lit for the output option terminal monitor.



Monitoring and resetting cumulative power (Pr.170, Pr.891)

- When the cumulative power is monitored (**Pr.52** = "25"), the output power monitor value is added up and is updated in 100 ms increments.
- The values are stored in EEPROM every 10 minutes. The values are also stored in EEPROM at power OFF or inverter reset.
- Increments and ranges of monitoring on the operation panel or parameter unit and via communication (RS-485 communication or other communication with communication option installed) are as follows (when Pr.891 = "9999 (initial value)").

| On operation panel or | parameter unit ^{*1} | Via communication | | | | |
|-----------------------|------------------------------|-------------------|-----------------|-----------|--|--|
| Range | Increment | Rai | Increment | | | |
| Kange | increment | Pr.170 = 10 | Pr.170 = 9999 | increment | | |
| 0 to 999.99 kWh | 0.01 kWh ^{*2} | | 0 to 65535 kWh | 1 kWh | | |
| 1000.0 to 9999.9 kWh | 0.1 kWh | 0 to 9999 kWh | (initial value) | | | |
| 10000 to 99999 kWh | 1 kWh | | (| | | |

- *1 For the FR-F820-02330(55K) or lower and FR-F840-01160(55K) or lower, the value is measured in 0.01 kWh increments and the upper five digits are displayed. For the FR-F820-03160(75K) or higher and FR-F840-01800(75K) or higher, the value is measured in 0.1 kWh increments and the upper five digits are displayed.
 - For the FR-F820-02330(55K) or lower and FR-F840-01160(55K) or lower, the cumulative energy up to 999.99 kWh is displayed in 0.01 increments such as "999.99", and that of 1000 kWh or more is displayed in 0.1 increments such as "1000.0".
- *2 The display in 0.01 kWh increments is available only for the FR-F820-02330(55K) or lower and FR-F840-01160(55K) or lower.
- The decimal point position on the watt-hour meter can be shifted to left. The number of digits to be shifted is equal to the setting of Pr.891 Cumulative power monitor digit shifted times. For example, when Pr.891 = "2", the cumulative power value 1278.56 kWh is displayed as 12.78 (in 100 kWh increments) on the operation panel, or displayed as 12 on a display used for monitoring via communication.
- When **Pr.891** = "0 to 4", the meter stops at the maximum number. When **Pr.891** = "9999", the meter returns to 0 and the counting starts again.
- Writing "0" in Pr.170 clears the cumulative power monitor.



• When Pr.170 is read just after "0" has been written in Pr.170, the setting "9999" or "10" is displayed.

Monitoring cumulative energization time (Pr.563)

- When the cumulative energization time is selected as a monitor item (**Pr.52** = "20"), the counter of cumulative energization time since the inverter shipment accumulated every hour is displayed.
- The cumulative energization time is displayed in 0.001-hour increments until the cumulative time reaches one hour, and then the time is displayed in 1-hour increments.
- The EEPROM is updated every minute until the cumulative energization time reaches one hour, and then the EEPROM is updated every 10 minutes. The EEPROM is also updated at power OFF.
- When the cumulative energization time counter reaches 65535, it starts from 0 again. The number of times the cumulative energization time counter reaches 65535 can be checked with **Pr.563**.

NOTE

• The cumulative energization time does not increase if the power is turned OFF after less than an hour.

Actual operation time monitoring (Pr.171, Pr.564)

- On the actual operation time monitoring (**Pr.52** = "23"), the inverter running time is added up every hour. (Time is not added up during a stop.)
- · The time is displayed in 1-hour increments.
- The values are stored in EEPROM every 10 minutes. The EEPROM is also updated at power OFF.
- When the cumulative energization time counter reaches 65535, it starts from 0 again. The number of times the actual operation time counter reaches 65535 can be checked with **Pr.564**.
- · Setting "0" in Pr.171 clears the actual operation time meter.

- NOTE

- The actual operation time does not increase if the cumulative running time before power OFF is less than an hour.
- Once "0" is set in **Pr.171**, the setting of **Pr.171** is always turned to "9999" afterwards. Setting "9999" does not clear the actual operation time meter.

Hiding the decimal places for the monitors (Pr.268)

 The numerical figures after a decimal point displayed on the operation panel may fluctuate during analog input, etc. The decimal places can be hidden by selecting the decimal digits with **Pr.268**.

| Pr.268 setting | Description |
|----------------------|---|
| 9999 (initial value) | No function |
| 0 | For the first or second decimal places (0.1 increments or 0.01 increments) of the monitor, numbers in the first decimal place and smaller are rounded to display an integral value (1 increments). The monitor value equal to or smaller than 0.99 is displayed as 0. |
| 1 | When monitoring with the second decimal place (0.01 increments), the 0.01 decimal place is dropped and the monitor displays the first decimal place (0.1 increments). When monitoring with the first decimal place, the display will not change. |

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• The number of readout digits of the cumulative energization time (**Pr.52** = "20"), actual operation time (**Pr.52** = "23"), cumulative energy (**Pr.52** = "25"), and cumulative energy saving (**Pr.52** = "51") does not change.

Enabling display of negative numbers during monitoring (Pr.290)

• Negative signal outputs can be selected for the items monitored via terminal AM (analog voltage output), via a communication option, and on the operation panel. To check which items can be monitored with indication of negative numbers, refer to the monitor items list (on page 306).

| Dr 200 potting | Negative indication (-) | | | | | |
|-------------------|-------------------------|-----------------|------------------------------------|-------------------------|--|--|
| Pr.290 setting | Terminal AM | Operation panel | Communication option ^{*1} | FR Configurator2 etc.*2 | | |
| 0 (initial value) | — | — | — | — | | |
| 1 | Enabled | — | — | — | | |
| 2 | — | Enabled | — | — | | |
| 3 | Enabled | Enabled | — | — | | |
| 4 | — | — | Enabled | Enabled | | |
| 5 | Enabled | — | Enabled | Enabled | | |
| 6 | — | Enabled | Enabled | Enabled | | |
| 7 | Enabled | Enabled | Enabled | Enabled | | |

-: Negative numbers indication disabled (positive only)

- *1 The following communication does not support negative output. RS-485 communication (Mitsubishi inverter protocol, MODBUS RTU, BACnet), LONWORKS communication (FR-A8NL), and SLMP communication
- *2 Under the condition that the high-speed sampling and the negative output are selected for FR Configurator2, the display range of the output frequency (Monitor No.1) is -300.00 Hz to 300.00 Hz.

A value outside the range is clamped at -300.00 Hz or 300.00 Hz. Under the same condition, the display range of the running speed (Monitor No.6) is -30000 r/min to 30000 r/min. A value outside the range is clamped at -30000 r/min or 30000 r/min. During the trace sampling, the same display ranges are applied. A value outside the ranges is clamped.

• Select the item group to enable the indication of negative signed numbers by setting Pr.1018 Monitor with sign selection.

| Monitor item | Pr.1018 setting | | | |
|---------------------------------|-----------------|---------------------|--|--|
| Womor tem | 9999 | 0 (1) ^{*1} | | |
| Output frequency | — | ° ^{*2} | | |
| Motor speed | — | °*2 | | |
| Motor torque | 0 | 0 | | |
| PID deviation | 0 | 0 | | |
| BACnet terminal AM output level | 0 | 0 | | |
| Remote output 1 | 0 | 0 | | |
| Remote output 2 | 0 | 0 | | |
| Remote output 3 | 0 | 0 | | |
| Remote output 4 | 0 | 0 | | |
| PID manipulated amount | 0 | 0 | | |
| Second PID deviation | 0 | 0 | | |
| Second PID manipulated amount | 0 | 0 | | |
| Control circuit temperature | 0 | 0 | | |

o: Negative numbers displayed with minus sign, —: Negative numbers not displayed (positive only)

- *1 The same operation is performed for the both settings.
- *2 Negative numbers are not displayed on the operation panel. Confirm the rotation direction with the [FWD] or [REV] indicator.

NOTE

- When the output via terminal AM (analog voltage output) is set to "Negative numbers indication enabled", the output is within the range of -10 to +10 VDC. Connect the meter with which output level is matched.
- Parameter unit (FR-PU07) displays only positive values.

Monitor filter (Pr.1106 to Pr.1108)

• The response level (filter time constant) of the following monitor indicators can be adjusted. Increase the setting when a monitor indicator is unstable, for example.

| Pr. | Monitor number | Monitor indicator name |
|------|----------------|--------------------------|
| 1106 | 7 | Motor torque |
| 1100 | 17 | Load meter |
| 1107 | 6 | Motor speed |
| 1108 | 18 | Motor excitation current |

Parameters referred to
 Pr.30 Regenerative function selection page 566
 Pr.37 Speed display, Pr.144 Speed setting switchover page 303
 Pr.55 Frequency monitoring reference, Pr.56 Current monitoring reference, Pr.866 Torque monitoring reference page 314

5.8.3 Monitor display selection for terminals FM/CA and AM

Monitored values are output in either of the following: analog voltage (terminal AM), pulse train (terminal FM) for the FM type inverter, or analog current (terminal CA) for the CA type inverter.

The signal (monitor item) to be output to terminal FM/CA and terminal AM can be selected.

| _ | Nama | Initial value | | 0 /// | Description | | | |
|-------------|--------------------------------------|-------------------------|----|--|--|---|--------------------------|---|
| Pr. | Name | FM | CA | Setting range | Description | | | |
| 54 M300 | FM/CA terminal function selection | 1 (output frequency) | | 1 to 3, 5 to 14, 17, 18, 21, 24, 34, 50, 52, 53, 61, 62, 67, 69, 70, 85, 87 to 90, 92, 93, 95, 98 | Select the item monitored via terminal FM or CA. | | | |
| 158 M301 | AM terminal function selection | | | 1 to 3, 5 to 14, 17, 18, 21, 24, 34, 50, 52 to 54, 61, 62, 67, 69, 70, 86 to 96, 98 | Select the item monitore | d via terminal AM. | | |
| 55 M040 | Frequency monitoring reference | 60 Hz 50 Hz | | 0 to 590 Hz | Set the full-scale value w monitor value to termina | /hen outputting the frequency Is FM, CA and AM. | | |
| 56 | Current monitoring | Inverter rated current | | 0 to 500 A ^{*1} | | of a meter which corresponds to | | |
| M041 | reference | | | 0 to 3600 A ^{*2} | the output via terminal FM/CA or terminal AM to monitor the output current. | | | |
| 866 M042 | Torque monitoring reference | 150% | | 0% to 400% | Enter the full-scale value of a meter which corresponds to the output via terminal FM/CA or terminal AM to monitor the motor torque. | | | |
| 290 M044 | Monitor negative output selection | 0 | | 0 to 7 | Set the availability of negative signals output via terminal AM, to the operation panel, and through communication. (Refer to page 313.) | | | |
| | | | | | Pulse train input | Pulse train output | | |
| | | | | _ | (terminal JOG) | (terminal FM) | | |
| | | 0 | | 0 | JOG signal ^{*3} | FM output ^{*4} | | |
| | | | | 1 | Pulse train input | FM output ^{*4} | | |
| | | | | | | 10 ^{*4} | JOG signal ^{*3} | High-speed pulse train output (50% duty) |
| 291 D100 | Pulse train I/O selection | | | 11 ^{*4} | Pulse train input High-speed pulse train or (50% duty) | | | |
| 0010 | | | | 20 ^{*4} | JOG signal ^{*3} | High-speed pulse train output (ON width fixed) | | |
| | | | | 21 ^{*4} | Pulse train input | High-speed pulse train output (ON width fixed) | | |
| | | | | 100 ^{*4} | Pulse train input | High-speed pulse train output (ON width fixed) Output the pulse train input without changes. | | |

*1 For the FR-F820-02330(55K) or lower and FR-F840-01160(55K) or lower.

*2 For the FR-F820-75K(03160) or higher and FR-F840-75K(01800) or higher.

*3 Function assigned to **Pr.185 JOG terminal function selection**.

*4 Valid only for the FM type inverters.

Monitor description list (Pr.54, Pr.158)

- Set Pr.54 FM/CA terminal function selection for monitoring via terminal FM (pulse train output) or terminal CA (analog current output).
- Set Pr.158 AM terminal function selection for monitoring via terminal AM (analog voltage output). Negative signals can be output via terminal AM (in the range of -10 to +10 VDC). The circle in the Negative output column indicates that the output of negative signals is available via terminal AM. (To enable or disable the output of negative signals, refer to page 305.)
- Refer to the following table and select the item to be monitored. (Refer to page 306 for the list of monitor items.)

| Monitor item | Increment and unit | Pr.54 (FM/CA) Pr.158 (AM) setting | Terminal FM/CA/AM full-scale value | Negative output | Remarks |
|---|--|--------------------------------------|---|-----------------|--|
| Output frequency | 0.01 Hz | 1 | Pr.55 | °*3 | |
| Output current ^{*2} | 0.01/0.1 A ^{*1} | 2 | Pr.56 | | |
| Output voltage | 0.1 V | 3 | 200 V class: 400 V 400 V class: 800 V | | |
| Frequency setting value | 0.01 Hz | 5 | Pr.55 | | |
| Motor speed | 1 (r/min) | 6 | The value converted with the Pr.37, Pr.144 value from Pr.55 . | ° ^{*3} | Refer to page 303 for the monitoring of the operation speed. |
| Motor torque | 0.1% | 7 | Pr.866 | 0 | |
| Converter output voltage ^{*2} | 0.1 V | 8 | 200 V class: 400 V 400 V class: 800 V | | |
| — | — | 9 | — | | For manufacturer setting. Do not set. |
| Electronic thermal O/L relayLoad factor | 0.1% | 10 | Electronic thermal O/L relay (100%) | | |
| Output current peak value | 0.01/0.1 A ^{*1} | 11 | Pr.56 | | |
| Converter output voltage peak value | 0.1 V | 12 | 200 V class: 400 V 400 V class: 800 V | | |
| Input power | 0.01/0.1 kW ^{*1} | 13 | Inverter rated power × 2 | | |
| Output power ^{*2} | 0.01/0.1 kW ^{*1} | 14 | Inverter rated power × 2 | | |
| Load meter | 0.1% | 17 | Pr.866 | | |
| Motor excitation current | 0.01 A/0.1 A ^{*1} | 18 | Pr.56 | | |
| Reference voltage output | _ | 21 | — | | Terminal FM: When Pr.291 = "0 or 1", output is 1440 pulses/s. When Pr.291 \neq "0 or 1", output is 50k pulses/s. Terminal CA: Output is 20 mA. Terminal AM: Output is 10 V. |
| Motor load factor | 0.1% | 24 | 200% | | • |
| Motor output | 0.01/0.1 kW ^{*1} | 34 | Rated motor capacity | | |
| Power saving effect | Increment and unit vary depending on the parameter settings. | 50 | Inverter capacity | | For the information of the power saving effect monitoring, refer to page 324. |
| PID set point | 0.1% | 52 | 100% | | |
| PID measured value | 0.1% | 53 | 100% | | Refer to page 432 for the PID control. |
| PID deviation | 0.1% | 54 ^{*4} | 100% | 0 | |
| Motor thermal load factor | 0.1% | 61 | Motor thermal activation level (100%) | | |
| Inverter thermal load factor | 0.1% | 62 | Inverter thermal activation level (100%) | | |
| PID measured value 2 | 0.1% | 67 | 100% | | Refer to page 432 for the PID control. |
| PID input pressure value | 0.1% | 69 | 100% | | Displays the input pressure value of the PID input pressure control function. |
| PLC function analog output | 0.1% | 70 | 100% | 0 | Valid by setting Pr.414 = "1 or 2". Refer to page 483 for the PLC function. |
| BACnet terminal FM/CA output level | 0.1% | 85 ^{*5} | 100% | | The value set in the Analog Output object (ID=0: Terminal FM/CA) for BACnet communication is output. |
| BACnet terminal AM output level | 0.1% | 86 ^{*4} | 100% | 0 | The value set in the Analog Output object (ID=1: Terminal AM) for BACnet communication is output. (The output is always negative regardless of the Pr.290 setting when the monitored value is negative.) |

| Monitor item | Increment and unit | Pr.54 (FM/CA) Pr.158 (AM) setting | Terminal FM/CA/AM full-scale value | Negative output | Remarks |
|-------------------------------|-----------------------|--------------------------------------|---------------------------------------|--------------------|---|
| Remote output value 1 | 0.1% | 87 | 1000% | | |
| Remote output value 2 | 0.1% | 88 | 1000% | | Refer to page 343 for the analog |
| Remote output value 3 | 0.1% | 89 | 1000% | | remote output. |
| Remote output value 4 | 0.1% | 90 | 1000% | | |
| PID manipulated amount | 0.1% | 91 ^{*4} | 100% | 0 | |
| Second PID set point | 0.1% | 92 | 100% | | |
| Second PID measured value | 0.1% | 93 | 100% | | |
| Second PID deviation | 0.1% | 94 ^{*4} | 100% | 0 | Refer to page 432 for the PID control. |
| Second PID measured value 2 | 0.1% | 95 | 100% | | |
| Second PID manipulated amount | 0.1% | 96 ^{*4} | 100% | 0 | |
| Control circuit temperature | 1°C | 98 | 100°C | 0 | Terminal FM/CA: 0 to 100°C Terminal AM: -20 to 100°C |

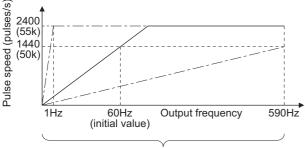
*1 The increment differs according to the inverter capacity. (FR-F820-02330(55K) or lower, FR-F840-01160(55K) or lower / FR-F820-03160(75K) or higher, FR-F840-01800(75K) or higher)

*2 The inverter regards the output current which is less than the specified current level (5% of the rated inverter current) as 0 A. Therefore, each readout of an output current and output power may show "0" if a too small-capacity motor is used as contrasted with the inverter capacity and the output current falls below the specified value.

- *3 Setting of Pr.1018 Monitor with sign selection is required.
- *4 The setting is available only in **Pr.158** (terminal AM).
- *5 The setting is available only in **Pr.54** (terminal FM/CA).

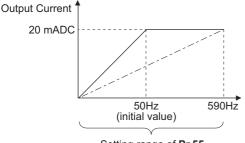
Frequency monitor reference (Pr.55)

- Enter the full scale value of a meter used to monitor the output frequency or the frequency setting value via terminal FM/ CA or terminal AM.
- For the FM type inverter, enter the full-scale value of the meter corresponding to a pulse train of 1440 pulses/s (or 50k pulses/s) output via terminal FM. Enter the frequency value (for example, 60 Hz or 120 Hz) at full scale of the meter (1 mA analog meter) installed between terminal FM and terminal SD. Pulse speed is proportional to the output frequency of the inverter. (The maximum output pulse train is 2400 pulses/s (or 55k pulses/s).)



Setting range of Pr.55

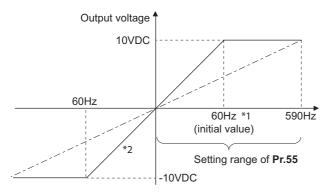
• For the CA type inverter, enter the full-scale value of the meter corresponding to a current of 20 mADC output via terminal CA. Enter the current value (for example, 60 Hz or 120 Hz) at full scale of the meter (20 mADC ammeter) installed between terminal CA and terminal 5. Output current is proportional to the frequency. (The maximum output current is 20 mADC.)



- Setting range of Pr.55
- Enter the full-scale value of the meter corresponding to a voltage of 10 VDC output via terminal AM. Enter the current value (for example, 60 Hz or 120 Hz) at full scale of the meter (10 VDC voltmeter) installed between terminal AM and terminal 5. Output voltage is proportional to the frequency. (The maximum output voltage is 10 VDC.)

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5.8 (M) Item and output signal for monitoring



- *1 FM type: 60 Hz, CA type: 50 Hz
- *2 Output of negative signals enabled when Pr.290 Monitor negative output selection = "1 or 3"

Current monitor reference (Pr.56)

- Enter the full scale value of a meter used to monitor the output current, the output current peak value, or the motor excitation current via terminal FM/CA or terminal AM.
- For the FM type inverter, enter the full-scale value of the meter corresponding to a pulse train of 1440 pulses/s (or 50k pulses/s) output via terminal FM. Enter the current value at full scale of the meter (1 mA analog meter) installed between terminal FM and terminal SD. Pulse speed is proportional to the output current monitored. (The maximum output pulse train is 2400 pulses/s (or 55k pulses/s).)
- For the CA type inverter, enter the full-scale value of the current meter corresponding to a current of 20 mADC output via terminal CA. Enter the current value at full scale of the meter (20 mADC ammeter) installed between terminal CA and terminal 5. Output current is proportional to the output current monitored. (The maximum output current is 20 mADC.)
- Enter the full-scale value of the current meter corresponding to a voltage of 10 VDC output via terminal AM. Enter the
 current value at full scale of the meter (10 VDC voltmeter) installed between terminal AM and terminal 5. Output voltage is
 proportional to the output current monitored. (The maximum output voltage is 10 VDC.)

Torque monitor reference (Pr.866)

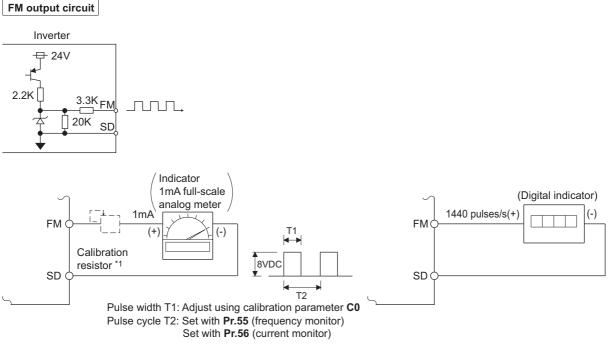
- Enter the full scale value of a meter used to monitor the output torque via terminal FM/CA or terminal AM.
- For the FM type inverter, enter the full-scale value of the torque meter corresponding to a pulse train of 1440 pulses/s (or 50k pulses/s) output via terminal FM. Enter the torque value at full scale of the meter (1 mA analog meter) installed between terminal FM and terminal SD. Pulse speed is proportional to the torque monitored. (The maximum output pulse train is 2400 pulses/s (or 55k pulses/s).)
- For the CA type inverter, enter the full-scale value of the torque meter corresponding to a current of 20 mADC output via terminal CA. Enter the torque value at full scale of the meter (20 mADC ammeter) installed between terminal CA and terminal 5. Output current is proportional to the torque monitored. (The maximum output voltage is 20 mADC.)
- Enter the full-scale value of the torque meter corresponding to a voltage of 10 VDC output via terminal AM. Enter the torque value at full scale of the meter (10 VDC voltmeter) installed between terminal AM and terminal 5. Output voltage is proportional to the torque monitored. (The maximum output voltage is 10 VDC.)

Terminal FM pulse train output (Pr.291)

- · Two kinds of pulse trains can be output via terminal FM.
- When Pr.291 Pulse train I/O selection = "0 (initial value) or 1", pulse train is output via terminal FM, with a maximum output of 8 VDC and 2400 pulses/s.

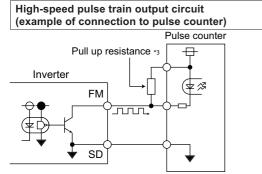
The pulse width can be adjusted on the operation panel or the parameter unit by using the calibration parameter C0 (Pr.900) FM/CA terminal calibration.

• A 1 mA full-scale DC ammeter or a digital meter can be used to give commands (such as inverter output frequency command).



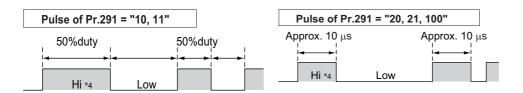
- *1 Not needed when the operation panel or the parameter unit is used for calibration. Use a calibration resistor when the indicator (frequency meter) needs to be calibrated by a neighboring device because the indicator is located far from the inverter.
 - However, the frequency meter needle may not deflect to full-scale if the calibration resistor is connected. In this case, calibrate additionally with the operation panel or parameter unit.
- *2 In the initial setting, 1 mA full-scale and 1440 pulses/s terminal FM are used at 60 Hz.
- When Pr.291 Pulse train I/O selection = "10, 11, 20, 21, or 100", this is high-speed pulse train output for open collector output. A maximum pulse train of 55k pulses/s is output.

There are two types of pulse width: "50% duty" and "fixed ON width"; this cannot be adjusted with the calibration parameter **C0 (Pr.900) FM/CA terminal calibration**.



*1 The pulses may weaken due to stray capacitance in the wiring if the wiring is long, and the pulse counter will be unable to recognize the pulses. Connect the open collector output to the power source with a pull-up resistor if the wiring is too long. Check the pulse counter specs for the pull-up resistance. The resistance should be at 80 mA of the load current or less.

- When Pr.291 = "10, or 11", the pulse cycle is 50% duty (ON width and OFF width are the same).
- When Pr.291 = "20, 21, or 100", the pulse ON width is output at a fixed width (approx. 10 μs).
- At the "100" setting, the same pulse train from the pulse train input (terminal JOG) will be output. This is used when running at a synchronized speed with more than one inverter. (Refer to page 258.)



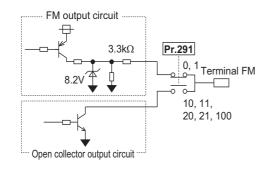
*1 "HIGH" indicates when the open collector output transistor is OFF.

| Item | High-speed pulse train output specifications | | |
|-----------------------------------|---|--|--|
| Output method | NPN open collector output | | |
| Voltage between collector-emitter | 30 V (max.) | | |
| Maximum permissible load current | 80 mA | | |
| Output pulse rate | 0 to 55k pulses/s ^{*1} | | |
| Output resolution | 3 pulses/s (excluding jitter) | | |

*1 50k pulses/s when the monitor output value is 100%.

🗖 NOTE

- Terminal JOG input specifications (pulse train input or contact input) can be selected with **Pr.291**. When changing the setting value, be careful not to change the terminal JOG input specifications. (Refer to page 258 for pulse train input.)
- Install a meter between terminals FM and SD after changing the **Pr.291** setting value. During output the pulse train via terminal FM (voltage output), be careful that voltage is not added to terminal FM.
- The meter cannot be used for the pulse input in a source logic type.
- If the All parameter clear is performed when the high-speed pulse train output is selected (**Pr.291** = "10, 11, 20, 21, or 100"), the output via terminal FM is changed from high-speed pulse train output to the voltage output because the **Pr.291** setting resets to the initial value "0". To perform the All parameter clear, remove the device connected to terminal FM first.



5.8.4 Adjustment of terminal FM/CA and terminal AM

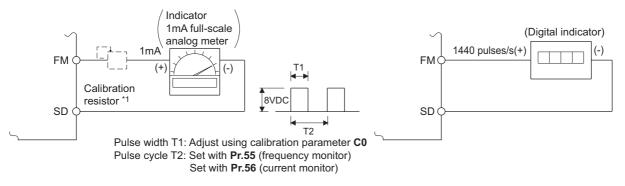
The output via terminal FM/CA or terminal AM corresponding to the full-scale value of a meter can be adjusted (calibrated) on the operation panel or the parameter unit.

| Pr. | Name | Initial value | Setting range | Description |
|-----------------------------------|-----------------------------|---------------|---------------|---|
| C0 (900) M310 ^{*1} | FM/CA terminal calibration | — | — | Calibrates the scale of the meter connected to terminals FM and CA. |
| C1 (901) M320 ^{*1} | AM terminal calibration | _ | _ | Calibrates the scale of the analog meter connected to terminal AM. |
| C8 (930) M330 ^{*1} | Current output bias signal | 0% | 0% to 100% | Set the signal value at the minimum analog current output. |
| C9 (930) M331 ^{*1} | Current output bias current | 0% | 0% to 100% | Set the current value at the minimum analog current output. |
| C10 (931) M332 ^{*1} | Current output gain signal | 100% | 0% to 100% | Sets the signal value when the analog current output is at maximum. |
| C11 (931) M333 ^{*1} | Current output gain current | 100% | 0% to 100% | Set the current value at the maximum analog current output. |
| 867 M321 | AM output filter | 0.01 s | 0 to 5 s | Set a filter for output via terminal AM. |
| 869 M334 | Current output filter | 0.01 s | 0 to 5 s | Set a filter for output via terminal CA. |

*1 The parameter number in parentheses is that used (displayed) on the LCD operation panel and the parameter unit.

Terminal FM calibration (C0 (Pr.900))

- The output via terminal FM is set to the pulse output. By setting C0 (Pr.900), the meter connected to the inverter can be calibrated by parameter setting without use of a calibration resistor.
- The pulse train output via terminal FM can be used for digital display on a digital counter. The output is 1440 pulses/s at full scale. (Refer to page 314 for the full-scale value of each monitor item.)



*1 Not needed when the operation panel or the parameter unit is used for calibration. Use a calibration resistor when the indicator (frequency meter) needs to be calibrated by a neighboring device because the indicator is located far from the inverter.

However, the frequency meter needle may not deflect to full-scale if the calibration resistor is connected. In this case, perform calibration using the operation panel or parameter unit.

- *2 In the initial setting, 1 mA full-scale and 1440 pulses/s terminal FM are used at 60 Hz.
- · Calibrate the output via terminal FM in the following procedure.
 - 1. Connect an indicator (frequency meter) across terminals FM and SD on the inverter. (Note the polarity. Terminal FM is positive.)
 - 2. When a calibration resistor has already been connected, adjust the resistance to "0" or remove the resistor.
 - 3. Set a monitor item in Pr.54 AM terminal function selection. (Refer to page 314.) When the output frequency or inverter output current is selected on the monitor, set the output frequency or current value at which the output signal will be 1440 pulses/s, using Pr.55 Frequency monitoring reference or Pr.56 Current monitoring reference beforehand. Normally, at 1440 pulses/s the meter deflects to full-scale.
 - 4. If the meter needle does not point to maximum even at maximum output, calibrate it with C0 (Pr.900).

- NOTE

- When outputting an item such as the output current, which cannot reach a 100% value easily by operation, set **Pr.54** to "21" (reference voltage output) and calibrate. A pulse train of 1440 pulses/s are output via terminal FM.
- When **Pr.310 Analog meter voltage output selection** = "21", the output via terminal AM cannot be calibrated. For details on **Pr.310**, refer to the Instruction Manual of the FR-A8AY.
- The wiring length to terminal FM should be 200 m at maximum.
- The initial value of the calibration parameter **C0 (Pr.900)** is set to 1 mA full-scale and 1440 pulses/s terminal FM pulse train output at 60 Hz. The maximum pulse train output of terminal FM is 2400 pulses/s.
- When connecting a frequency meter between terminals FM-SD and monitoring the output frequency, it is necessary to change **Pr.55** to the maximum frequency, since the FM terminal output will be saturated at the initial value when the maximum frequency reaches 100 Hz or greater.
- Calibration with the calibration parameter C0 (Pr.900) cannot be done when Pr.291 Pulse train I/O selection = "10, 11, 20, 21, or 100" (high-speed pulse train output).

Calibration procedure for terminal FM when using the operation panel (FR-DU08)

| Оре | rating procedure |
|-----|--|
| 1. | Turning ON the power of the inverter |
| _ | The operation panel is in the monitor mode. |
| 2. | Changing the operation mode |
| | Press EXT to choose the PU operation mode. [PU] indicator turns ON. |
| | Calibration is also possible in the External operation mode. |
| 3. | Selecting the parameter setting mode |
| | Press MODE to choose the parameter setting mode. (The parameter number read previously appears.) |
| 4. | Calibration parameter selection |
| | Turn 🍪 until "Ĺ " appears. Press 📧 to display "Ĺ ". |
| 5. | Selecting a parameter |
| | Turn 🕲 until "[[C0(Pr.900) FM/CA terminal calibration) appears. Press [SET] to enable the |
| | parameter setting. |
| | The monitored value of the item (initially the output frequency) selected by Pr.54 FM/CA terminal function selection will appear. |
| 6. | |
| 0. | Pulse output via terminal FM |
| | If stopped, press FWD or REV to start the inverter operation. (To monitor the output frequency, motor connection |
| | is not required.) When a monitor that does not require inverter operation is set in Pr.54 , calibration is also possible during a stop |
| | status. |
| 7. | Scale adjustment |
| | Turn 🚱 to move the meter needle to a desired position. |
| 8. | Setting completed |
| | Press SET to confirm the selection. The monitored value and "[]" blink alternately. |
| | Turn 🕄 to read another parameter. |
| | • Press set to return to the "[" display. |
| | Press SET twice to show the next parameter. |
| | NOTE |

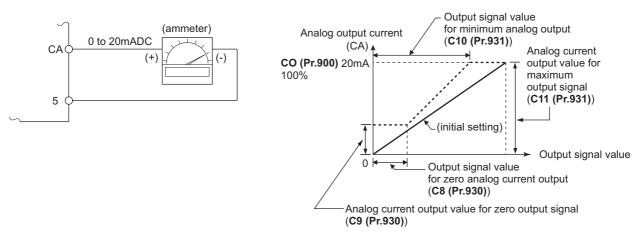
- Calibration can also be made for External operation. Set the frequency in the External operation mode, and make calibration in the above procedure.
- Calibration can be performed during operation.
- For the operation from the parameter unit, refer to the Instruction Manual of the parameter unit.

5.8 (M) Item and output signal for monitoring

5

Terminal CA calibration (C0 (Pr.900), C8 (Pr.930) to C11 (Pr.931))

- Terminal CA is initially set to provide a 20 mADC output in the full-scale state of the corresponding monitor item. The calibration parameter C0 (Pr.900) allows the output current ratio (gains) to be adjusted according to the meter scale. Note that the maximum output current is 20 mADC.
- Set a value at the minimum current output in the calibration parameters C8 (Pr.930) and C9 (Pr.930). The calibration parameters C10 (Pr.931) and C11 (Pr.931) are used to set a value at the maximum current output.
- Set the output signal values (output monitor set with **Pr.54**) at zero or at the maximum current output via terminal CA using the calibration parameters **C8 (Pr.930)** and **C10 (Pr.931)**. The full scale for each monitor is 100% at this time.
- Set the output current values (output monitor set with Pr.54) at zero and at the maximum current output via terminal CA (using the calibration parameters C9 (Pr.930) and C11 (Pr.931). The output current calibrated by the calibration parameter C0 (Pr.900) is 100% at this time.



- Calibrate the output via terminal CA in the following procedure.
 - **1.** Connect a 0-20 mADC indicator (frequency meter) across terminals CA and 5 on the inverter. (Note the polarity. Terminal CA is positive.)
 - 2. Set the initial value of the calibration parameter C8 (Pr.930) to C11 (Pr.931). If the meter needle does not indicate zero when the current input is at zero, calibrate the meter using C8 (Pr.930) and C9 (Pr.930).
 - **3.** Set a monitor item in **Pr.54 FM/CA terminal function selection**. (Refer to page 314.) When the output frequency or inverter output current is selected on the monitor, set the output frequency or current value at which the output signal will be 20 mA, using **Pr.55** or **Pr.56** beforehand.
 - 4. If the meter needle does not point to maximum even at maximum output, calibrate it with C0 (Pr.900).

NOTE

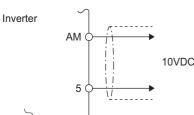
- When outputting an item such as output current, which cannot reach a 100% value easily by operation, set **Pr.54** to "21" (reference voltage output) and calibrate. A current of 20 mADC is output via terminal CA.
- When **Pr.310 Analog meter voltage output selection** = "21", the output via terminal CA cannot be calibrated. For details on **Pr.310**, refer to the Instruction Manual of the FR-A8AY.
- The output via terminal CA is enabled even if C8 (Pr.930) \geq C10 (Pr.931), C9 (Pr.930) \geq C11 (Pr.931).

Adjusting the response of terminal CA (Pr.869)

- Using **Pr.869**, the output voltage response of terminal CA can be adjusted in the range of 0 to 5 seconds.
- Increasing the setting stabilizes the output via terminal CA more but reduces the response level. (Setting "0" sets the response level to 7 ms.)

Calibration of terminal AM (C1 (Pr.901))

• Terminal AM is initially set to provide a 10 VDC output in the full-scale state of the corresponding monitor item. The calibration parameter C1 (Pr.901) AM terminal calibration allows the output voltage ratio (gains) to be adjusted according to the meter scale. Note that the maximum output voltage is 10 VDC.



- Calibrate the output via terminal AM in the following procedure. •
 - 1. Connect a 0-10 VDC indicator (frequency meter) across terminal AM and terminal 5 on the inverter. (Note the polarity. Terminal AM is positive.)
 - 2. Set a monitor item in Pr.158 AM terminal function selection. (Refer to page 314.) When the output frequency or inverter output current is selected on the monitor, set the output frequency or current value at which the output signal is 10 V, using Pr.55 or Pr.56 beforehand.
 - 3. If the meter needle does not point to maximum even at maximum output, calibrate it with C1 (Pr.901).

- When outputting an item such as the output current, which cannot reach a 100% value easily by operation, set Pr.158 to "21" (reference voltage output) and calibrate. A voltage of 10 VDC is output via terminal AM.
- When Pr.306 Analog output signal selection = "21", the output via terminal AM cannot be calibrated. For details on Pr.306, refer to the Instruction Manual of the FR-A8AY.
- Use Pr.290 Monitor negative output selection to enable negative signals output via terminal AM. The output voltage range is -10 to +10 VDC. Calibrate the maximum positive value output via terminal AM.

Adjusting the response of terminal AM (Pr.867)

- Use Pr.867 to adjust the output voltage response of the terminal AM in the range of 0 to 5 seconds.
- · Increasing the setting stabilizes the output via terminal AM more but reduces the response level. (Setting "0" means the setting of the response level to 7 ms.)

Parameters referred to

- Pr.54 FM/CA terminal function selection page 314 Pr.55 Frequency monitoring reference page 314
- Pr.56 Current monitoring reference S page 314 Pr.158 AM terminal function selection S page 314
- Pr.290 Monitor negative output selection page 314
- Pr.291 Pulse train I/O selection 3 page 258

5.8.5 Energy saving monitoring

From the power consumption estimated value during commercial power supply operation, the energy saving effect by use of the inverter can be monitored and output.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|---|-------------------------|--|---|
| 52 M100 | Operation panel main monitor selection | 0 (output frequency) | | |
| 774 M101 | Operation panel monitor selection 1 | 1 37 | | |
| 775 M102 | Operation panel monitor selection 2 | 9999 | Refer to page | 50: Energy saving effect monitoring |
| 776 M103 | Operation panel monitor selection 3 | | 305. | 51: Cumulative energy saving monitoring |
| 992 M104 | Operation panel setting dial push monitor selection | 0 (set frequency) | | |
| 54 M300 | FM/CA terminal function selection | 1 (output | Refer to page | FOr Energy on ving offerst monitoring |
| 158 M301 | AM terminal function selection | frequency) | 314. | 50: Energy saving effect monitoring |
| 891 M023 | Cumulative power monitor digit shifted | 9999 | 0 to 4 | Set the number of times to move the digit of cumulative power monitored value. The readout peaks out at the upper limit of readout. |
| 1023 | times | | 9999 | The function of moving the decimal point is not available. The readout is reset to 0 when it exceeds the upper limit. |
| 892 M200 | Load factor | 100% | 30% to 150% | Set the load factor for the commercial power supply operation. The setting is used for calculation of the estimated power consumption during commercial power supply operation by being multiplied by the power consumption rate (page 328). |
| 893 M201 | Energy saving monitor reference (motor capacity) | Inverter rated capacity | 0.1 to 55 kW ^{*1} 0 to 3600 kW ^{*2} | Set the motor capacity (pump capacity). Setting this parameter is required for calculating the rate of saved power, the rate of average energy saving, and the commercial power. |
| | | | 0 | Discharge damper control (fan) |
| 894 | Control selection during | <u> </u> | 1 | Inlet damper control (fan) |
| M202 | commercial power- supply operation | 0 | 2 | Valve control (pump) |
| | Supply operation | | 3 | Commercial power supply drive (fixed value) |
| | | | 0 | Consider the commercial power as 100%. |
| 895 | Power saving rate reference value | 9999 | 1 | Consider the power set in Pr.893 as 100% |
| M203 | reference value | | 9999 | No function |
| 896 M204 | Power unit cost | 9999 | 0 to 500 | Set the power unit cost. Setting this parameter is required for displaying the energy cost savings in the energy saving monitoring. |
| | | | 9999 | No function |
| 897 | Power saving monitor | | 0 | The time period for averaging is 30 minutes. |
| 897 M205 | Power saving monitor average time | 9999 | 1 to 1000 h | Set the number of hours for averaging. |
| WIZUJ | average time | | 9999 | No function |
| | | | 0 | Clear the cumulative monitor value |
| 898 | Power caving aumulative | | 1 | Hold the cumulative monitor value |
| 898 M206 | Power saving cumulative monitor clear | 9999 | 10 | Continue accumulation (upper limit communication data is 9999) |
| 141200 | | | 9999 | Continue accumulation (upper limit communication data is 65535) |
| 899 M207 | Operation time rate (estimated value) | 9999 | 0% to 100% | Setting this parameter is required for calculating the annual energy saving. Set an annual operating rate (considering a 24- hours-a-day and 365-days-a-year operation as 100%). |
| | | | 9999 | No function |

*1 For the FR-F820-02330(55K) or lower, and FR-F840-01160(55K) or lower.

*2 For the FR-F820-03160(75K) or higher, and FR-F840-01800(75K) or higher.

Energy saving monitoring list

• The items in the energy saving effect monitoring (items which can be monitored when "50" is set in **Pr.52**, **Pr.54**, **Pr.158**, **Pr.774** to **Pr.776**, and **Pr.992**) are listed below.

(The items which can be monitored via terminal FM or CA (**Pr.54** setting) and via terminal AM (**Pr.158** setting) are limited to [1 Power saving] and [3 Average power saving].)

| | Energy saving | Description and formula | Unit and | Parameter setting | | | | |
|---|----------------------------|--|-------------------------------|-------------------|----------|-------------|--------|--|
| | monitor item | Description and formula | increment | Pr.895 | Pr.896 | Pr.897 | Pr.899 | |
| 1 | Power saving | The difference between the input power calculated by the inverter and the estimated power required to run a motor off a commercial power supply. [Input power for commercial power supply operation] - [Monitored value of inverter input power] | 0.01/0.1 kW ^{*3} | 9999 | | | | |
| 2 | Power saving rate | It is defined as the power saving expressed as a percentage. The rate of the power saving with respect to the estimated input power for the commercial power supply operation is determined using the following formula. [1 Power saving] Power during commercial power supply operation | 0.1% | 0 | _ | 9999 | | |
| | | The rate of the power saving with respect to the Pr.893 setting is determined using the following formula. [1 Power saving] Pr.893 | | 1 | | | | |
| 3 | Average power saving | It is defined as the average hourly energy saving during a monitoring time (set in Pr.897). $\frac{\sum ([1 \text{ Power saving}] \times \Delta t)}{\text{Pr.897}}$ | 0.01/0.1 kWh ^{*3} | 9999 | | | _ | |
| 4 | Average power saving rate | It is defined as the average hourly energy saving expressed as a percentage. The rate of the average hourly energy saving with respect to the estimated input power for the commercial power supply operation is determined using the following formula. $\frac{\sum ([2 \text{ Power saving rate}] \times \Delta t)}{\text{Pr.897}} \times 100$ | 0.1% | 0 | 9999 | 0 to 1000 h | | |
| | | The rate of the average hourly energy saving with respect to the Pr.893 setting is determined using the following formula. [3 Average power saving] Pr.893 × 100 | | 1 | | | | |
| 5 | Average power cost savings | It is defined as a monetary value of the average hourly energy saving, determined using the following formula. [3 Average power saving] × Pr.896 setting | 0.01/0.1 ^{*3} | _ | 0 to 500 | | | |

 The items in the cumulative energy saving monitoring (items which can be monitored when "51" is set in Pr.52, Pr.774 to Pr.776, and Pr.992) are listed below.

(The digit of the cumulative energy saving monitored value can be moved to the right according to the setting of **Pr.891 Cumulative power monitor digit shifted times**.)

| | Energy saving | Description and formula | Unit and | | Paramet | er setting | |
|---|-------------------------------|---|---|--------|----------|------------|---------------|
| | monitor item | Description and formula | increment | Pr.895 | Pr.896 | Pr.897 | Pr.899 |
| 6 | Power saving amount | It is defined as a cumulative energy saving during monitoring, determined by multiplying the saved power by the number of inverter operating hours. Σ ([1 Power saving] × Δ t) | 0.01 kWh/ 0.1 kWh *1*2*3 | _ | 9999 | | 9999 |
| 7 | Power cost savings | It is defined as a monetary value of the cumulative energy saving. [6 Power saving amount] × Pr.896 setting | 0.01/ 0.1 ^{*1*3} | _ | 0 to 500 | | |
| 8 | Annual power saving amount | It is defined as an estimated annual energy saving. $\frac{[6 \text{ Power saving amount}]}{\text{Operation time during power}} \times 24 \times 365 \times \frac{\text{Pr.899}}{100}$ | 0.01 kWh/ 0.1 kWh ^{*1*2*3} | _ | 9999 | _ | 0% to 100% |
| 9 | Annual power cost savings | It is defined as a monetary value of annual energy saving. [8 Annual power saving amount] × Pr.896 setting | 0.01/ 0.1 ^{*1*3} | _ | 0 to 500 | | 10070 |

*1 For monitoring via communication (RS-485 communication, or other communication using a communication option), the increments are 1 in no units. For example, a value "10.00 kWh" is converted into "10" for communication data.

*2 On the LCD operation panel or the parameter unit, a readout is displayed in units of kilowatt-hours (kW).

*3 The increment differs according to the inverter capacity. (Increment left of a slash for FR-F820-02330(55K) or lower, FR-F840-01160(55K) or lower. Increment right of a slash for FR-F820-03160(75K) or higher, FR-F840-01800(75K) or higher.)

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- The operation panel and the parameter unit have a 5-digit display. This means, for example, that a monitored value up to 999.99 is displayed in 0.01 increments and a monitor value of 1000 or more is displayed in 0.1 increments as "1000.0". The maximum monitored value displayed is "99999".
- The maximum monitored value via communication (RS-485 communication or other communication with communication option installed) is 65535 when Pr.898 Power saving cumulative monitor clear = "9999". The maximum monitored value on monitoring in 0.01 increments is "655.35", and that on monitoring in 0.1 increments is "6553.5".

Power saving real-time monitoring ([1 Power saving], [2 Power saving rate])

- During **[1 Power saving]** monitoring, an energy saving effect (power difference) of using the inverter as compared to the commercial power supply operation is calculated and displayed on the main monitor.
- In the following cases, the monitored value of [1 Power saving] is "0".

The result of calculating the saved power is negative value.

DC injection brake works.

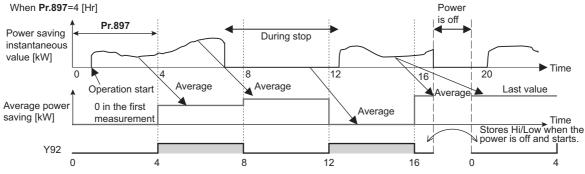
The motor is not connected with the inverter (monitored value of output current is 0 A).

On [2 Power saving rate] monitoring, the rate of the saved power considering the consumed power (estimate) during the power supply operation as 100% is displayed when Pr.895 Power saving rate reference value is set to "0". When Pr.895 is set to "1", the rate of the saved power with respect to the setting of Pr.893 Energy saving monitor reference (motor capacity) that is referenced as 100% is displayed.

Average power saving monitoring ([3 Average power saving], [4 Average power saving rate], [5 Average power cost savings])

- The average power saving monitors are displayed by setting a value other than 9999 in **Pr.897 Power saving monitor** average time.
- On [3 Average power saving] monitoring, the average hourly energy saving every preset time period is displayed.

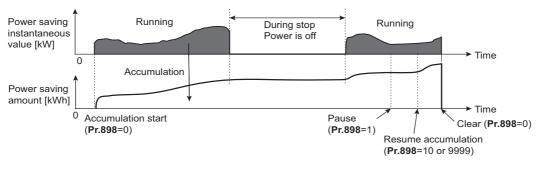
• When the setting of **Pr.897** is changed, when the inverter is powered ON, or when the inverter is reset, the averaging is restarted. The Energy saving average value updated timing (Y92) signal is inverted every time the averaging is restarted.



- On [4 Average power saving rate] monitoring, the average hourly monitored value of [2 Power saving rate]) is displayed when **Pr.895 Power saving rate reference value** is set to "0 or 1".
- On [5 Average power cost savings] monitoring, a monetary value of the average hourly energy saving ([3 Average power saving] × Pr.896 setting) is displayed when the unit price, power cost per kilowatt (hour), is set in Pr.896 Power unit cost.

Cumulative energy saving monitoring ([6 Power saving amount], [7 Power cost saving], [8 Annual power saving amount], [9 Annual power cost savings])

- The digit of the cumulative energy monitored value can be moved to the right by the number set in Pr.891 Cumulative power monitor digit shifted times. For example, when the cumulative energy is 1278.56 kWh and Pr.891 is set to "2", "12.78" is displayed (in 100's of units) on the PU/DU and the communication data is converted into "12". When Pr.891 = "0 to 4" and the cumulative energy reaches more than the upper limit of readout, the readout peaks out at the upper limit, which indicates that moving digit is necessary. When Pr.891 = "9999" and the cumulative energy reaches more than the upper limit of readout, cumulative energy reaches more than the energy restarts. The readout of other items in the cumulative energy saving monitoring peaks out at the upper limit of readout.
- With the monitored value of **[6 Power saving amount]**, a cumulative energy saving during a desired time period can be measured. Follow this procedure.
 - 1. Set "10" or "9999" in Pr.898 Power saving cumulative monitor clear.
 - 2. Change the setting of **Pr.898** to "0" when you want to start measuring the energy saving. The cumulative value is cleared and the cumulative energy saving meter restarts.
 - **3.** Change the setting of **Pr.898** to "1" when you want to stop measuring the energy saving. The meter stops and the cumulative value is fixed.

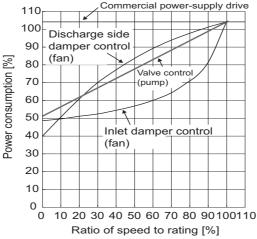


- NOTE

• The cumulative value of energy saving is refreshed every hour. This means that the last cumulative value is displayed at a restart of the inverter and the cumulative meter restarts if the time elapsed between turning OFF and re-turning ON of the inverter is shorter than an hour. (In some cases, the cumulative energy value may decrease.)

Estimated input power for the commercial power supply operation (Pr.892, Pr.893, Pr.894)

- Select the pattern of the commercial power supply operation from among four patterns (discharge damper control (fan), suction damper control (fan), valve control (pump) and commercial power drive), and set it in Pr.894 Control selection during commercial power-supply operation.
- Set the motor capacity (pump capacity) in Pr.893 Energy saving monitor reference (motor capacity).
- Refer to the following graph to find the rate of power consumption (%) during commercial power supply operation based on the selected pattern and the rate of motor rotations per minute with respect to the rated speed (the result of dividing the present output frequency by **Pr.3 Base frequency** setting).



• The estimated input power (kW) for the commercial power supply operation is calculated from the motor capacity set in **Pr.893**, the setting of **Pr.892 Load factor**, and the rate of power consumption using the following formula.

| Estimated consumed power during | = Pr.893 (kW) × | Consumed power (%) | Pr.892 (%) | |
|--|------------------------|--------------------|------------|--|
| commercial power supply operation (kW) | - F1.095 (KVV) ^ | 100 | 100 | |

NOTE

• If the output frequency rises to the setting of **Pr.3 Base frequency** or higher, it stays at a constant value because the rotations per minute cannot rise higher than the power supply frequency during commercial power supply operation.

Annual energy saving and its monetary value (Pr.899)

- When the operation time rate (ratio of the time period in year when the inverter drives the motor) [%] is set in Pr.899, the
 annual energy saving effect can be estimated.
- When the inverter is operated in specific patterns, the estimate annual energy saving can be calculated by measuring the energy saving in a certain period.
- Refer to the following procedure to set the operation time rate.
 - **1.** Estimate the average operation time per day (h/day).
 - 2. Calculate the operation days per year (days/year) using the following formula: Average operation days per month × 12 (months).
 - **3.** Calculate the annual operation time (h/year) from values determined in Step 1 and Step 2, using the following formula.

Annual operation time (h/year) = average time (h/day) × number of operation days (days/year)

4. Calculate the operation time rate using the following formula, and set it in Pr.899.

```
Operation time rate (%) = \frac{\text{Annual operation time (h/year)}}{24 (h/day) \times 365 (days/year)} \times 100(\%)
```



• Setting example for operation time rate: In the case where the average operation time per day is about 21 hours and the average operation days per month is 16 days.

Annual operation time = 21 (h/day) × 16 (days/month) × 12 (months) = 4032 (h/year)

Operation time rate (%) = $\frac{4032 \text{ (h/year)}}{24 \text{ (h/day)} \times 365 \text{ (days/year)}} \times 100(\%) = 46.03\%$

Therefore, set 46.03% in Pr.899.

 Calculate the annual energy saving from the value of [3 Average power saving] cumulated according to the setting of Pr.899 Operation time rate (estimated value).

> Annual power saving amount (kWh/year) = With **Pr.898** = 10 or 9999, average power × 24h × 365 days × **Pr.899** saving (kW) during cumulative period

• When the power cost per hour is set in **Pr.896 Power unit cost**, the annual energy cost savings can be monitored. The annual energy cost savings is determined by calculation using the following formula.

Annual power cost saving = annual power saving amount (kWh/year) × Pr.896



• During regenerative driving, substitute the output power during the commercial power supply operation for the saved power (therefore, input power = 0).

« Parameters referred to »

Pr.3 Base frequency ☞ page 552 Pr.52 Operation panel main monitor selection ☞ page 305 Pr.54 FM/CA terminal function selection ☞ page 314 Pr.158 AM terminal function selection ☞ page 314

5.8.6 Output terminal function selection

Use the following parameters to change the functions of the open collector output terminals and relay output terminals.

| Pr. | Nam | 10 | Initial value | Signal name | Setting range |
|---------------------------|-------------------------------------|--|--------------------|--|---|
| 190 M400 | RUN terminal function selection | | 0 | RUN (Inverter running) | |
| 191 M401 | SU terminal function selection | | 1 | SU (Up to frequency) | 0 to 5, 7, 8, 10 to 19, 25, 26, 35, 39 to 42, 45 to 54, 57, 64 to 68, 70 to 80, 82, 85, 90 to 96, 98 to |
| 192 M402 | IPF terminal function | For open collector output terminal | 2 ^{*1} | IPF (Instantaneous power failure/undervoltage) | 105, 107, 108, 110 to 116, 125, 126, 135, 139 to 142, 145 to 154, 157, 164 to 168, 170 to 180, 182, |
| 141402 | Tunction selection | | 9999 ^{*2} | Function disabled. | 185, 190 to 196, 198 to 208, 211 to 213, 215, 217 |
| 193 M403 | OL terminal function selection | | 3 | OL (Overload warning) | to 220, 226, 228 to 230, 247, 300 to 308, 311 to 313, 315, 317 to 320, 326, 328 to 330, 347, 9999 |
| 194 M404 | FU terminal function selection | | 4 | FU (Output frequency detection) | |
| 195 M405 | ABC1 terminal function selection | | 99 | ALM (Fault) | 0 to 5, 7, 8, 10 to 19, 25, 26, 35, 39 to 42, 45 to 54, 57, 64 to 68, 70 to 80, 82, 85, 90, 91, 94 to 96, |
| 196 M406 | ABC2 terminal function selection | For relay output terminal | 9999 | No function | 98 to 105, 107, 108, 110 to 116, 125, 126, 135, 139 to 142, 145 to 154, 157, 164 to 168, 170 to 180, 182, 185, 190, 191, 194 to 196, 198 to 208, 211 to 213, 215, 217 to 220, 226, 228 to 230, 247, 300 to 308, 311 to 313, 315, 317 to 320, 326, 328 to 330, 347, 9999 |
| 313 M410 ^{*3} | DO0 output selection | g | 9999 | No function | |
| 314 M411 ^{*3} | DO1 output selection | | 9999 | No function | |
| 315 M412 ^{*3} | DO2 output selection | | 9999 | No function | 0 to 5, 7, 8, 10 to 19, 25, 26, 35, 39 to 42, 45 to 54, 57, 64 to 66, 68, 70 to 80, 85 to 96, 98 to 105, 107, 108, 110 to 116, 125, 126, 135, 139 to 142, |
| 316 M413 ^{*3} | DO3 output selection | | 9999 | No function | 145 to 154, 157, 164 to 166, 168, 170 to 180, 185 to 196, 198 to 208, 211 to 213, 215, 217 to 220, |
| 317 M414 ^{*3} | DO4 output selection | F | 9999 | No function | 226, 228 to 230, 247 to 250, 300 to 308, 311 to 313, 315, 317 to 320, 326, 328 to 330, 347 to 350, 9999 |
| 318 M415 ^{*3} | DO5 output selection | For terminal on the option | 9999 | No function | |
| 319 M416 ^{*3} | DO6 output selection | | 9999 | No function | |
| 320 M420 ^{*3} | RA1 output selection | | 0 | RUN (Inverter running) | |
| 321 M421 ^{*3} | RA2 output selection | | 1 | SU (Up to frequency) | 0 to 5, 7, 8, 10 to 19, 25, 26, 35, 39 to 42, 45 to 54, 57, 64 to 66, 68, 70 to 80, 85 to 91, 94 to 96, 08, 00, 200 to 208, 211 to 213, 215, 217 to 220 |
| 322 | RA3 output | | 2 ^{*1} | IPF (Instantaneous power failure/undervoltage) | 98, 99, 200 to 208, 211 to 213, 215, 217 to 220, 226, 228 to 230, 247 to 250, 9999 |
| M422 ^{*3} | selection | | 9999 ^{*2} | No function | |
| | | Initial | | | |

| Pr. | Name | Initial value | Setting range | Description | | |
|------|--------------------------|------------------|---------------|--|--|--|
| 289 | Inverter output terminal | 9999 | 5 to 50 ms | Set the time delay for the output terminal response. | | |
| M431 | • | | 9999 | No filtering of the output terminal. | | |

*1 The initial value is for standard models and IP55 compatible models.

*2 The initial value is for separated converter types.

*3 The setting is available when the PLC function is enabled.

♦ Output signal list

- A function listed below can be set to each output terminal.
- Refer to the following table and set the parameters. (0 to 99, 200 to 299: Positive logic, 100 to 199, 300 to 399: Negative logic)

| Set | ting | Signal | | | Related | Refer | |
|-------------------|-------------------|-----------|--|--|--|-------------|--|
| Positive logic | Negative logic | name | Function | Operation | parameter | to page | |
| 0 | 100 | RUN | Inverter running | Output during operation when the inverter output frequency reaches Pr.13 Starting frequency or higher. | — | 335 | |
| 1 | 101 | SU | Up to frequency *1 | Output when the output frequency reaches the set frequency. | Pr.41 | 337 | |
| 2 | 102 | IPF | Instantaneous power failure/ undervoltage ^{*2} | Output when an instantaneous power failure or undervoltage protection operation occurs. | Pr.57 | 466, 472 | |
| 3 | 103 | OL | Overload warning | Output while the stall prevention function works. | Pr.22, Pr.23, Pr.66, Pr.148, Pr.149, Pr.154 | 290 | |
| 4 | 104 | FU | Output frequency detection | Output when the output frequency reaches the frequency set in Pr.42 (Pr.43 during reverse rotation) or higher. | Pr.42, Pr.43 | 337 | |
| 5 | 105 | FU2 | Second output frequency detection | Output when the output frequency reaches the frequency set in Pr.50 or higher. | Pr.50 | 337 | |
| 7 | 107 | For manuf | acturer setting. Do not set. | | | | |
| 8 | 108 | THP | Electronic thermal O/L relay pre-alarm | Output when the cumulative electronic thermal O/L relay value reaches 85% of the trip level. (The electronic thermal O/L relay function (E.THT/E.THM) is activated when the value reaches 100%.) | Pr.9 | 266 | |
| 10 | 110 | PU | PU operation mode | Output when PU operation mode is selected. | Pr.79 | 240 | |
| 11 | 111 | RY | Inverter operation ready | Output when the reset process is completed after powering ON the inverter or when the inverter is ready to start operation with the start signal ON or during operation. | _ | 335 | |
| 12 | 112 | Y12 | Output current detection | Output when the output current is higher than the Pr.150 setting for the time set in Pr.151 or longer. | Pr.150, Pr.151 | 339 | |
| 13 | 113 | Y13 | Zero current detection | Output when the output current is lower than the Pr.152 setting for the time set in Pr.153 or longer. | Pr.152, Pr.153 | 339 | |
| 14 | 114 | FDN | PID lower limit | Output when the input value is lower than the lower limit set for the PID control operation. | | | |
| 15 | 115 | FUP | PID upper limit | Output when the input value is higher than the upper limit set for the PID control operation. | Pr.127 to Pr.134, Pr.575 to Pr.577, Pr.1346, Pr.1370 | 419 | |
| 16 | 116 | RL | PID forward/reverse rotation output | Output during forward rotation operation in the PID control operation. | | | |
| 17 | — | MC1 | Electronic bypass MC1 | | Dr 425 4c Dr 400 | | |
| 18 | — | MC2 | Electronic bypass MC2 | Used to work the electronic bypass function. | Pr.135 to Pr.139, Pr.159 | 404 | |
| 19 | — | MC3 | Electronic bypass MC3 | | | | |
| 25 | 125 | FAN | Fan fault output | Output when a fan fault occurs. | Pr.244 | 273 | |
| 26 | 126 | FIN | Heat sink overheat pre-alarm | Output when the heat sink temperature rises to 85% of temperature at which the protective function of the Heat sink overheat is activated. | _ | 602 | |
| 35 | 135 | TU | Torque detection | Output when the motor torque is higher than the Pr.864 setting. | Pr.864 | 341 | |
| 39 | 139 | Y39 | Start time tuning completion | Output when tuning at start-up is completed. | Pr.95, Pr.574 | 400 | |
| 40 | 140 | Y40 | Trace status | Output during trace operation. | Pr.1020 to Pr.1047 | 486 | |
| 41 | 141 | FB | Speed detection | Output when the actual motor rotations per | | | |
| 42 | 142 | FB2 | Second speed detection | minute (estimate) reaches the setting of Pr.42 (Pr.50) . | Pr.42, Pr.50 | 337 | |

| Set | ting | Signal | | | Related | Refe |
|-------------------|-------------------|--------|---|---|--|------------|
| Positive logic | Negative logic | name | Function | Operation | parameter | to page |
| 45 | 145 | RUN3 | Inverter running and start command ON | The signal is ON while the inverter is running or while the start command signal is ON. | — | 335 |
| 46 | 146 | Y46 | During deceleration at occurrence of power failure | Output when the power-failure deceleration function is activated. (The signal output is retained until the function stops.) | Pr.261 to Pr.266 | 478 |
| 47 | 147 | PID | During PID control activated | Output during the PID control operation. | Pr.127 to Pr.134, Pr.575 to Pr.577 | 419 |
| 48 | 148 | Y48 | PID deviation limit | Output when the absolute deviation value exceeds the limit value. | Pr.127 to Pr.134, Pr.553, Pr.554 | 419 |
| 49 | 149 | Y49 | During pre-charge operation | Output while the pre-charge function is | | |
| 50 | 150 | Y50 | During second pre-charge operation | working. | Dr 407 to Dr 424 | |
| 51 | 151 | Y51 | Pre-charge time over | Output when the time period while the pre- | Pr.127 to Pr.134, Pr.241, Pr.553, | |
| 52 | 152 | Y52 | Second pre-charge time over | charge function is working reaches the time limit set in Pr.764 or Pr.769 . | Pr.554, Pr.575 to Pr.577, Pr.753 to | 445 |
| 53 | 153 | Y53 | Pre-charge level over | Output when the value higher than the | Pr.769, C42, C45 | |
| 54 | 154 | Y54 | Second pre-charge level over | detection level set in Pr.763 or Pr.768 is measured until the pre-charge function stops during pre-charge operation. | | |
| 57 | 157 | IPM | PM motor control | Output while the operation is performed under PM motor control. | Pr.71 to Pr.80, Pr.998 | 182 |
| 64 | 164 | Y64 | During retry | Output during retry operation. | Pr.65 to Pr.69 | 276 |
| 65 | 165 | Y65 | Emergency drive in operation ^{*2} | Output during emergency drive operation. | Pr.514, Pr.515, | 279 |
| 66 | 166 | ALM3 | Fault output during emergency drive ^{*2} | Output when a fault occurs during emergency drive operation. | Pr.523, Pr.524, Pr.1013 | 215 |
| 67 | 167 | Y67 | Power failed ^{*3} | Output when the inverter power output is shut off due to power failure or undervoltage or when the power failure time deceleration-to- stop function is activated. | Pr.261 to Pr.266 | 478 |
| 68 | 168 | EV | 24 V external power supply operation | Output while the inverter operated with a 24 V power supplied from an external source. | _ | 73 |
| 70 | 170 | SLEEP | PID output interruption | Output while PID output suspension function is activated. | Pr.127 to Pr.134, Pr.575 to Pr.577 | 419 |
| 71 | 171 | RO1 | Commercial power supply side motor 1 connection RO1 | | | |
| 72 | 172 | RO2 | Commercial power supply side motor 1 connection RO2 | | | |
| 73 | 173 | RO3 | Commercial power supply side motor 1 connection RO3 | | | |
| 74 | 174 | RO4 | Commercial power supply side motor 1 connection RO4 | Output depending on the motor drive conditions when the multi-pump function is | Pr.575 to Pr.591 | 450 |
| 75 | 175 | RIO1 | Inverter side motor 1 connection RIO1 | used. | | |
| 76 | 176 | RIO2 | Inverter side motor 1 connection RIO2 | | | |
| 77 | 177 | RIO3 | Inverter side motor 1 connection RIO3 | | | |
| 78 | 178 | RIO4 | Inverter side motor 1 connection RIO4 | | | |
| 79 | 179 | Y79 | Pulse train output of output power | Output in pulses every time the cumulative value of energy output from the inverter reaches the Pr.799 setting. | Pr.799 | 346 |
| 80 | 180 | SAFE | Safety monitor output | Output while the safety stop function is activated. | — | 74 |
| 82 | 182 | Y82 | BACnet binary output | Enables output from the Binary Output object for BACnet communication. | Pr.549 | 533 |
| 85 | 185 | Y85 | DC current feeding ^{*2} | Output during power failure or undervoltage of the AC power supply. | Pr.30 | 566 |

| | tting | Signal | | | Related | Refer |
|-------------------|-------------------|--------|---|--|--|-------------|
| Positive logic | Negative logic | name | Function | Operation | parameter | to page |
| 86 | 186 | Y86 | Control circuit capacitor life (for Pr.313 to Pr.322) ^{*5} | Output when the control circuit capacitor approaches the end of its life. | | |
| 87 | 187 | Y87 | Main circuit capacitor life (for Pr.313 to Pr.322) ^{*2*5} | Output when the main circuit capacitor approaches the end of its life. | | |
| 88 | 188 | Y88 | Cooling fan life (for Pr.313 to Pr.322) ^{*5} | Output when the cooling fan approaches the end of its life. | Pr.255 to Pr.259 | 220 |
| 89 | 189 | Y89 | Inrush current limit circuit life (for Pr.313 to Pr.322) ^{*2*5} | Output when the inrush current limit circuit approaches the end of its life. | | |
| 90 | 190 | Y90 | Life alarm | Output when any of the control circuit capacitor, main circuit capacitor, inrush current limit circuit, or the cooling fan approaches the end of its life. | - | |
| 91 | 191 | Y91 | Fault output 3 (Power-OFF signal) | Output when the Fault occurs due to an inverter circuit fault or connection fault. | _ | 336 |
| 92 | 192 | Y92 | Energy saving average value updated timing | Switches between ON and OFF every time the average energy saving is updated during the energy saving monitoring. This signal cannot be assigned to any of the relay output terminal (Pr.195, Pr.196, Pr.320 to Pr.322). | Pr.52, Pr.54, Pr.158, Pr.891 to Pr.899 | 324 |
| 93 | 193 | Y93 | Current average monitor | Output in pulses for transmission of the average current value and the maintenance timer value. This signal cannot be assigned to any of the relay output terminal (Pr.195 , Pr.196 , Pr.320 to Pr.322). | Pr.555 to Pr.557 | 225 |
| 94 | 194 | ALM2 | Fault output 2 | Output when the inverter's protective function is activated to stop the power output (when the Fault occurs) | | 336 |
| 95 | 195 | Y95 | Maintenance timer | Output when the value of Pr.503 reaches the Pr.504 setting or higher. | Pr.503, Pr.504 | 224 |
| 96 | 196 | REM | Remote output | Output via a terminal by setting a proper number in a relative parameter. | Pr.495 to Pr.497 | 341 |
| 98 | 198 | LF | Alarm | Output when an Alarm fault (fan fault or a communication error) occurs. | Pr.121, Pr.244 | 273, 500 |
| 99 | 199 | ALM | Fault | Output when the inverter's protective function is activated to stop the power output (when the Fault occurs). The signal output stops when the inverter reset starts. | _ | 336 |
| 200 | 300 | FDN2 | Second PID lower limit | Output when the input value is lower than the lower limit set for the second PID control operation. | | |
| 201 | 301 | FUP2 | Second PID upper limit | Output when the input value is higher than the upper limit set for the second PID control operation. | Pr.753 to Pr.758 | |
| 202 | 302 | RL2 | Second PID forward/reverse rotation output | Output during forward rotation operation in the second PID control operation. |] | 419 |
| 203 | 303 | PID2 | During second PID control activated | Output during the second PID control operation. | | |
| 204 | 304 | SLEEP2 | shutoff | | Pr.753 to Pr.758, Pr.1147 to Pr.1149 | |
| 205 | 305 | Y205 | Second PID deviation limit | Output when the absolute deviation value exceeds the limit value during the second PID control operation. | Pr.753 to Pr.758, Pr.1145, Pr.1146 | |
| 206 | 306 | Y206 | Cooling fan operation command | operation Output when the cooling fan operation is commanded. | | 273 |
| 207 | 307 | Y207 | Control circuit temperature | Output when the temperature of the control | | 347 |
| 208 | 308 | PS | PU stopped | Output while the PU is stopped. | Pr.75 | 196 |

| Set | ting | Signal | | | Related | Refe |
|-------------------|-------------------|----------------|---|---|---|------------|
| Positive logic | Negative logic | Signal name | Function | Operation | parameter | to page |
| 211 | 311 | LUP | Upper limit warning detection | Output when the load fault upper limit warning is detected. | | |
| 212 | 312 | LDN | Lower limit warning detection | Output when the load fault lower limit warning is detected. | Pr.1480 to Pr.1492 | 298 |
| 213 | 313 | Y213 | During load characteristics measurement | Output during measurement of the load characteristics. | | |
| 215 | 315 | Y215 | During cleaning | Output during operation of the cleaning function. | Pr.1469 to Pr.1479 | 415 |
| 217 | 317 | Y217 | Priming pump operation | Output to start the priming pump. | Pr.1363 | |
| 218 | 318 | STIR | Stirring | Output during the stirring operation. | Pr.1364, Pr.1365 | 1 |
| 219 | 319 | Y219 | PID upper/lower limit pre- warning | Output when the PID measured value meets | Pr.1346, Pr.1370 | |
| 220 | 320 | Y220 | Second PID upper/lower limit pre-warning | the requirements of the limit pre-warning signal output conditions. | to Pr.1373 | |
| 226 | 326 | Y226 | Auxiliary pressure pump operation Output when the PID deviation exceeds the auxiliary pressure pump operation starting level. | | Pr.1374, Pr.1375 | 459 |
| 228 | 328 | DRY | Dry run | Output when a dry-run state is detected. | Pr.42, Pr.43, Pr.132, Pr.1144, Pr.1370 | |
| 229 | 329 | Y229 | PID input pressure warning | Output when the pump inlet pressure reaches the warning level. | Pr.1370, Pr.1373, Pr.1377, Pr.1378, Pr.1380 | |
| 230 | 330 | Y230 | PID input pressure fault | Output when the pump inlet pressure reaches the fault level. | Pr.1370, Pr.1377, Pr.1379, Pr.1381 | |
| 247 | 347 | LSYN | Phase synchronization completion | Output when phase synchronization for bypass switching has completed. (For FR- A8AVP) ^{*4} | Pr.139 | _ |
| 248 | 348 | Y248 | Estimated residual-life of main circuit capacitor (for Pr.313 to Pr.322)*2*5 | Output when the main circuit capacitor approaches the end of its estimated life. | Pr.255, Pr.506 | |
| 249 | 349 | Y249 | ABC1 relay contact life (for Pr.313 to Pr.322) ^{*5} | Output when the relay contacts of terminals A1, B1, and C1 approach the end of their life. | Pr.255, Pr.507 | 220 |
| 250 | 350 | Y250 | ABC2 relay contact life (for Pr.313 to Pr.322) ^{*5} | Output when the relay contacts of terminals A2, B2, and C2 approach the end of their life. | Pr.255, Pr.508 | |
| 9999 | | — | No function | — | — | — |

*1 Note that changing the frequency setting with an analog signal or the setting dial on the operation panel (FR-DU08) may cause the turning ON and OFF of the Up to frequency (SU) signal depending on its changing speed and the timing of the speed change determined by the acceleration/ deceleration time setting. (The signal state changing does not occur when the acceleration/deceleration time is set to 0 seconds.)

*2 The setting is available for the standard structure model and the IP55 compatible model.

*3 This signal cannot be assigned to any of the output terminals for plug-in options (FR-A8AY and FR-A8AR).

*4 Available when the plug-in option is connected.

*5 This signal is available when the PLC function is enabled, or when an option (FR-A8AY, FR-A8AR, FR-A8NC, or FR-A8NCE) is installed. Use Pr.313 to Pr.322 to assign the function to the terminal. For the information of the availability of these parameters for each option, refer to the Instruction Manual of the option.

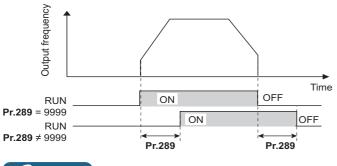
*6 On restarting the inverter, the Fault output 2 (ALM2) signal turns OFF at the time the inverter power turns OFF.

🗖 NOTE

- One function can be assigned to more than one terminal.
- The function works during the terminal conducts when the parameter setting is any of "0 to 99, 200 to 299", and the function works during the terminal does not conduct when the setting is "100 to 199, 300 to 399".
- When Pr.76 Fault code output selection = "1", the outputs of terminals SU, IPF, OL, and FU are used only for outputting the fault code according to the Pr.76 setting. (When the inverter's protective function is activated, the signal for the fault code is output.)
- The output of terminal RUN and the outputs of the relay output terminals are not affected by the **Pr.76** setting.
- Changing the terminal assignment using Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.
- Do not assign the signal to terminals A1, B1, and C1 or terminals A2, B2, and C2 which frequently changes its state between ON and OFF. Otherwise, the life of the relay contact may be shortened.

♦ Adjusting the output terminal response level (Pr.289)

• The responsivity of the output terminals can be delayed in a range between 5 to 50 ms. (The following is the operation example of the RUN signal.)

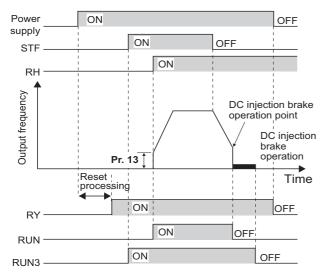


🗖 NOTE

- When **Pr.157 OL signal output timer** is set for the Overload warning (OL) signal output, the OL signal is output when the set time of (**Pr.157 + Pr.289**) elapses.
- The signal output for the PLC function (see page 483) and for the fault code output (see page 345) are not affected by the **Pr.289** setting (not filtered for responsivity).

Inverter operation ready signal (RY signal) and Inverter running signals (RUN and RUN3 signals)

- When the inverter is ready for operation, the Inverter operation ready (RY) signal turns ON (and stays ON during operation).
- When the inverter output frequency reaches the setting of **Pr.13 Starting frequency** or higher, the Inverter running (RUN) signal turns ON. The signals are OFF while the inverter is stopped or during the DC injection brake operation.
- The Inverter running and start command ON (RUN3) signal is ON while the inverter is running or while the start command signal is ON (When the start command signal is ON, the RUN3 signal is ON even while the inverter's protective function is activated or while the MRS signal is ON.) The RUN3 signal is ON even during the DC injection brake operation, and the signal is OFF when the inverter stops.



• The ON/OFF state of each signal according to the inverter operating status is shown in the matrix below.

| | Start signal | Start signal | Start signal | | | put shutoff ^{*2} | | estart after ins power failure | |
|------------------|-----------------------|-----------------------|-----------------------|--------------------|--------------------|---------------------------|--------------------|-----------------------------------|-----------------------------|
| Output | OFF | ON | ON | injection | | | | During coasting | |
| signal | (inverter stopped) | (inverter stopped) | (inverter running) | brake operation | Start signal ON | Start signal OFF | Start signal ON | Start signal OFF | running after restart |
| RY ^{*3} | ON | ON | ON | ON | OFF | | ON ^{*1} | | ON |
| RUN | OFF | OFF | ON | OFF | OFF | | OFF | | ON |
| RUN3 | OFF | ON | ON | ON | ON | OFF | ON | OFF | ON |

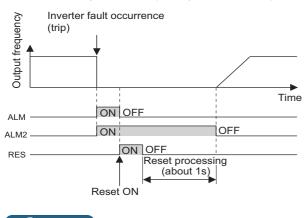
- *1 The signal is OFF during power failure or undervoltage.
- *2 This means the state during a fault occurrence or while the MRS signal is ON, etc.
- *3 The signal is OFF while power is not supplied to the main circuit.
- To use the RY, RUN, or RUN3 signal, set the corresponding number selected from the following table in any parameter from Pr.190 to Pr.196 (Output terminal function selection) to assign the function to an output terminal.

| Output signal | Pr.190 to Pr.196 settings | | | | |
|---------------|---------------------------|----------------|--|--|--|
| Output signal | Positive logic | Negative logic | | | |
| RY | 11 | 111 | | | |
| RUN | 0 | 100 | | | |
| RUN3 | 45 | 145 | | | |

• The RUN signal (positive logic) is initially assigned to the terminal RUN.

◆ Fault (ALM) signal and Fault output 2 (ALM2) signal

- The fault signal (ALM or ALM2 signal) is output when an inverter protective function is activated.
- The ALM2 signal stays ON during the resetting the inverter after the Fault occurs.
- To use the ALM2 signal, set "94 (positive logic) or 194 (negative logic)" in any parameter from **Pr.190 to Pr.196 (Output** terminal function selection) to assign the function to an output terminal.
- The ALM signal is initially assigned to the relay terminals A1, B1, and C1.



• NOTE

For details on the inverter faults, refer to page 594.

Input power shutoff like magnetic contactor (Y91 signal)

- The Fault output 3 (Y91) signal is output when a fault originating in the inverter circuit or a connection fault occurs.
- To use the Y91 signal, set "91 (positive logic) or 191 (negative logic)" in any parameter from **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function to an output terminal.
- The following is the list of faults that output the Y91 signal. (For details on faults, refer to page 594.)

| Fault type |
|--|
| Inrush current limit circuit fault (E.IOH) |
| CPU fault (E.CPU) |
| CPU fault (E.6) |
| CPU fault (E.7) |
| Parameter storage device fault (control circuit board) (E.PE) |
| Parameter storage device fault (main circuit board) (E.PE2) |
| Internal storage device fault (E.PE6) |
| 24 VDC power fault (E.P24) |
| Operation panel power supply short circuit/RS-485 terminals power supply short circuit (E.CTE) |
| Output side earth (ground) fault overcurrent (E.GF) |
| Output phase loss (E.LF) |
| Internal circuit fault (E.BE) |
| Internal circuit fault (E.13/E.PBT) |

Changing the special relay function for the PLC function

For the PLC function, the function of special relays (SM1225 to SM1234) can be changed by setting Pr.313 to Pr.322. (For details on the PLC function, refer to the PLC Function Programming Manual.)

Parameters referred to

Pr.13 Starting frequency 🗁 page 238, page 239 Pr.76 Fault code output selection 🖙 page 345

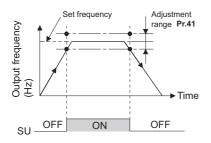
5.8.7 Output frequency detection

If the inverter output frequency which reaches a specific value is detected, the relative signal is output.

| Pr. | Name | | value | Setting | Description |
|-------------|--|----------------------------|-------|-------------|--|
| F1. | Name | FM | CA | range | Description |
| 41 M441 | Up-to-frequency sensitivity | 10% | | 0% to 100% | Set the level where the SU signal turns ON. |
| 42 M442 | Output frequency detection | 6 Hz | | 0 to 590 Hz | Set the frequency at which the FU (or FB) signal turns ON. |
| 43 M443 | Output frequency detection for reverse | detection for reverse 9999 | | 0 to 590 Hz | Set the frequency at which the FU (or FB) signal turns ON only while the motor rotates in reverse direction. |
| 111443 | rotation | | | 9999 | The frequency same as the Pr.42 setting is set. |
| 50 M444 | Second output frequency detection | 30 Hz | | 0 to 590 Hz | Set the frequency at which the FU2 (or FB2) signal turns ON. |
| 870 M400 | Speed detection hysteresis | 0 Hz | | 0 to 5 Hz | Set the hysteresis width for the detected frequency. |

Setting the notification zone of the output frequency reaching the set point (SU signal, Pr.41)

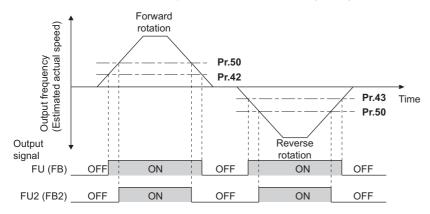
- The Up to frequency (SU) signal is output when the output frequency reaches the set frequency.
- Set the value in the range of ±1% to ±100% in **Pr.41** to determine tolerance for the set frequency (considered as 100% point).
- It may be useful to use this signal to start operating related equipment after checking that the set frequency has been reached.



Output frequency detection (FU (FB) signal, FU (FB2) signal, Pr.42, Pr.43, Pr.50)

- The Output frequency detection (FU/FU2) signal or the Speed detection (FB/FB2) signal is useful for applying or releasing electromagnetic brake, etc.
- The FU signal is output when the output frequency (frequency command value) reaches or exceeds the Pr.42 setting.
- During PM motor control, the FB signal is output when the estimated actual motor rotations per minute reaches the Pr.42 setting. Under V/F control and Advanced magnetic flux vector control, the FU signal and the FB signal are output at the same time.
- The frequency detection dedicated to motor rotation in reverse direction is enabled by setting the frequency in Pr.43.
- When **Pr.43** ≠ "9999", the **Pr.42** setting is for the forward rotation operation and the **Pr.43** setting is for the reverse rotation operation.

• When a different detection point of the frequency is required, **Pr.50** is available. The FU2 (or FB2) signal can be set to be output when the output frequency reaches the **Pr.50** setting or higher.



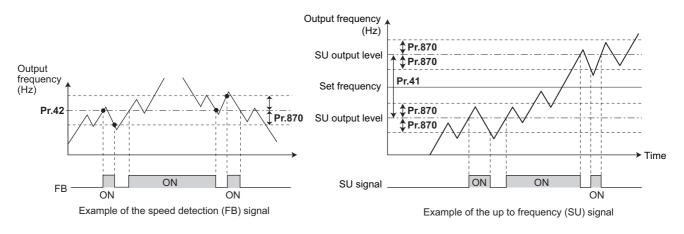
• To use each signal, set the corresponding number selected from the following table in any parameter from **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function to an output terminal.

| Output | Pr.190 to Pr. | Related | |
|--------|----------------|----------------|-----------|
| signal | Positive logic | Negative logic | parameter |
| FU | 4 | 104 | 42, 43 |
| FB | 41 | 141 | 42, 43 |
| FU2 | 5 | 105 | 50 |
| FB2 | 42 | 142 | 50 |

Speed detection hysteresis (Pr.870)

Setting the hysteresis width for the detected frequency prevents chattering of the Speed detection (FB) signal. When an
output frequency fluctuates, the Up to frequency (SU) signal and the Output frequency detection signals (FB and FB2) may
chatter (turns ON and OFF repeatedly).

Setting hysteresis to the detected frequency prevents chattering of these signals.



- NOTE

- In the initial setting, the FU signal is assigned to terminal FU, and the SU signal is assigned to terminal SU.
- All signals shown in the following table are OFF during the DC injection brake operation and during tuning at start-up.
- The reference frequency in comparison with the set frequency differs depending on the control method.

| Control method or function | Reference frequency | | | | | |
|---------------------------------------|--|--|--|--|--|--|
| control method of function | FU, FU2 | FB, FB2, SU | | | | |
| V/F control | Output frequency | Output frequency | | | | |
| Advanced magnetic flux vector control | Output frequency before the slip compensation | Output frequency before the slip compensation | | | | |
| PM motor control | Frequency command value | Estimated frequency (actual motor speed) | | | | |

- Setting a higher value in Pr.870 causes a lower responsivity of the signals for frequency detection (SU, FB, and FB2 signals).
- Changing the terminal assignment using **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.190 to Pr.196 (Output terminal function selection) F page 330

5.8.8 Output current detection function

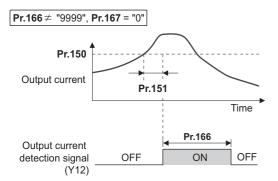
If the inverter output current which reaches a specific value is detected, the relative signal is output via an output terminal.

| Pr. | Name | Initial value | | Sotting range | Description | | |
|-------------|---|---------------|------|---------------|--|-----------|--|
| Pr. | Name | FM | CA | Setting range | Description | | |
| 150 M460 | Output current detection level | 120% | 110% | 0% to 400% | Set the level to detect the output current. Consider the value of the rated inverter current as 100%. | | |
| 151 M461 | Output current detection signal delay time | 0 s | | 0 to 10 s | Set the timing to detect the output current. Enter the delay time between the time when the output current reaches the set current or higher and the time when the Output current detection (Y12) signal is output. | | |
| 152 M462 | Zero current detection level | 5% | | 0% to 400% | Set the level to detect the zero current. Consider the value of the inverter rated current as 100%. | | |
| 153 M463 | Zero current detection time | 0.5 s | | 0 to 10 s | Set the time from the time when the output current drops to the Pr.152 setting or lower to the time when the Zero current detection (Y13) signal is output. | | |
| 166 | Output current detection | 0.1 s | | | | 0 to 10 s | Set the retention time period during which the Y12 signal is ON. |
| | signal retention time | | | 9999 | The Y12 signal is retained ON. The signal turns OFF at the next start-up of the inverter. | | |
| 167 M464 | Output current detection operation selection | 0 | | 0, 1, 10, 11 | Select the inverter operation at the time when the Y12 signal and the Y13 signal turn ON. | | |

Output current detection (Y12 signal, Pr.150, Pr.151, Pr.166, Pr.167)

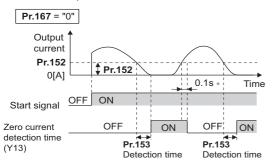
- · The output current detection function is useful for overtorque detection.
- If the inverter output during inverter running remains higher than the **Pr.150** setting for the time set in **Pr.151** or longer, the Output current detection (Y12) signal is output from the inverter's open collector or the relay output terminal.
- When the Y12 signal turns ON, the ON state is retained for the time set in Pr.166.
- When Pr.166 = "9999", the ON state is retained until the next start-up of the inverter.
- Setting Pr.167 = "1" while the Y12 signal is ON does not cause the fault E.CDO. The Pr.167 setting becomes valid after the Y12 signal is turned OFF.
- To use the Y12 signal, set "12 (positive logic) or 112 (negative logic)" in any parameter from **Pr.190 to Pr.196 (Output** terminal function selection) to assign the function to the output terminal.
- Use Pr.167 to select the inverter operation at the time when Y12 signal turns ON, whether the inverter output stops or the inverter operation continues.

| Pr.167 setting | When the Y12 signal turns ON | When the Y13 signal turns ON | | |
|-------------------|-----------------------------------|-----------------------------------|--|--|
| 0 (initial value) | Operation continues. | Operation continues. | | |
| 1 | Operation stops by fault (E.CDO). | Operation continues. | | |
| 10 | Operation continues. | Operation stops by fault (E.CDO). | | |
| 11 | Operation stops by fault (E.CDO). | Operation stops by fault (E.CDO). | | |



Zero current detection (Y13 signal, Pr.152, Pr.153)

- If the inverter output during inverter running remains higher than the **Pr.152** setting for the time set in **Pr.153** or longer, the Zero current detection (Y13) signal is output from the inverter's open collector or the relay output terminal.
- Once the Zero current detection (Y13) signal turns ON, the signal is retained ON for at least 0.1 second.
- If the inverter output current drops to zero, slippage due to gravity may occur, especially in a lift application, because the motor torque is not generated. To prevent this, the Y13 signal can be output from the inverter to apply the mechanical brake at zero current output.
- To use the Y13 signal, set "13 (positive logic) or 113 (negative logic)" in any parameter from **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function to the output terminal.
- Use **Pr.167** to select the inverter operation at the time when Y13 signal turns ON, whether the inverter output stops or the inverter operation continues.



* When the output is restored to the **Pr.152** level, the Y13 signal is turned OFF after 0.1 s.

NOTE

- This function is enabled during online or offline auto tuning.
- The response time of the Y12 and Y13 signals is approximately 0.1 second. However, the response time varies according to the load condition.
- When Pr.152 = "0", the zero current detection function is disabled.
- Changing the terminal assignment using **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

- The setting of the zero current detection level should not be too low, and the setting of the zero current detection time should not be too long. Doing so may cause the signal for the zero current detection not to be output when the output current is very low and the motor torque is not generated.
- A safety backup such as an emergency brake must be provided to prevent machines or equipment in hazardous conditions even if the Zero current detection is used.

Parameters referred to

Online auto tuning 🖙 page 400 Offline auto tuning 🖙 page 383, page 392

Pr.190 to Pr.196 (Output terminal function selection) F page 330

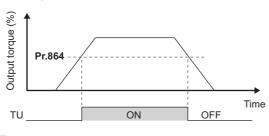
5.8.9 Output torque detection function

Magneticifiux PM

If the motor torque which reaches a specific value is detected, the relative signal is output. The signal is useful for applying or releasing electromagnetic brake, etc.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|------------------|---------------|---------------|--|
| 864 M470 | Torque detection | 150% | 10% to 400% | Set a value of the torque at which the TU signal turns ON. |

- The Torque detection (TU) signal turns ON when the motor output torque reaches the value of torque set in **Pr.864** or higher. The TU signal turns OFF when the motor output torque drops lower than the set value.
- Pr.864 is not available under V/F control.
- To use the TU signal, set "35 (positive logic) or 135 (negative logic)" in one of Pr.190 to Pr.196 (Output terminal function selection) to assign the function to the output terminal.



• NOTE

 Changing the terminal assignment using Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.190 to Pr.196 (Output terminal function selection) 🖙 page 330

5.8.10 Remote output function

The signal can be turned ON or OFF via the output terminal on the inverter as if the terminal is the remote output terminal for a programmable controller.

| Pr. | Name | Initial value | Setting range | Descriptio | n | |
|-------------|-----------------------------|---------------|------------------|--|--|---|
| | | | 0 | Remote output data is cleared when the inverter power is turned OFF. | Remote output data is cleared during an inverter | |
| 495 | Permete output coloction | 0 | 1 | Remote output data is retained even after the inverter power is turned OFF. | reset. | |
| M500 | Remote output selection | | 0 | 10 | Remote output data is cleared when the inverter power is turned OFF. | Remote output data is retained during an inverter |
| | | | 11 | Remote output data is retained even after the inverter power is turned OFF. | reset. | |
| 496 M501 | Remote output data 1 | 0 | 0 to 4095 | Set a decimal number to enter a binary number in every bit corresponding to each of the output terminals on the inverter. | | |
| 497 M502 | Remote output data 2 0 0 to | | 0 to 4095 | Set a decimal number to enter a binary number in every bit corresponding to each of the output terminals on the option FR-A8AY or FR-A8AR. | | |

Remote output setting (REM signal, Pr.496, Pr.497)

- The signal assigned to each of the output terminal can be turned ON or OFF according to the settings of Pr.496 and Pr.497.
 The signal assigned to each of the remote output terminal can be turned ON or OFF through communication via the PU connector, via the RS-485 terminals, or via a communication option.
- To use the Remote output (REM) signal, set "96 (positive logic) or 196 (negative logic)" in any parameter from Pr.190 to Pr.196 (Output terminal function selection) to assign the function to the terminal.

- Refer to the following figures to check correspondences between the bit and the actual terminal. When "1" is set in the bit corresponding to the terminal to which the REM signal assigned by setting a number in Pr.496 and Pr.497 each, the signal turns ON (or OFF in negative logic setting). Also, setting "0" allows the signal to turn OFF (or ON in negative logic setting).
- For example, when Pr.190 RUN terminal function selection = "96" (positive logic) and "1" (H01) is set in Pr.496, the REM signal assigned to terminal RUN turns ON.

Pr.496

| b11 | | | | | | | | | | | b0 |
|-----|----|----|----|----|------|------|----|----|-----|----|-----|
| *1 | *1 | *1 | *1 | *1 | ABC2 | ABC1 | FU | οĽ | IPF | US | RUN |

Pr.497

| b11 | | | | | | | | | | | b0 |
|-----|----|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|
| *1 | *1 | RA3 *3 | RA2 *3 | RA1 *3 | Y6 *2 | Y5 *2 | Y4 *2 | Y3 *2 | Y2 *2 | Y1 *2 | Y0 *2 |

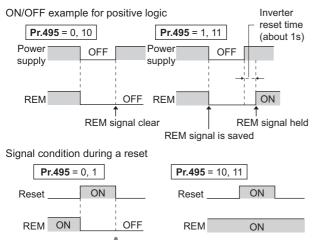
*1 Any value

*2 Y0 to Y6 are available when the output-extending option (FR-A8AY) is installed.

*3 RA1 to RA3 are available when the relay output option (FR-A8AR) is installed.

Remote output data retention (REM signal, Pr.495)

- When the inverter power is reset (or a power failure occurs) while Pr.495 = "0 (initial value) or 10", the REM signal setting is cleared. (The ON/OFF state of the signal assigned to each terminal is determined by the settings in Pr.190 to Pr.196.) The settings in Pr.496 and Pr.497 are reset to "0".
- When Pr.495 = "1 or 11", the remote output data is stored in EEPROM before the inverter power is turned OFF. This means that the signal output setting after power restoration is the same as that before the power was turned OFF. However, when Pr.495 = "1", the data during an inverter reset (terminal reset or reset request via communication) is not saved.
- When Pr.495 = "10 or 11", the remote output data in the signal before the reset is stored even during an inverter reset.



* When **Pr.495** = "1", the signal condition saved in EEPROM (condition of the last power OFF) is applied.

- The output terminal to which the REM signal is not assigned by using Pr.190 to Pr.196 does not turn ON or OFF when "1 or 0" is set in bit corresponding to each of the terminals by using Pr.496 and Pr.497. (ON/OFF command affects only the terminal to which the REM signal is assigned.)
- When Pr.495 = "1 or 11" (remote output data retained at power OFF), take measures to keep the control circuit power ON, such as connecting terminal R1/L11 with terminal P/+ and connecting terminal S1/L21 with terminal N/- . If the control power is not retained, the output signal after the inverter power turns ON is not guaranteed to work. When the high power factor converter (FR-HC2) or the converter unit (FR-CC2) is connected to the inverter, assign the FR-HC2/FR-CC2 connection, instantaneous power failure detection (X11) signal to an input terminal and input the IPF signal from the FR-HC2/FR-CC2 to the inverter via the terminal to which the X11 signal is assigned.

K Parameters referred to

Pr.190 to Pr.196 (Output terminal function selection) F page 330

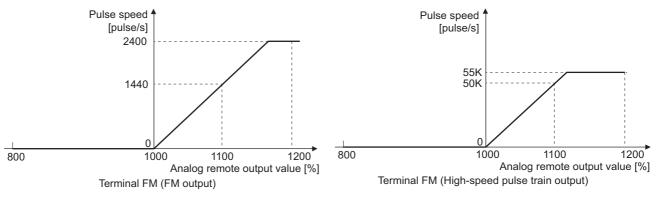
5.8.11 Analog remote output function

An analog value can be output via the analog output terminal on the inverter.

| Pr. | Name | Initial value | Setting range | Description | | | | | |
|-------------|------------------------------|--|------------------|---|---|--|---|------------------------------------|--|
| | | | 0 | Remote output data is cleared when the inverter power is turned OFF. | Remote output data is cleared | | | | |
| 655 | Analog remote output | 0 | 1 | Remote output data is retained even after the inverter power is turned OFF. | during an inverter reset. | | | | |
| M530 | selection | 0 | 10 | Remote output data is cleared when the inverter power is turned OFF. | Remote output data is | | | | |
| | | | 11 | | 11 ' | | Remote output data is retained even after the inverter power is turned OFF. | retained during an inverter reset. | |
| 656 M531 | Analog remote output 1 | alog remote output 1 1000% 800% to 1200% | | Value output via the terminal for which "87" is set in the terminal function selection parameter (Pr.54 or Pr.158) | | | | | |
| 657 M532 | Analog remote output 2 | 1000% | 800% to 1200% | Value output via the terminal for which "88" is set in the terminal function selection parameter (Pr.54 or Pr.158) | Set the analog value output via terminal FM or CA, via terminal AM, and via the | | | | |
| 658 M533 | Analog remote output 3 1000% | | 800% to 1200% | Value output via the terminal for which "89" is set in the terminal function selection parameter (Pr.54 or Pr.158) | analog output terminal on the option FR-A8AY. | | | | |
| 659 M534 | Analog remote output 4 | ote output 4 1000% 80 | | Value output via the terminal for which "90" is set in the terminal function selection parameter (Pr.54 or Pr.158) | | | | | |

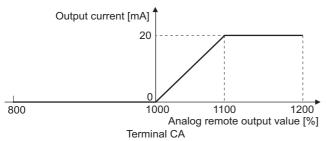
Analog remote output (Pr.656 to Pr.659)

- The analog signal of the value set in **Pr.656 to Pr.659 (Analog remote output)** can be output via terminal FM or CA, terminal AM and the analog output terminal on the option FR-A8AY.
- When **Pr.54 FM/CA terminal function selection** = "87, 88, 89, or 90" (Remote output value), the type FM inverter can output a pulse train via terminal FM.
- For FM output (when Pr.291 Pulse train I/O selection = "0 (initial value) or 1"): Terminal FM output [pulses/s] = 1440 [Hz] × (Analog remote output value - 1000)/100 Where the output range is 0 to 2400 pulses/s.
- For high-speed pulse output (when Pr.291 Pulse train I/O selection = "10, 11, 20, or 21"): Terminal FM output [pulses/s] = 50k [Hz] × (Analog remote output value - 1000)/100 Where the output range is 0 to 55k pulses/s.



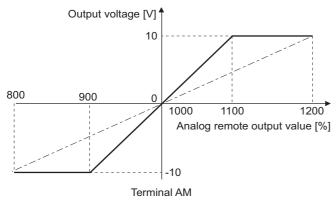
• When **Pr.54 FM/CA terminal function selection** = "87, 88, 89, or 90" (remote output), the type CA inverter can output any analog current via terminal CA.

• Terminal CA output [mA] = 20 [mA] × (Analog remote output value - 1000)/100 Where the output range is 0 to 20 mA.



- When Pr.158 AM terminal function selection = "87, 88, 89, or 90", an analog voltage can be output via terminal AM.
- Terminal AM output [V] = 10 [V] × (Analog remote output value 1000)/100

The output range is -10 to +10 V regardless of the Pr.290 Monitor negative output selection setting.



Analog remote output data retention (Pr.655)

- When the power supply is reset (including a power failure) while **Pr.655 Analog remote output selection** = "0" (initial value) or 10" and, the remote analog output (**Pr.656 to Pr.659**) returns to its initial value (1000%).
- When Pr.655 = "1 or 11", the remote output data is stored in EEPROM before the inverter power is turned OFF. This means that the signal output setting after power restoration is the same as that before the power was turned OFF. However, when Pr.655 = "1", the data during an inverter reset (terminal reset or reset request via communication) is not saved.
- When Pr.655 = "10 or 11", the remote output data in the signal before the reset is stored even during an inverter reset.
- When the setting in Pr.655 is changed, the remote analog output (Pr.656 to Pr.659) returns to its initial value (1000%).

ON/OFF example for positive logic Inverter reset time **Pr.655** = 0, 10 **Pr.655** = 1, 11 (about 1s) Power Power OFF OFF supply supply Analog Analog output output Analog output Analog Analog clear output output saved held Signal condition during a reset **Pr.655** = 0, 1 **Pr.655** = 10, 11 ON ON Reset Reset Analog Analog output output

* When Pr.655 = "1", the signal condition saved in EEPROM (condition of the last power OFF) is applied.



• When Pr.655 = "1 or 11" (remote output data retained at power OFF), take measures to keep the control circuit power ON, such as connecting terminal R1/L11 with terminal P/+ and connecting terminal S1/L21 with terminal N/- (while power is supplied via input terminals R/L1, S/L2 and T/L3). If the control power is not retained, the output signal after the inverter power turns ON is not guaranteed to work. When connecting the high power factor converter FR-HC2, assign the instantaneous power failure detection (X11) signal to an input terminal to input the IPF signal from the FR-HC2 to the terminal for X11 signal.

Parameters referred to

Pr.54 FM/CA terminal function selection ☞ page 314 Pr.158 AM terminal function selection ☞ page 314 Pr.290 Monitor negative output selection ☞ page 314 Pr.291 Pulse train I/O selection ☞ page 314

5.8.12 Fault code output selection

When a fault occurs, the corresponding data can be output as a 4-bit digital signal using via an open collector output terminal. The fault code can be read using an input module of programmable controller, etc.

| Pr. | Name | Initial value | Setting range | Description |
|------------|-----------------------------|---------------|---------------|---|
| 70 | | | 0 | Without fault code output |
| 76 M510 | Fault code output selection | 0 | 1 | With fault code output |
| more | | | 2 | Fault code is output only when a fault occurs |

• Fault codes can be output to the output terminals by setting Pr.76 Fault code output selection = "1 or 2".

- When the setting is "2", a fault code is only output when a fault occurs. In normal operation the terminal outputs the signal assigned in **Pr.191 to Pr.194 (output terminal function selection)**.
- The fault codes that can be output are shown in the following table. (0: Output transistor OFF, 1: Output transistor ON)

| Operation panel | | Output termi | nal operation | | Fault and a |
|--------------------------------|----|--------------|---------------|----|-------------|
| indication (FR-DU08) | SU | IPF | OL | FU | Fault code |
| Normal ^{*1} | 0 | 0 | 0 | 0 | 0 |
| E.OC1 | 0 | 0 | 0 | 1 | 1 |
| E.OC2 | 0 | 0 | 1 | 0 | 2 |
| E.OC3 | 0 | 0 | 1 | 1 | 3 |
| E.OV1 to E.OV3 | 0 | 1 | 0 | 0 | 4 |
| E.THM | 0 | 1 | 0 | 1 | 5 |
| E.THT | 0 | 1 | 1 | 0 | 6 |
| E.IPF | 0 | 1 | 1 | 1 | 7 |
| E.UVT | 1 | 0 | 0 | 0 | 8 |
| E.FIN | 1 | 0 | 0 | 1 | 9 |
| E.BE | 1 | 0 | 1 | 0 | A |
| E. GF | 1 | 0 | 1 | 1 | В |
| E.OHT | 1 | 1 | 0 | 0 | С |
| E.OLT | 1 | 1 | 0 | 1 | D |
| E.OPT E.OP1 | 1 | 1 | 1 | 0 | E |
| Terminals other than the above | 1 | 1 | 1 | 1 | F |

*1 When Pr.76 = "2", the terminal outputs the signal assigned by Pr.191 to Pr.194.

NOTE

• If an error occurs while **Pr.76** ≠ "0", the output terminals SU, IPF, OL, and FU output the signals in the table above regardless of the settings in **Pr.191 to Pr.194 (Output terminal function selection)**. Take caution when controlling the inverter with the output signals set by **Pr.191 to Pr.194**.

Parameters referred to

Pr.190 to Pr.196 (Output terminal function selection) 🖙 page 330

5.8.13 Pulse train output to announce cumulative output energy

Every time when the output energy cumulated from the time at power ON or at an inverter reset or when the setting of **Pr.799 Pulse increment setting for output power** has been changed increments by the set value, the Pulse train output of output power (Y79) signal is output in pulses.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|---|---------------|------------------|---|
| 799 M520 | Pulse increment setting for output power | 1 kWh | 10 kWh, 100 kWh, | The Pulse train output of output power (Y79) signal is output in pulses every time when the output energy increments by the set amount of energy (kWh). |

Pulse increment setting for output power (Y79 signal, Pr.799)

- Every time when the output energy cumulated from the time at power ON or at an inverter reset increments by the set value of **Pr.799 Pulse increment setting for output power**, the Pulse train output of output power (Y79) signal is output in pulses.
- The inverter does not stop cumulating (can continue to cumulate) the output energy even if the retry function or the automatic restart after instantaneous power failure function works because the cause of the function activation is a mini power failure which is too short to cause an inverter reset.
- If a power failure occurs, the cumulative value is reset to 0 kWh and restart cumulating.
- To use the Y79 signal, set "79 (positive logic) or 179 (negative logic)" in any parameter from **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function to the output terminal.

| Outpu | ut power | |
|--|--|------|
| 20kWh 10kWh Pulse output of output power (Y79) | OFF IN for 0.15s When Pr.799 = 10 | Time |
| | | |

- NOTE
 - Because the accumulated data in the inverter is cleared when control power is lost by power failure or at an inverter reset, the value on the monitor cannot be used to charge electricity bill.
 - Changing the terminal assignment using **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal. (Refer to page 330.)
 - Do not assign the signal to terminal ABC1 or terminal ABC2 whose pulse outputs are frequently turned ON/OFF. Otherwise, the life of the relay contact may be shortened.

Parameters referred to

Pr.190 to Pr.196 (Output terminal function selection) F page 330

5.8.14 Detection of control circuit temperature

The temperature of the control circuit board can be monitored, and a signal can be output according to a predetermined temperature setting.

| Pr. | Name | Initial value | Setting range | Description |
|------|-----------------------------|---------------|---------------|---|
| 663 | Control circuit temperature | 0°C | 0°C to 100°C | Set the temperature where the Y207 signal turns |
| M060 | signal output level | 00 | | ON. |

Control circuit temperature monitoring

- The temperature of the control circuit board can be monitored within the range of 0°C to 100°C on the operation panel, or via terminal FM/CA, or terminal AM. Refer to page 305 for information on how to select the monitor item.
- When **Pr.290 Monitor negative output selection** is set to enable display of the negative numbers for monitoring on the operation panel or via terminal AM, the range of monitoring is -20°C to 100°C.
- The monitor value is a rough approximation of the change in the surrounding air temperature of the inverter. Use this parameter to grasp the operating environment of the inverter.

Control circuit temperature detection (Pr.663, Y207 signal)

- The Y207 signal can be output when the control circuit temperature reaches the Pr.663 setting or higher.
- To use the Y207 signal, set "207 (positive logic) or 307 (negative logic)" in any parameter from **Pr.190 to Pr.196 (Output** terminal function selection) to assign the function to the output terminal.

- The Y207 signal is turned OFF when the control circuit temperature becomes 5°C or more lower than the **Pr.663** setting.
- Changing the terminal assignment using Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.54 FM/CA terminal function selection F page 314

- Pr.158 AM terminal function selection Page 314
- Pr.190 to Pr.196 (Output terminal function selection) > page 330
- Pr.290 Monitor negative output selection Frage 314

5.9 (T) Multi-function input terminal parameters

| Purpose | Pa | | Refer to page | |
|---|---|---|--|-----|
| To inverse the rotation direction with the voltage/current analog input selection (terminals 1, 2, and 4) | Analog input selection | P.T000, P.T001 | Pr.73, Pr.267 | 349 |
| To assign functions to analog input terminals | Terminal 1 and terminal 4 function assignment | P.T010, P.T040 | Pr.858, Pr.868 | 352 |
| To adjust the main speed by the analog auxiliary input | Analog auxiliary input and compensation (addition compensation and override functions) | P.T000, P.T021, P.T041, P.T050, P.T051 | Pr.73, Pr.242, Pr.243, Pr.252, Pr.253 | 353 |
| To eliminate noise on analog inputs | Analog input filter | P.T002, P.T003, P.T005, P.T007 | Pr.74, Pr.822, Pr.832, Pr.849 | 355 |
| To adjust analog input frequency/ voltage (current) (calibration) | Frequency setting voltage (current) bias and gain | P.T100 to P.T103, P.T200 to P.T203, P.T400 to P.T403, P.M043 | Pr.125, Pr.126, Pr.241, C2 to C7 (Pr.902 to Pr.905), C12 to C15 (Pr.917 to Pr.918) | 357 |
| To adjust voltage (current) of stall prevention operation level (calibration) | Bias and gain for voltage (current) setting of stall prevention operation level | P.T110 to P.T113, P.T410 to P.T413, P.M043 | Pr.241, C16 to C19 (Pr.919 to Pr.920), C38 to C41 (Pr.932 to Pr.933) | 363 |
| To continue operating at analog current input loss | 4 mA input check | P.T052 to P.T054 | Pr.573, Pr.777, Pr.778 | 369 |
| To assign functions to input terminals | Input terminal function selection | P.T700 to P.T711, P.T740 | Pr.178 to Pr.189, Pr.699 | 373 |
| | Output stop signal (MRS) input selection | P.T720 | Pr.17 | 375 |
| To change the input specification (NO/ NC contact) of input signals | Inverter run enable signal (X10) input selection | P.T721 | Pr.599 | 568 |
| | Power failure stop external signal (X48) input selection | P.T722 | Pr.606 | 478 |
| To enable the second function only during the constant speed | RT signal function validity condition selection | P.T730 | Pr.155 | 377 |
| To assign start and forward/reverse commands to different signals | Start signal (STF/STR) operation selection | P.G106 | Pr.250 | 563 |

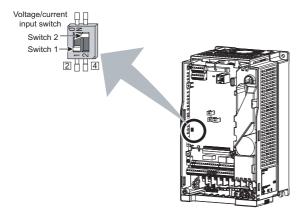
5.9.1 Analog input selection

The functions to switch the analog input terminal specifications, override function, forward/reverse rotation by the input signal polarity are selectable.

| Pr. | Name | Initial value | Setting range | | Description |
|-----------------------------|--|-------------------|---------------------|--|--|
| 73 | 73 | | 0 to 5, 10 to 15 | Switch 1 - OFF (initial status) | The terminal 2 input specification (0 to 5 V, 0 to 10 V, 0 to 20 mA) and terminal 1 input specification (0 |
| T000 Analog input selection | 1 | 6 to 7, 16, 17 | Switch 1 - ON | to ± 5 V, 0 to ± 10 V) are selectable. Also the override and reversible operation settings are selectable. | |
| 267 | 267 Terminal 4 input T001 selection | 0 | 0 | Switch 2 - ON (initial status) | Terminal 4 input, 4 to 20 mA |
| T001 | | | 1 | Switch 2 - OFF | Terminal 4 input, 0 to 5 V |
| | | | 2 | | Terminal 4 input, 0 to 10 V |

Analog input specification selection

• For terminals 2 and 4 used for analog input, the voltage input (0 to 5 V, 0 to 10 V) and current input (0 to 20 mA) are selectable. To change the input specification, change the setting of **Pr.73 (Pr.267)** and the voltage/current input selection switch (switch 1 or switch 2).



| Switch s | Switch state Input specification | | Input terminal | Rated specification | |
|----------|----------------------------------|--------------------------------|-------------------|---|---|
| Switch 1 | ON | Current input | Terminal 2 | For voltage input, the input resistance is 10 ±1 k Ω and the | |
| Switch | OFF | Voltage input (initial status) | | maximum permissible voltage is 20 VDC. | |
| Switch 2 | ON | Current input (initial status) | Tamainal A | | For current input, the input resistance is 245 $\pm 5 \Omega$ and the |
| Switch 2 | OFF Voltage input | | Terminal 4 | maximum permissible current is 30 mA. | |

- · Change the setting of the voltage/current input selection switch to change the rated specification of terminal 2 or 4.
- Set Pr.73 (Pr.267) and the voltage/current input selection switch according to the analog signal input. The incorrect
 settings shown in the following table cause a failure. The inverter does not operate properly with other incorrect settings.

| Setting causing a failure | | Operation | | |
|---------------------------|-----------------------|--|--|--|
| Switch setting | Terminal input | Operation | | |
| ON (Current input) | Voltage input | Causes an analog signal output circuit failure in an external device (due to increased loads on the signal output circuit of the external device). | | |
| OFF (Voltage input) | Current input | Causes an input circuit failure in the inverter (due to an increased output power in the analog signal output circuit of an external device). | | |

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- NOTE
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Check the number of the voltage/current input selection switch before setting, because it is different from the switch number indicated on the FR-F700(P) series inverter.

Set Pr.73 and the voltage/current input selection switch according to the following table.

| Pr.73 setting | Terminal 2 input | Switch 1 | Terminal 1 input | Compensation input terminal compensation method | Reversible polarity |
|-------------------|--------------------------|----------|--------------------------|---|---|
| 0 | 0 to 10 V ^{*1} | OFF | 0 to ±10 V | | |
| 1 (initial value) | 0 to 5 V ^{*1} | OFF | 0 to ±10 V | Terminal 1 addition | |
| 2 | 0 to 10 V ^{*1} | OFF | 0 to ±5 V | compensation | |
| 3 | 0 to 5 V ^{*1} | OFF | 0 to ±5 V | | Not applied (state in which a negative |
| 4 | 0 to 10 V | OFF | 0 to ±10 V ^{*1} | Terminal 2 override | polarity frequency command signal is not accepted) |
| 5 | 0 to 5 V | OFF | 0 to ±5 V ^{*1} | Terminal 2 Overnde | . , |
| 6 | 0 to 20 mA ^{*1} | ON | 0 to ±10 V | | |
| 7 | 0 to 20 mA ^{*1} | ON | 0 to ±5 V | | |
| 10 | 0 to 10 V ^{*1} | OFF | 0 to ±10 V | Terminal 1 addition | |
| 11 | 0 to 5 V ^{*1} | OFF | 0 to ±10 V | compensation | |
| 12 | 0 to 10 V ^{*1} | OFF | 0 to ±5 V | | |
| 13 | 0 to 5 V ^{*1} | OFF | 0 to ±5 V | | Applied |
| 14 | 0 to 10 V | OFF | 0 to ±10 V ^{*1} | | Applied |
| 15 | 0 to 5 V | OFF | 0 to ±5 V ^{*1} | Terminal 2 override | |
| 16 | 0 to 20 mA ^{*1} | ON | 0 to ±10 V | Terminal 1 addition | |
| 17 | 0 to 20 mA ^{*1} | ON | 0 to ±5 V | compensation | |

*1 The main speed setting is indicated.

- When the Terminal 4 input selection (AU) signal is turned ON, terminal 4 is used to set the main speed. In this case, terminals 1 and 2 are not used to set the main speed.
- · Set Pr.267 and the voltage/current input selection switch according to the following table.

| Pr.267 setting | Terminal 4 input | Switch 2 |
|-------------------|------------------|----------|
| 0 (initial value) | 4 to 20 mA | ON |
| 1 | 0 to 5 V | OFF |
| 2 | 0 to 10 V | OFF |

- NOTE

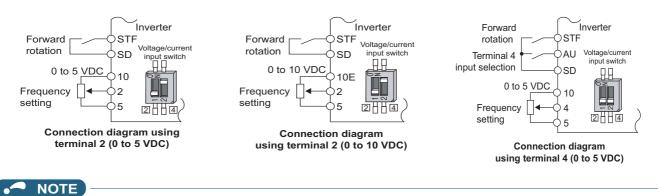
- To enable terminal 4, turn ON the AU signal.
- Set the parameters and the switch settings so that they agree. Incorrect setting may cause a fault, failure, or malfunction.
- The frequency setting auxiliary input through terminal 1 is added to the main speed setting signal input through terminal 2 or 4.
- When the override setting is selected, terminal 1 or 4 is set to the main speed setting, and terminal 2 is set to the override signal (0 to 5 V or 0 to 10 V, and 50% to 150%). (If the main speed signal is not input through terminal 1 or 4, the compensation by terminal 2 is disabled.)
- Use **Pr.125** (**Pr.126**) (frequency setting gain) to change the maximum output frequency at the input of the maximum output frequency command voltage (current). At this time, the command voltage (current) need not be input. Also, the acceleration/ deceleration time, which is a slope up/down to the acceleration/deceleration reference frequency, is not affected by the change in **Pr.73** setting.
- When "4" is set in **Pr.858 Terminal 4 function assignment (Pr.868 Terminal 1 function assignment)**, the stall prevention operation level is input through terminal 1 (4). To input frequency through terminal 1 (4), set "0 (initial value)" in **Pr.858 (Pr.868)**.
- Always calibrate the input after changing the voltage/current input signal with **Pr.73 (Pr.267)** and the voltage/current input selection switch.
- When Pr.561 PTC thermistor protection level ≠ "9999", terminal 2 is not used for the analog frequency command.

Running with analog input voltage

- For the frequency setting signal, input 0 to 5 VDC (or 0 to 10 VDC) between terminals 2 and 5. The 5 V (10 V) input is the maximum output frequency.
- The power supply 5 V (10 V) can be input by either using the internal power supply or preparing an external power supply. The internal power supply is 5 VDC output between terminals 10 and 5, and 10 VDC output between terminals 10E and 5.

| Terminal | Inverter internal power source voltage | Frequency setting resolution | Pr.73 (terminal 2 input voltage) |
|----------|--|------------------------------|----------------------------------|
| 10 | 5 VDC | 0.030/60 Hz | 0 to 5 VDC input |
| 10E | 10 VDC | 0.015/60 Hz | 0 to 10 VDC input |

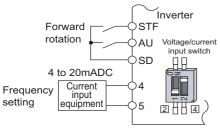
- To supply the 10 VDC input to terminal 2, set "0, 2, 4, 10, 12, or 14" in Pr.73. (The initial value is 0 to 5 V.)
- Set "1 (0 to 5 VDC)" or "2 (0 to 10 VDC)" in Pr.267 and turn OFF the voltage/current input selection switch to input voltage through terminal 4. Turning ON the AU signal activates the terminal 4 input.



• The wiring length of terminal 10, 2, and 5 should be 30 m at maximum.

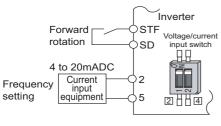
Running with analog input current

- For constant pressure or temperature control with fans, pumps, or other devices, automatic operation is available by setting the regulator output signal 4 to 20 mADC to between terminals 4 and 5.
- To use terminal 4, the AU signal needs to be turned ON.



Connection diagram using terminal 4 (4 to 20mADC)

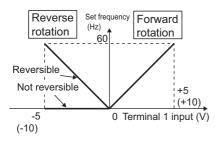
 Set "6, 7, 16, or 17" in Pr.73 and turn ON the voltage/current input selection switch to input current through terminal 2. In this case, the AU signal does not need to be turned ON.



Connection diagram using terminal 2 (4 to 20mADC)

Performing forward/reverse rotation with the analog input (polarity reversible operation)

- Setting "10 to 17" in Pr.73 enables the polarity reversible operation.
- Set a positive or negative input (0 to ±5 V or 0 to ±10 V) to terminal 1 to allow the operation of forward/reverse rotation according to the polarity of the input value.



Compensation input characteristics when STF is ON

Parameters referred to

Pr.22 Stall prevention operation level 3 page 290

Pr.125 Terminal 2 frequency setting gain frequency, Pr.126 Terminal 4 frequency setting gain frequency 🗊 page 357

Pr.252, Pr.253 Override bias/gain Pr.252, Pr.253 Override bias/gain Pr.252 Pr.253 Pr.2561 PTC thermistor protection level Page 266

Pr.858 Terminal 4 function assignment, Pr.868 Terminal 1 function assignment 3 page 352

5.9.2 Analog input terminal (terminal 1, 4) function assignment

The analog input terminal 1 and terminal 4 functions are set and changeable with parameters.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|-----------------------------------|---------------|---------------|---|
| 868 T010 | Terminal 1 function assignment | 0 | 0, 4, 9999 | Select the terminal 1 function. (Refer to the following table.) |
| 858 T040 | Terminal 4 function assignment | 0 | 0, 4, 9999 | Select the terminal 4 function. (Refer to the following table.) |

• The frequency (speed) command, stall prevention level, and auxiliary frequency setting are selectable for terminals 1 and 4 used for analog input.

The functions available are different depending on the settings in **Pr.868 Terminal 1 function assignment** and **Pr.858 Terminal 4 function assignment** as shown in the following table.

| Setting value | Terminal 1 function (Pr.868) | Terminal 4 function (Pr.858) |
|-------------------|--|--|
| 0 (initial value) | Auxiliary frequency setting | Frequency command (AU signal-ON) |
| 4 | Stall prevention operation level input | Stall prevention operation level input ^{*1} |
| 9999 | — | — |

-: No function

*1 Invalid when **Pr.868** = "4".



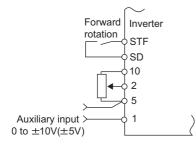
• When Pr.868 = "4" (stall prevention), the terminal 4 function is enabled regardless of the ON/OFF state of the AU signal.

5.9.3 Analog input compensation

The analog input for multi-speed operation or speed setting (main speed) through terminal 2 or 4 can be compensated by adding an input, or terminal 2 can be used for an auxiliary input to compensate the analog input at a fixed ratio using the override function.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|---|---------------|--------------------------------|---|
| 73 | Analog input selection | 1 | 0 to 3, 6, 7, 10 to 13, 16, 17 | Compensation by addition |
| т000 | Analog input selection | | 4, 5, 14, 15 | Compensation using the override function |
| 242 T021 | Terminal 1 added compensation amount (terminal 2) | 100% | 0% to 100% | Set the percentage of addition when terminal 2 is used to set the main speed. |
| 243 T041 | Terminal 1 added compensation amount (terminal 4) | 75% | 0% to 100% | Set the percentage of addition when terminal 4 is used to set the main speed. |
| 252 T050 | Override bias | 50% | 0% to 200% | Set bias compensation for the override function. |
| 253 T051 | Override gain | 150% | 0% to 200% | Set gain compensation for the override function. |

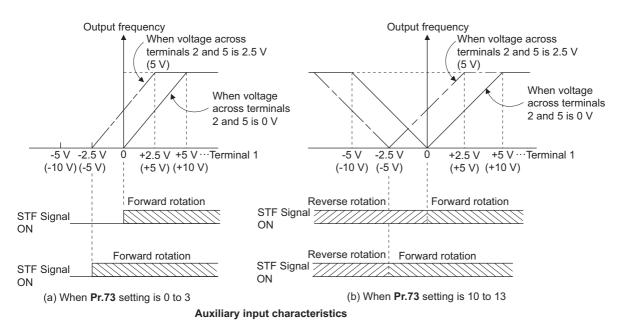
Compensation by addition (Pr.242, Pr.243)



Example of addition compensation connection

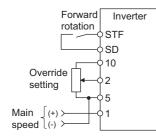
- A compensation signal can be added to the main speed setting for such as synchronous or continuous speed control operation.
- Set "0 to 3, 6, 7, 10 to 13, 16, or 17" in **Pr.73** to add the voltage determined by the terminal 1 input when the main speed setting is input through terminal 2.
- When a negative voltage obtained from the addition, it is regarded as 0 and the operation is stopped when **Pr.73** = "0 to 3, 6, or 7", and the operation is reversed (polarity reversible operation) after the STF signal is turned ON when **Pr.73** = "10 to 13, 16, or 17".
- The terminal 1 compensation input can be added to the multi-speed setting or terminal 4 (initial value: 4 to 20 mA).
- The degree of addition to terminal 2 is adjustable with **Pr.242** and the degree of addition to terminal 4 is adjustable with **Pr.243**.

| Analog command value with use of terminal 2 = terminal 2 input + terminal 1 input × - | Pr.242 | |
|---|--------|--|
| Analog command value with use of terminal 2 – terminal 2 input + terminal 1 input × – | 100(%) | |
| Analog command value with use of terminal 4= terminal 4 input + terminal 1 input × - | Pr.243 | |
| | 100(%) | |



After changing the **Pr.73** setting, check the setting of the voltage/current input selection switch. Incorrect setting may cause a fault, failure, or malfunction. (Refer to page 349 for the setting.)

Override function (Pr.252, Pr.253)

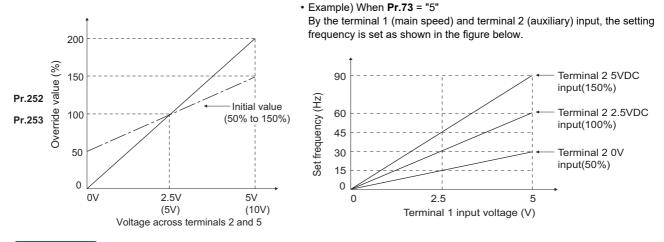


Connection example for the override function

- Use the override function to make the main speed changed at a specified rate.
- Set "4, 5, 14, or 15" in **Pr.73** to select the override function.
- When the override function is selected, terminal 1 or 4 is used for the main speed setting, and terminal 2 is used for the override signal. (If the main speed signal is not input through terminal 1 or 4, the compensation by terminal 2 is disabled.)
- Specify the scope of override by using Pr.252 and Pr.253.
- How to calculate the set frequency when the override function is used: Main speed setting frequency (Hz): Terminals 1 or 4 input, multi-speed setting Compensation (%): Terminal 2 input

Set frequency (Hz) = Main speed setting frequency (Hz) × $\frac{\text{Compensation (%)}}{(42)^{10}}$

100(%)



- To use terminal 4, the AU signal needs to be turned ON.
- To make compensation input for multi-speed operation or remote setting, set Pr.28 Multi-speed input compensation selection = "1" (with compensation) (initial value "0").
- After changing the **Pr.73** setting, check the setting of the voltage/current input selection switch. Incorrect setting may cause a fault, failure, or malfunction. (Refer to page 349 for the setting.)

A Parameters referred to

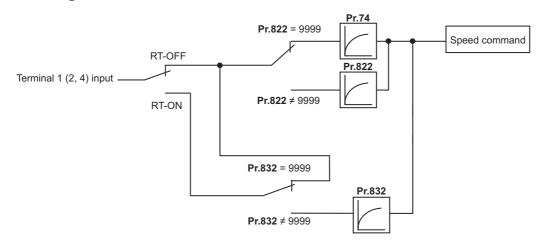
Pr.28 Multi-speed input compensation selection 🖙 page 263 Pr.73 Analog input selection 🖙 page 349

5.9.4 Response level of analog input and noise elimination

The response level and stability of frequency command using the analog input signal (terminal 1, 2, or 4) can be adjusted.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|-----------------------------------|---------------|----------------|--|
| 74 T002 | Input filter time constant | 1 | 0 to 8 | Set the primary delay filter time constant to the analog input command. If the setting is too large, response becomes slow. |
| 822 T003 | Speed setting filter 1 | 9999 | 0 to 5 s | Set the primary delay filter time constant to the external speed command (analog input command). |
| 1003 | | | 9999 | As set in Pr.74 . |
| 832 T005 | Speed setting filter 2 | 9999 | 0 to 5 s, 9999 | Second function of Pr.822 (enabled when the RT signal is ON) |
| 849 T007 | Analog input offset adjustment | 100% | 0% to 200% | Set offset for the analog speed input (terminal 2). The motor is prevented from rotating due to noise in the analog input or other factors when a zero speed command is given. |

Block diagram



Analog input time constant (Pr.74)

- · Use this parameter to eliminate noise on the frequency setting circuit.
- Increase the filter time constant if the operation is unstable due to noise or other factors.
- If the setting is too large, response becomes slow. (The time constant can be between 0 and 8, which are about 2 ms to 1 s.)

Analog speed command input time constant (Pr.822, Pr.832)

- Use **Pr.822 Speed setting filter 1** to set the primary delay filter time constant to the external speed command (analog input command). Increase the setting of the time constant to allow delays in follow-up of the speed command or when the analog input voltage is unstable.
- Use **Pr.832 Speed setting filter 2** to change the time constant to use one inverter to switch operation between two or more motors.
- Pr.832 Speed setting filter 2 is enabled when the RT signal is ON.

Analog speed command input offset adjustment (Pr.849)

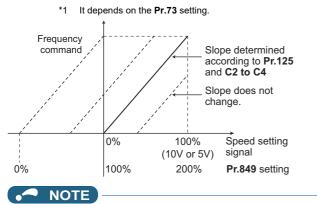
- Use this parameter to set a range in which the motor is stopped for prevention of incorrect motor operation in a very low speed rotation when the speed command is an analog input.
- The voltage range is offset according to the setting in Pr.849 Analog input offset adjustment, assuming that 100% corresponds to zero.

100% < Pr.849 Positive side

100% > Pr.849 Negative side

The detailed calculation of the offset voltage is as described below:

Offset voltage [V] = Voltage at the time of 100% (5 V or 10 V^{*1}) × (**Pr.849** - 100) / 100



• The analog input filter is invalid (no filter) during PID control operation.

Parameters referred to

Pr.73 Analog input selection 🖙 page 349

Pr.125, C2 to C4 (bias and gain of the terminal 2 frequency setting) 🖙 page 357

5.9.5 Frequency setting voltage (current) bias and gain

The magnitude (slope) of the output frequency can be set as desired in relation to the frequency setting signal (0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mA). Use **Pr.73 Analog input selection (Pr.267 Terminal 4 input selection)** and the voltage/current input selection switch to switch among input of 0 to 5 VDC, 0 to 10 V, and 4 to 20 mA. (Refer to page 349.)

| Pr. Name | | Initial value | | Setting | Description | |
|---|--|---------------|-------|---------------|--|---|
| F1. | Name | FM | CA | range | Decemption | |
| C2 (902) T200 ^{*1} | Terminal 2 frequency setting bias frequency | 0 Hz | | 0 to 590 Hz | Set the bias frequency | for the terminal 2 input. |
| C3 (902) T201 ^{*1} | Terminal 2 frequency setting bias | 0% | | 0% to 300% | Set the converted % of 2 input. | the bias voltage (current) for the terminal |
| 125 (903) T202 T022 ^{*1} | Terminal 2 frequency setting gain frequency | 60 Hz | 50 Hz | 0 to 590 Hz | Set the gain (maximum) frequency for the terminal 2 input. | |
| C4 (903) T203 ^{*1} | Terminal 2 frequency setting gain | 100% | | 0% to 300% | Set the converted % of 2 input. | the gain voltage (current) for the terminal |
| C5 (904) T400 ^{*1} | Terminal 4 frequency setting bias frequency | 0 Hz | | 0 to 590 Hz | Set the bias frequency | for the terminal 4 input. |
| C6 (904) T401 ^{*1} | Terminal 4 frequency setting bias | 20% | | 0% to 300% | Set the converted % of the bias current (voltage) for the terminal 4 input. | |
| 126 (905) T402 T042 ^{*1} | Terminal 4 frequency setting gain frequency | 60 Hz | 50 Hz | 0 to 590 Hz | z Set the gain (maximum) frequency for the terminal 4 input. | |
| C7 (905) T403 ^{*1} | Terminal 4 frequency setting gain | 100% | | 0% to 300% | Set the converted % of the gain current (voltage) for the terminal 4 input. | |
| C12 (917) T100 ^{*1} | Terminal 1 bias frequency (speed) | 0 Hz | | 0 to 590 Hz | Z Set the bias frequency (speed) for the terminal 1 input. (Speed limit) | |
| C13 (917) T101 ^{*1} | Terminal 1 bias (speed) | 0% | | 0% to 300% | Set the converted % of the bias voltage for the terminal 1 input. (Speed limit) | |
| C14 (918) T102 ^{*1} | Terminal 1 gain frequency (speed) | 60 Hz | 50 Hz | 0 to 590 Hz | z Set the gain (maximum) frequency (speed) for the terminal 1 input. (Speed limit) | |
| C15 (918) T103 ^{*1} | Terminal 1 gain (speed) | 100% | | 0% to 300% | Set the converted % of the gain voltage for the terminal 1 input. (Speed limit) | |
| 241 M043 | Analog input display unit switchover | 0 | | 0 1 | % display Select the unit for analog input display. V/mA display Select the unit for analog input display. | |

*1 The parameter number in parentheses is the one for use with the LCD operation panel and the parameter unit.

Relationship between the analog input terminal function and the calibration parameter

· Calibration parameter according to the terminal 1 function

| Pr.868 | Terminal function | Calibration parameter | | | |
|----------------------|--|--|--|--|--|
| setting | reminariunction | Bias setting | Gain setting | | |
| 0 (initial value) | Auxiliary Frequency (speed) setting | C2 (Pr.902) Terminal 2 frequency setting bias frequency C3 (Pr.902) Terminal 2 frequency setting bias C5 (Pr.904) Terminal 4 frequency setting bias frequency C6 (Pr.904) Terminal 4 frequency setting bias | Pr.125 Terminal 2 frequency setting gain frequency C4 (Pr.903) Terminal 2 frequency setting gain Pr.126 Terminal 4 frequency setting gain frequency C7 (Pr.905) Terminal 4 frequency setting gain | | |
| 4 | Stall prevention operation level ^{*1} | C16 (Pr.919) Terminal 1 bias command (torque) C17 (Pr.919) Terminal 1 bias (torque) | C18 (Pr.920) Terminal 1 gain command (torque) C19 (Pr.920) Terminal 1 gain (torque) | | |
| 9999 | No function | — | — | | |

· Calibration parameter according to the terminal 4 function

| Pr.858 | Terminal function | Calibration parameter | | | |
|----------------------|--|--|--|--|--|
| setting | | Bias setting | Gain setting | | |
| 0 (initial value) | Frequency command | C5 (Pr.904) Terminal 4 frequency setting bias frequency C6 (Pr.904) Terminal 4 frequency setting bias | Pr.126 Terminal 4 frequency setting gain frequency C7 (Pr.905) Terminal 4 frequency setting gain | | |
| 4 | Stall prevention operation level ^{*1} | C38 (Pr.932) Terminal 4 bias command (torque) C39 (Pr.932) Terminal 4 bias (torque) | C40 (Pr.933) Terminal 4 gain command (torque) C41 (Pr.933) Terminal 4 gain (torque) | | |
| 9999 | No function | — | — | | |

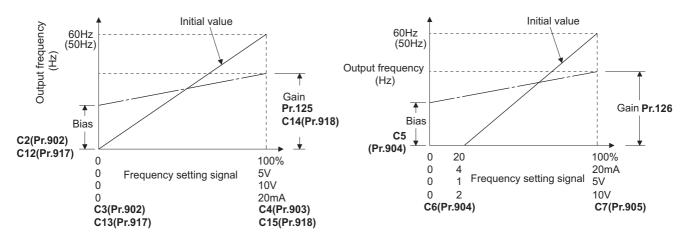
*1 Use Pr.148 Stall prevention level at 0 V input and Pr.149 Stall prevention level at 10 V input to adjust bias and gain for setting the stall prevention operation level under V/F control and Advanced magnetic flux vector control.

Changing the frequency for the maximum analog input (Pr.125, Pr.126)

Use Pr.125 (Pr.126) to change the frequency setting (gain) for the maximum analog input voltage (current).
 (C2 (Pr.902) to C7 (Pr.905) settings do not need to be changed.)

Analog input bias/gain calibration (C2 (Pr.902) to C7 (Pr.905), C12 (Pr.917) to C15 (Pr.918))

- The "bias" and "gain" functions serve to adjust the relationship between a setting input signal and the output frequency. A setting input signal is such as a 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mADC signal externally input to set the output frequency.
- Set the bias frequency of the terminal 2 input using C2 (Pr.902). (It is initially set to the frequency at 0 V.)
- Use Pr.125 to set the output frequency to the frequency command voltage (current) set by Pr.73 Analog input selection.
- Set the bias frequency of the terminal 1 input using C12 (Pr.917). (It is initially set to the frequency at 0 V.)
- Set the gain frequency of the terminal 1 input using C14 (Pr.918). (It is initially set to the frequency at 10 V.)
- Set the bias frequency of the terminal 4 input using C5 (Pr.904). (It is initially set to the frequency at 4 mA.)
- Use Pr.126 to set the output frequency to the 20 mA input of the frequency command current (4 to 20 mA).



There are three methods to adjust the bias/gain frequency setting voltage (current).
 Adjustment by applying voltage (current) between terminals 2 and 5 (4 and 5) to set the voltage (current) at the bias/gain

frequency. 🖙 page 360

Adjustment by selecting the voltage (current) at the bias/gain frequency without applying voltage (current) between terminals 2 and 5 (4 and 5). Figure 361

Adjustment by changing the frequency without adjusting the voltage (current). Frequency adjusted adjusting the voltage (current).



- When the slope of the frequency is changed after calibration of terminal 2, the slope of the frequency is also changed for terminal 1.
- When voltage is applied to terminal 1 while calibration of terminal 2 or terminal 4 is in progress, the terminal 1 input value is added to the terminal 2 (4) input value.
- Always calibrate the input after changing the voltage/current input signal with **Pr.73 (Pr.267)** and the voltage/current input selection switch.

Display unit changing for analog input (Pr.241)

- The analog input display unit (%/V/mA) can be changed for analog input bias/gain calibration.
- Depending on the terminal input specification setting of **Pr.73 (Pr.267)** and the voltage/current input switch, the unit of the displayed value of **C3 (Pr.902)**, **C4 (Pr.903)**, **C6 (Pr.904)** and **C7 (Pr.905)** changes as follows:

| Analog command (via terminal 2 or 4) (depending on the settings of Pr.73 (Pr.267) and the voltage/current input selection switch) | Pr.241 = 0 (initial value) | Pr.241 = 1 |
|--|----------------------------|----------------------|
| 0 to 5 V input | 0% to 100% (0.1%) | 0 to 5 V (0.01 V) |
| 0 to 10 V input | 0% to 100% (0.1%) | 0 to 10 V (0.01 V) |
| 0 to 20 mA input | 0% to 100% (0.1%) | 0 to 20 mA (0.01 mA) |

When voltage is applied to terminal 1 while the terminal 1 input specification (0 to ±5 V, 0 to ±10 V) does not agree with the main speed (terminal 2 or terminal 4 input) specification (0 to 5 V, 0 to 10 V, 0 to 20 mA), the analog input is not correctly displayed. (For example, when 0 V is applied to terminal 2 and 10 V is applied to terminal 1 in the initial status, the value is indicated as 5 V (100%).)

Set "0 (initial value)" in Pr.241 to use the % display.

Frequency setting voltage (current) bias/gain adjustment method

Adjustment by applying voltage (current) between terminals 2 and 5 (4 and 5) to set the voltage (current) at the bias/gain frequency (Example of adjustment at the gain frequency)

Operating procedure

| 1. | Turning ON the power of the inverter |
|----|---|
| | The operation panel is in the monitor mode. |

2. Changing the operation mode

Press $\left[\frac{PU}{EXT}\right]$ to choose the PU operation mode. The [PU] indicator turns ON.

3. Selecting the parameter setting mode

Press MODE to choose the parameter setting mode. (The parameter number read previously appears.)

4. Calibration parameter selection

Turn 🚱 until "[. . . . " appears. Press SET to display "[-----".

5. Selecting a parameter

"[

"," (C7 (Pr.905) Terminal 4 frequency setting gain) for terminal 4.

6. Analog voltage (current) display

Press SET to display the analog voltage (current) value (%) currently applied to terminal 2 (4).

Do not touch 💮 until calibration is completed.

7. Voltage (current) application

Apply a 5 V (20 mA). (Turn the external potentiometer connected between terminals 2 and 5 (terminals 4 and 5) to a desired position.)

8. Setting completed

Press **SET** to confirm the selection. The analog voltage (current) % and "**C 4** (**C 7**)" are displayed alternately.

- Turn 🖾 to read another parameter.
- Press SET to return to the "[-- -- -- " display.
- Press SET twice to show the next parameter.

■ Adjustment by selecting the voltage (current) at the bias/gain frequency without applying voltage (current) between terminals 2 and 5 (4 and 5) (Example of adjustment at the gain frequency)

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- **2.** Changing the operation mode

Press $\left\| \frac{PU}{EXT} \right\|$ to choose the PU operation mode. The [PU] indicator turns ON.

3. Selecting the parameter setting mode

Press MODE to choose the parameter setting mode. (The parameter number read previously appears.)

4. Calibration parameter selection

Turn 🕄 until "[_____ " appears. Press SET to display "[_ - - - - ".

5. Selecting a parameter

Turn 😳 until "[너" (C4 (Pr.903) Terminal 2 frequency setting gain) appears for terminal 2, or "[기" (C7 (Pr.905) Terminal 4 frequency setting gain) for terminal 4.

6. Analog voltage (current) display

Press SET to display the analog voltage (current) value (%) currently applied to terminal 2 (4).

7. Analog voltage (current) adjustment

When 🔀 is turned, the gain voltage (current) value (%) currently set to the parameter appears.

Turn 💭 until the desired gain voltage (current) value (%) appears.

8. Setting completed

Press set to confirm the selection. The analog voltage (current) % and " (', ', ')" are displayed alternately.

- Turn 🖾 to read another parameter.
- Press SET to return to the "[- - " display.
- Press SET twice to show the next parameter.

• Press 🚱 after step 6 to check the present bias/gain frequency setting. The setting cannot be checked after step 7.

■ Adjustment by changing the frequency without adjusting the voltage (current) (Example of changing the gain frequency from 60 Hz to 50 Hz)

Operating procedure

1. Selecting the parameter

Turn 💮 until "P | 25" (Pr.125) appears for terminal 2, or "P | 26" (Pr.126) for terminal 4.

Press SET to read the present set value. (60.00 Hz)

2. Changing the maximum frequency

Turn (\bigcirc) to change the set value to " $\subseteq \square \square \square$ ". (50.00 Hz)

Press SET to confirm the selection. " $\subseteq \square \square \square$ " and " $P : I \supseteq \subseteq (P : I \supseteq \subseteq)$ " are displayed alternately.

3. Selecting the mode and the monitor item

Press MODE three times to select the monitor mode, and change the monitor item to the frequency.

4. Start

Turn ON the start switch (STF/STR signal), and turn the frequency setting potentiometer clockwise slowly to full. (Refer to steps 2 and 3 in page 131.)

The motor is operated at 50 Hz.

NOTE

- If the frequency meter (display meter) connected between terminal FM and SD (CA and 5) does not indicate exactly 60 Hz, set the calibration parameter C0 FM/CA terminal calibration. (Refer to page 319.)
- If the voltage (current) values at the gain and bias frequencies are too close to each other, an error " E] " may be indicated.
- Changing C4 (Pr.903) or C7 (Pr.905) (gain adjustment) will not change Pr.20.
- Input to terminal 1 (frequency setting auxiliary input) is added to the frequency setting signal.
- For operation outline of the parameter unit (FR-PU07), refer to the Instruction Manual of the FR-PU07.
- To set the value to 120 Hz or higher, the Pr.18 High speed maximum frequency needs to be 120 Hz or higher. (Refer to page 287.)
- Use the calibration parameter C2 (Pr.902) or C5 (Pr.904) to set the bias frequency. (Refer to page 358.)

∕ CAUTION

Be cautious when setting any value other than "0" as the bias frequency at 0 V (0 mA). Even if a speed command is not given, simply turning ON the start signal will start the motor at the preset frequency.

Parameters referred to

- Pr.1 Maximum frequency, Pr.18 High speed maximum frequency 37 page 287
- Pr.20 Acceleration/deceleration reference frequency ☞ page 228 Pr.73 Analog input selection, Pr.267 Terminal 4 input selection ☞ page 349
- Pr.79 Operation mode selection 🖅 page

Pr.858 Terminal 4 function assignment, Pr.868 Terminal 1 function assignment 32 page 352

5.9.6 Bias and gain for voltage (current) setting of stall prevention operation level

PM

The magnitude (slope) of the stall prevention operation level can be set as desired in relation to the analog signal (0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mA).

Use **Pr.73 Analog input selection** or **Pr.267 Terminal 4 input selection** to switch among input 0 to 5 VDC, 0 to 10 VDC, and 4 to 20 mA. (Refer to page 349.)

| Pr. | Name | Initial value | Setting range | Des | cription | |
|---------------------------------|-------------------------------------|---------------|---------------|---|----------------------------------|--|
| C16 (919) ^{*1} T110 | Terminal 1 bias command (torque) | 0% | 0% to 400% | Set the bias stall prevent terminal 1 input. | ion operation level for the | |
| C17 (919) ^{*1} T111 | Terminal 1 bias (torque) | 0% | 0% to 300% | Set the converted % of the 1 input. | e bias voltage for the terminal | |
| C18 (920) ^{*1} T112 | Terminal 1 gain command (torque) | 150% | 0% to 400% | Set the gain (maximum) s for the terminal 1 input. | tall prevention operation level | |
| C19 (920) ^{*1} T113 | Terminal 1 gain (torque) | 100% | 0% to 300% | Set the converted % of the gain voltage for the terminal 1 input. | | |
| C38 (932) ^{*1} T410 | Terminal 4 bias command (torque) | 0% | 0% to 400% | Set the bias stall prevention operation level for the terminal 4 input. | | |
| C39 (932) ^{*1} T411 | Terminal 4 bias (torque) | 20% | 0% to 300% | Set the converted % of the bias current (voltage) for the terminal 4 input. | | |
| C40 (933) ^{*1} T412 | Terminal 4 gain command (torque) | 150% | 0% to 400% | Set the gain (maximum) stall prevention operation level for the terminal 4 input. | | |
| C41 (933) ^{*1} T413 | Terminal 4 gain (torque) | 100% | 0% to 300% | Set the converted % of the terminal 4 input. | e gain current (voltage) for the | |
| 241 | Analog input display unit | 0 | 0 | % display | Select the unit for analog | |
| M043 | switchover | 0 | 1 | V/mA display | input display. | |

*1 The parameter number in parentheses is the one for use with the LCD operation panel and the parameter unit.

Changing the function of analog input terminal

• In the initial setting, terminal 1 is used for analog input of the auxiliary speed setting (auxiliary speed limit), and terminal 4 is used for the speed command.

To use the analog input terminal to input the stall prevention operation level, set **Pr.868 Terminal 1 function assignment** and **Pr.858 Terminal 4 function assignment** to change the function. (Refer to page 352.)

Relationship between the analog input terminal function and the calibration parameter

· Calibration parameter according to the terminal 1 function

| Pr.868 | Terminal function | Calibration parameter | | | |
|----------------------|--|--|--|--|--|
| setting | renniaruncuon | Bias setting | Gain setting | | |
| 0 (initial value) | Auxiliary Frequency (speed) setting | C2 (Pr.902) Terminal 2 frequency setting bias frequency C3 (Pr.902) Terminal 2 frequency setting bias C5 (Pr.904) Terminal 4 frequency setting bias frequency C6 (Pr.904) Terminal 4 frequency setting bias | Pr.125 Terminal 2 frequency setting gain frequency C4 (Pr.903) Terminal 2 frequency setting gain Pr.126 Terminal 4 frequency setting gain frequency C7 (Pr.905) Terminal 4 frequency setting gain | | |
| 4 | Stall prevention operation level ^{*1} | C16 (Pr.919) Terminal 1 bias command (torque) C17 (Pr.919) Terminal 1 bias (torque) | C18 (Pr.920) Terminal 1 gain command (torque) C19 (Pr.920) Terminal 1 gain (torque) | | |
| 9999 | No function | _ | _ | | |

*1 Use **Pr.148 Stall prevention level at 0 V input** and **Pr.149 Stall prevention level at 10 V input** to adjust bias and gain for setting the stall prevention operation level under V/F control and Advanced magnetic flux vector control.

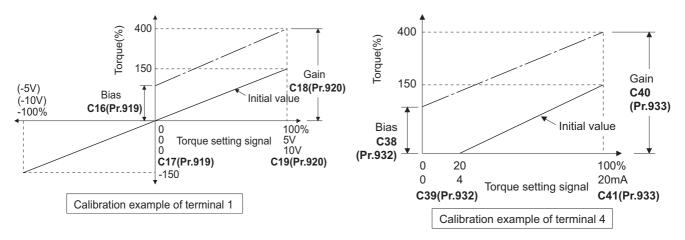
· Calibration parameter according to the terminal 4 function

| Pr.858 | Terminal function | Calibration parameter | | | |
|----------------------|--|--|--|--|--|
| setting | Terminal function | Bias setting | Gain setting | | |
| 0 (initial value) | Frequency (speed) command | C5 (Pr.904) Terminal 4 frequency setting bias frequency C6 (Pr.904) Terminal 4 frequency setting bias | Pr.126 Terminal 4 frequency setting gain frequency C7 (Pr.905) Terminal 4 frequency setting gain | | |
| 4 | Stall prevention operation level ^{*2} | C38 (Pr.932) Terminal 4 bias command (torque) C39 (Pr.932) Terminal 4 bias (torque) | C40 (Pr.933) Terminal 4 gain command (torque) C41 (Pr.933) Terminal 4 gain (torque) | | |
| 9999 | No function | — | — | | |

*2 Use Pr.148 Stall prevention level at 0 V input and Pr.149 Stall prevention level at 10 V input to adjust bias and gain for setting the stall prevention operation level under V/F control and Advanced magnetic flux vector control.

Changing the torque for the maximum analog input (C18 (Pr.920), C40 (Pr.933))

- Use C18 (Pr.920) or C40 (Pr.933) to change the stall prevention operation level setting (gain) of the maximum analog input voltage (current).
- Analog input bias/gain calibration (C16 (Pr.919) to C19 (Pr.920), C38 (Pr.932) to C41 (Pr.933))
- "Bias"/"gain" function can adjust the relation between the stall prevention operation level and the setting input signal. Examples of setting input signals are 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mADC, and they are externally input.
- Set the bias value of the terminal 1 input using C16 (Pr.919). (Shipped from factory with the stall prevention operation level for 0 V)
- Use C18 (Pr.920) to set the stall prevention operation level against the input voltage set by Pr.73 Analog input selection. (The initial value is 10 V.)
- Set the bias value of the terminal 4 input using C38 (Pr.932). (The initial value is the stall prevention operation level for 4 mA.)
- Use C40 (Pr.933) to set the stall prevention operation level against the 20 mA input of the input current (4 to 20 mA).



*1 If a negative command is given, the stall prevention operation level is regarded as "0".

There are three methods to adjust the bias/gain for voltage (current) setting.

Adjustment by applying voltage (current) between terminals 1 and 5 (4 and 5) to set the voltage (current) at the bias/gain level. Set page 366

Adjustment by selecting the voltage (current) at the bias/gain level without applying voltage (current) between terminals 1 and 5 (4 and 5). Figure 367

Adjustment by changing the stall prevention operation level only without adjusting the voltage (current). Figure 368

• NOTE

• Always calibrate the input after changing the voltage/current input signal with **Pr.73 (Pr.267)** and the voltage/current input selection switch.

• Display unit changing for analog input (Pr.241)

- The analog input display unit (%/V/mA) can be changed for analog input bias/gain calibration.
- Depending on the terminal input specification setting of Pr.73 (Pr.267), the unit of the displayed value of C17 (Pr.919), C19 (Pr.920), C39 (Pr.932), and C41 (Pr.933) changes as follows:

| Analog command (via terminal 1 or 4) (depending on the setting of Pr.73 (Pr.267)) | Pr.241 = 0 (initial value) | Pr.241 = 1 |
|---|----------------------------|----------------------|
| 0 to 5 V input | 0% to 100% (0.1%) | 0 to 5 V (0.01 V) |
| 0 to 10 V input | 0% to 100% (0.1%) | 0 to 10 V (0.01 V) |
| 0 to 20 mA input | 0% to 100% (0.1%) | 0 to 20 mA (0.01 mA) |

Adjustment method for the stall prevention operation level setting voltage (current) bias and gain

(a) Adjustment by applying voltage (current) between terminals 1 and 5 (4 and 5) to set the voltage (current) at the bias/gain level

| Operating procedure |
|---|
| 1. Turning ON the power of the inverter |
| The operation panel is in the monitor mode. |
| 2. Changing the operation mode |
| Press PU to choose the PU operation mode. [PU] indicator turns ON. |
| Calibration is also possible in the External operation mode. |
| 3. Selecting the parameter setting mode |
| Press MODE to choose the parameter setting mode. (The parameter number read previously appears.) |
| 4. Calibration parameter selection |
| Turn 🕄 until "[" appears. Press 📧 to display "[". |
| 5. Selecting a parameter |
| Turn 🚱 until "[马" (C19 (Pr.920) Terminal 1 gain (torque)) appears for terminal 1, or "[" (C41 |
| (Pr.933)Terminal 4 gain (torque)) for terminal 4. |
| 6. Analog voltage (current) display |
| Press [SET] to display the analog voltage (current) % currently applied to the terminal 1 (4). |
| Do not touch 🚱 until calibration is completed. |
| 7. Voltage (current) application |
| Apply a 5 V (20 mA). (Turn the external potentiometer connected between terminals 1 and 5 (terminals 4 and 5) to a desired position.) |
| 8. Setting completed |
| Press 📧 to confirm the selection. The analog voltage (current) % and "[19 ([4])" are displayed |
| alternately. |
| Turn 🚱 to read another parameter. |
| Press SET to return to the "[" display. |
| Press SET twice to show the next parameter. |

(b) Adjustment by selecting the voltage (current) at the bias/gain level without applying voltage (current) between terminals 1 and 5 (4 and 5)

| 1. Turning ON the power of the inverter The operation panel is in the monitor mode. 2. Changing the operation mode Press | Operating procedure |
|---|---|
| 2. Changing the operation mode Press he choose the PU operation mode. [PU] indicator turns ON. Calibration is also possible in the External operation mode. 3. Selecting the parameter setting mode Press hoose to choose the parameter setting mode. (The parameter number read previously appears.) 4. Calibration parameter selection Turn with "[, , " appears. Press st] to display "[". 5. Selecting a parameter Turn with "[] []" (C19 (Pr.920) Terminal 1 gain (torque)) appears for terminal 1, or "[] [] [] (C41 (Pr.933) Terminal 4 gain (torque)) for terminal 4. 6. Analog voltage (current) display Press str to display the analog voltage (current) % currently applied to the terminal 1 (4). 7. Analog voltage (current) adjustment When with the desired gain voltage (current) value (%) currently set to the parameter appears. 8. Setting completed Press str to confirm the selection. The analog voltage (current) % and "[] [] ([] [] ([] '] 1)" are displayed atternately. Turn to the adanother parameter. Press str to return to the "[] = " display. Press str to return to the "[] = " display. Press str to return to the transmeter. | 1. Turning ON the power of the inverter |
| Press is to choose the PU operation mode. [PU] indicator turns ON. Calibration is also possible in the External operation mode. 3. Selecting the parameter setting mode Press incot to choose the parameter setting mode. (The parameter number read previously appears.) 4. Calibration parameter selection Turn in the function parameter selection Turn in the function parameter selection Turn in the function parameter setting (C19 (Pr.920) Terminal 1 gain (torque)) appears for terminal 1, or "[4] !" (C41 (Pr.933) Terminal 4 gain (torque)) for terminal 4. 5. Selecting a parameter Turn is the function of the parameter display Press is to display the analog voltage (current) % currently applied to the terminal 1 (4). 7. Analog voltage (current) adjustment When is turned, the gain voltage (current) value (%) currently set to the parameter appears. Turn is the desired gain voltage (current) value (%) appears. 8. Setting completed Press is to confirm the selection. The analog voltage (current) % and "[4] ([4])" are displayed alternately. Turn is to read another parameter. Press is to read another parameter. | |
| Calibration is also possible in the External operation mode. 3. Selecting the parameter setting mode Press more to choose the parameter setting mode. (The parameter number read previously appears.) 4. Calibration parameter selection Turn (()) until "[" appears. Press str] to display "[". 5. Selecting a parameter Turn (()) until "[!G" (C19 (Pr.920) Terminal 1 gain (torque)) appears for terminal 1, or "[!" (C41 (Pr.933) Terminal 4 gain (torque)) for terminal 4. 6. Analog voltage (current) display Press str] to display the analog voltage (current) % currently applied to the terminal 1 (4). 7. Analog voltage (current) adjustment When (()) is turned, the gain voltage (current) value (%) currently set to the parameter appears. 8. Setting completed Press str] to confirm the selection. The analog voltage (current) % and "[!G] ([!])" are displayed atternately. Turn (()) to read another parameter. Press str] to return to the "[===== "display. Press str] to return to the "[===== "display. Press str] to return to the next parameter. | 2. Changing the operation mode |
| 3. Selecting the parameter setting mode Press Mode to choose the parameter setting mode. (The parameter number read previously appears.) 4. Calibration parameter selection Turn and until "[, "appears. Press str to display "[". 5. Selecting a parameter Turn and until "[[]]" (C19 (Pr.920) Terminal 1 gain (torque)) appears for terminal 1, or "[[]]" (C41 (Pr.933) Terminal 4 gain (torque)) for terminal 4. 6. Analog voltage (current) display Press str to display the analog voltage (current) % currently applied to the terminal 1 (4). 7. Analog voltage (current) adjustment When and the gain voltage (current) value (%) currently set to the parameter appears. Turn are the selection. The analog voltage (current) % and "[]] ([] [] ([] 4])" are displayed atternately. Turn are to confirm the selection. The analog voltage (current) % and "[]] ([] 4])" are displayed atternately. Furst str to return to the "[] " display. Press str to return to the "[] " display. Press str to return to the "[] " display. Press str to return to the next parameter. | Press PU to choose the PU operation mode. [PU] indicator turns ON. |
| Press inore to choose the parameter setting mode. (The parameter number read previously appears.) 4. Calibration parameter selection Turn Image: until *[" appears. Press set to display "[". 5. Selecting a parameter Turn Image: until *[" appears. Press set to display "[". 5. Selecting a parameter Turn Image: until *[" appears. Press set to display "[". 6. Selecting a parameter Turn Image: until *[" appears. Press set to display in terminal 1 gain (torque)) appears for terminal 1, or "[4];" (C41 (Pr.933) Terminal 4 gain (torque)) for terminal 4. 6. Analog voltage (current) display Press Set to display the analog voltage (current) % currently applied to the terminal 1 (4). 7. Analog voltage (current) adjustment When Image: is turned, the gain voltage (current) value (%) currently set to the parameter appears. Turn Image: until the desired gain voltage (current) value (%) appears. 8. Setting completed Press Set to confirm the selection. The analog voltage (current) % and "[![] ([_ '_ !])" are displayed alternately. Turn Image: to read another parameter. Press Set to read another parameter. Press Set to read another parameter. Press Set to read another parameter. P | Calibration is also possible in the External operation mode. |
| 4. Calibration parameter selection Turn S until "[, " appears. Press st to display "[". 5. Selecting a parameter Turn S until "[15" (C19 (Pr.920) Terminal 1 gain (torque)) appears for terminal 1, or "[4 i" (C41 (Pr.933) Terminal 4 gain (torque)) for terminal 4. 6. Analog voltage (current) display Press st to display the analog voltage (current) % currently applied to the terminal 1 (4). 7. Analog voltage (current) adjustment When S is turned, the gain voltage (current) value (%) currently set to the parameter appears. Turn S until the desired gain voltage (current) value (%) appears. 8. Setting completed Press st to confirm the selection. The analog voltage (current) % and "[19] ([4 i)" are displayed alternately. Turn S to read another parameter. Press St to return to the "[" display. Press St to is how the next parameter. | 3. Selecting the parameter setting mode |
| Turn in the analog voltage (current) value (%) currently set to the parameter appears. 5. Selecting a parameter Turn is until "[]]" (C19 (Pr.920) Terminal 1 gain (torque)) appears for terminal 1, or "[]]" (C41 (Pr.933) Terminal 4 gain (torque)) for terminal 4. 6. Analog voltage (current) display Press IsT to display the analog voltage (current) % currently applied to the terminal 1 (4). 7. Analog voltage (current) adjustment When is turned, the gain voltage (current) value (%) currently set to the parameter appears. 8. Setting completed Press IsT to confirm the selection. The analog voltage (current) % and "[]] ([]] ([]] 1] are displayed alternately. Turn is to read another parameter. Press IsT to return to the "[= = = = " display. Press IsT to is show the next parameter. | Press MODE to choose the parameter setting mode. (The parameter number read previously appears.) |
| 5. Selecting a parameter Turn is util "[]] "(C19 (Pr.920) Terminal 1 gain (torque)) appears for terminal 1, or "[]] "(C41 (Pr.933) Terminal 4 gain (torque)) for terminal 4. 6. Analog voltage (current) display Press ist to display the analog voltage (current) % currently applied to the terminal 1 (4). 7. Analog voltage (current) adjustment When is is turned, the gain voltage (current) value (%) currently set to the parameter appears. Turn is util the desired gain voltage (current) value (%) appears. 8. Setting completed Press ist to confirm the selection. The analog voltage (current) % and "[]] ([]] ([]])" are displayed alternately. Turn is to read another parameter. Press ist to return to the "[" display. Press ist wice to show the next parameter. | 4. Calibration parameter selection |
| Turn in the selection. The analog voltage (current) % and "[19 ([] ([19 ([] ([19 ([19 ([] | Turn 🥹 until "[" appears. Press 📧 to display " [". |
| (Pr.933) Terminal 4 gain (torque)) for terminal 4. 6. Analog voltage (current) display Press str to display the analog voltage (current) % currently applied to the terminal 1 (4). 7. Analog voltage (current) adjustment When S is turned, the gain voltage (current) value (%) currently set to the parameter appears. Turn V until the desired gain voltage (current) value (%) appears. 8. Setting completed Press str to confirm the selection. The analog voltage (current) % and "[19 ([4])" are displayed alternately. Turn V to read another parameter. Press Str to return to the "[" display. Press Str twice to show the next parameter. | 5. Selecting a parameter |
| 6. Analog voltage (current) display Press sFT to display the analog voltage (current) % currently applied to the terminal 1 (4). 7. Analog voltage (current) adjustment When S is turned, the gain voltage (current) value (%) currently set to the parameter appears. Turn S until the desired gain voltage (current) value (%) appears. 8. Setting completed Press sFT to confirm the selection. The analog voltage (current) % and "[[] ([4])" are displayed alternately. Turn S to read another parameter. Press SFT to return to the "[" display. Press SFT twice to show the next parameter. | Turn 🚱 until "[/글" (C19 (Pr.920) Terminal 1 gain (torque)) appears for terminal 1, or "[너 /" (C41 |
| Press set to display the analog voltage (current) % currently applied to the terminal 1 (4). 7. Analog voltage (current) adjustment When is turned, the gain voltage (current) value (%) currently set to the parameter appears. Turn is until the desired gain voltage (current) value (%) appears. 8. Setting completed Press set to confirm the selection. The analog voltage (current) % and "[[9 ([4])" are displayed alternately. Turn is to read another parameter. Press set to return to the "[" display. Press Set twice to show the next parameter. | (Pr.933) Terminal 4 gain (torque)) for terminal 4. |
| 7. Analog voltage (current) adjustment When is turned, the gain voltage (current) value (%) currently set to the parameter appears. Turn is until the desired gain voltage (current) value (%) appears. 8. Setting completed Press is to confirm the selection. The analog voltage (current) % and "[19 ([4 1)" are displayed alternately. Turn is to read another parameter. Press is to return to the "[" display. Press is twice to show the next parameter. | 6. Analog voltage (current) display |
| When ② is turned, the gain voltage (current) value (%) currently set to the parameter appears. Turn ③ until the desired gain voltage (current) value (%) appears. 8. Setting completed Press SET to confirm the selection. The analog voltage (current) % and "[19 ([4])" are displayed alternately. Turn ③ to read another parameter. Press SET to return to the "[" display. Press SET twice to show the next parameter. | Press SET to display the analog voltage (current) % currently applied to the terminal 1 (4). |
| Turn in until the desired gain voltage (current) value (%) appears. 8. Setting completed Press set to confirm the selection. The analog voltage (current) % and "[!] (['] !]" are displayed alternately. Turn is to read another parameter. Press SET to return to the "[" display. Press SET twice to show the next parameter. | 7. Analog voltage (current) adjustment |
| 8. Setting completed Press SET to confirm the selection. The analog voltage (current) % and "[!] ([4 !)" are displayed alternately. Turn to read another parameter. Press SET to return to the "[" display. Press SET twice to show the next parameter. | When 🕄 is turned, the gain voltage (current) value (%) currently set to the parameter appears. |
| Press SET to confirm the selection. The analog voltage (current) % and "[19 ([4 1)" are displayed alternately. Turn to read another parameter. Press SET to return to the "[" display. Press SET twice to show the next parameter. | Turn 🕄 until the desired gain voltage (current) value (%) appears. |
| alternately. Turn image: to read another parameter. Press image: to return to the "[" display. Press image: twice to show the next parameter. | 8. Setting completed |
| Turn Ito read another parameter. Press SET to return to the "[" display. Press SET twice to show the next parameter. | Press SET to confirm the selection. The analog voltage (current) % and "[19 ([41)" are displayed |
| Press SET to return to the "[" display. Press SET twice to show the next parameter. | alternately. |
| Press SET twice to show the next parameter. | Turn 😧 to read another parameter. |
| | Press SET to return to the " [" display. |
| NOTE | Press SET twice to show the next parameter. |
| | NOTE |

• Press after step 6 to check the present bias/gain setting of the stall prevention operation level. The setting cannot be checked after step 7.

5

(c) Adjustment by changing the stall prevention operation level only without adjusting the gain voltage (current). (Example of changing the gain value from 150% to 130%)

| Operating procedure |
|---|
| 1. Selecting the parameter |
| Turn 🛞 until "Ĺ / I (Pr.920) appears for terminal 2, or "Ĺ / [] " (Pr.933) for terminal 4. |
| Press SET to read the present set value. (150.00%) |
| 2. Changing the stall prevention operation level |
| Turn 🛞 to change the set value to " ∃∏∏[]" (130.00%) |
| Press set to confirm the selection. "] [] [] and "[(['])" are displayed alternately. |
| 3. Selecting the mode and the monitor item |
| Press MODE three times to select the monitor mode, and change the monitor item to the frequency. |
| 4. Start |
| Turn ON the start switch (STF or STR) to apply a voltage across terminals 1 and 5 (4 and 5), |
| Operation is performed with 130% stall prevention operation level. |
| |
| |
| • If the voltage (current) values at the gain and bias levels are too close to each other, an error (" 左 🖵 🚽 ") may be indicated. |
| For operation outline of the parameter unit (FR-PU07), refer to the Instruction Manual of the FR-PU07. |
| • Use the calibration parameter C16 (Pr.919) or C38 (Pr.932) to set the bias level. (Refer to page 364.) |

A Parameters referred to

- Pr.73 Analog input selection, Pr.267 Terminal 4 input selection 🖙 page 349 Pr.79 Operation mode selection 🖙 page 240 Pr.858 Terminal 4 function assignment, Pr.868 Terminal 1 function assignment 🖙 page 352

5.9.7 Checking of current input on analog input terminal

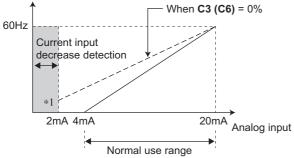
When current is input to the analog input terminal 2 or terminal 4, the input current can be checked and the operation when the input falls below the specified level (the analog current input is lost) can be selected. The operation can be continued even when the analog current input is lost.

| Pr. | Name | Initial value | Setting range | Description | |
|---------------------|---------------------------------|------------------|------------------|--|--|
| | | | 1 | Operation continues with output frequency before the current input loss. | |
| | | | 2 | 4 mA input fault (E.LCI) is activated when the current input loss is detected. | Check the current input on terminals 2 and 4. |
| | | | 3 | The inverter output decelerates the motor to a stop when the current input loss is detected. After the motor is stopped, 4 mA input fault (E.LCI) is activated. | |
| | | | 4 | Operation continues at the frequency set in Pr.777. | |
| | | | 11 | Operation continues at the output frequency before the current input loss. | |
| | | | 12 | 4 mA input fault (E.LCI) is activated when the current input loss is detected. | Check the |
| 573 T052 | 4 mA input check selection | 9999 | 13 | The inverter output decelerates the motor to a stop when the current input loss is detected. After the motor is stopped, 4 mA input fault (E.LCI) is activated. | current input on terminal 4. |
| | | | 14 | Operation continues at the frequency set in Pr.777. | |
| | | | 21 | Operation continues with output frequency before the current input loss. | |
| | | | 22 | 4 mA input fault (E.LCI) is activated when the current input loss is detected. | Check the |
| | | | 23 | The inverter output decelerates the motor to a stop when the current input loss is detected. After the motor is stopped, 4 mA input fault (E.LCI) is activated. | current input on terminal 2. |
| | | | 24 | Operation continues at the frequency set in Pr.777. | |
| | | | 9999 | No current input check | · |
| 777 T053 | 4 mA input fault operation 9999 | | 0 to 590 Hz | Set the frequency to continue operation when curre (Valid when Pr.573 = "4, 14, or 24") | ent input is lost. |
| A681 | frequency | | 9999 | No current input check when Pr.573 = "4, 14, or 24 | " |
| 778 T054 A682 | 4 mA input check filter | 0 s | 0 to 10 s | Set the current input loss detection time. | |

Analog current input loss condition (Pr.778)

- When the current input to terminal 4 (terminal 2) continues to be 2 mA or less for the period set in **Pr.778**, it is considered as loss of analog current input and the Alarm (LF) signal is turned ON. The LF signal turns OFF when the current input becomes 3 mA or higher.
- For the LF signal, set "98 (positive logic) or 198 (negative logic)" in any parameter from **Pr.190 to Pr.196 (Output terminal** function selection) to assign the function to the output terminal.





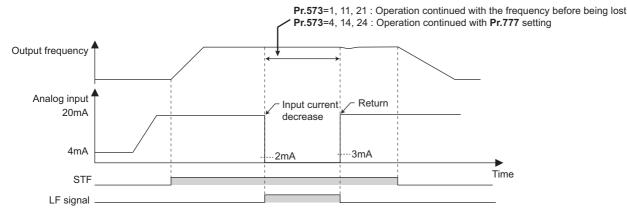
*1 When **Pr.573** ≠ "9999" and the terminal 4 (terminal 2) input is calibrated to 2 mA or less in **C2 (Pr.902) (C5 (Pr.904))**, the operation set in **Pr.573** is applied to the frequency at the input of 2 mA or less.



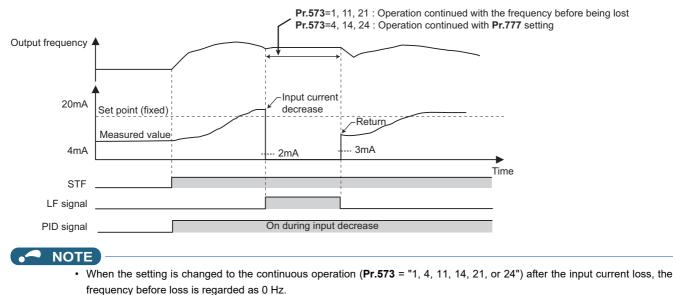
• Changing the terminal assignment using **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Continuing operation when the analog current input is lost (Pr.573 = "1, 4, 11, 14, 21, or 24", Pr.777)

- When **Pr.573** = "1, 11, or 21", operation continues at the output frequency before the current input loss.
- When Pr.573 = "4, 14, or 24" and Pr.777 ≠ "9999", operation continues at the frequency set in Pr.777.
- When the start command is turned OFF during current input loss, the inverter output decelerates the motor to a stop immediately, and the operation is not restarted even if a start command is input again.
- When the current input is restored, the LF signal is turned OFF, and operation is performed according to the current input.
- The following is the operation example during External operation.



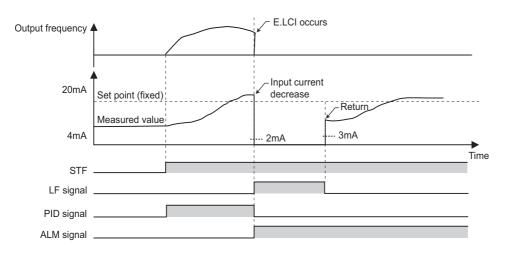
· The following is the operation example during PID control (reverse action) operation.



Fault output (Pr.573 = "2, 12, or 22")

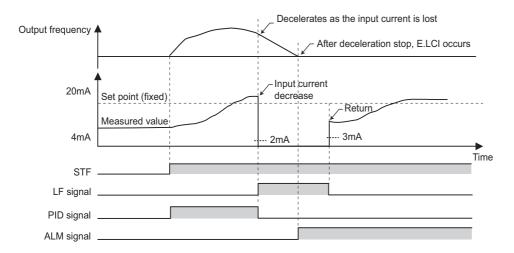
When the analog current input becomes 2 mA or lower, the protective function E.LCI (4 mA input fault) is activated and the
output is shut off.

• The following is the operation example during PID control (reverse action) operation.

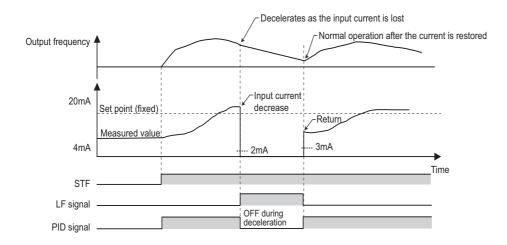


Fault output after deceleration to stop (Pr.573 = "3, 13, or 23")

- When the analog current input becomes 2 mA or lower, the inverter output decelerates the motor to a stop, and then the protective function E.LCI (4 mA input fault) is activated and the output is shut off.
- When the analog current input is restored during the deceleration, the motor is accelerated again and operates according to the current input.
- The following is the operation example during PID control (reverse action) operation.



• The following is the operation example when the analog input current is restored during deceleration under PID control (reverse action).



Functions related to current input check

| Function | Operation | Refer to page |
|---|--|---------------|
| Minimum frequency | When the operation continues, the minimum frequency setting is valid even during current input loss. | 287 |
| Multi-speed operation | The multi-speed setting signal is prioritized even during current input loss (the motor operates according to the multi-speed setting even during continuous operation at the predetermined frequency or during deceleration to a stop). When the multi-speed setting signal is turned OFF while the input current is lost during the multi-speed operation, the motor is decelerated to a stop even if the parameter is set to continue operation when the current input is lost. | 263 |
| JOG operation | JOG operation is prioritized even during current input loss (the motor operation switches to JOB operation even during continuous operation at the predetermined frequency or during deceleration to a stop). When the JOG signal is turned OFF while the input current is lost during the JOG operation, the motor is decelerated to a stop even if the parameter is set to continue operation when the current input is lost. | 261 |
| MRS signal | The MRS signal is enabled even during current input loss (output is shut off by turning ON the MRS signal even during continuous operation at the predetermined frequency or during deceleration to a stop). | 375 |
| Remote setting | When the operation using the remote setting function is changed to the continuous operation after the current input is lost, acceleration, deceleration, and clear operations by the remote setting are disabled. The operations are enabled after restoration of current input. | 234 |
| Retry function | When the protective function is activated during continuous operation after the current input is lost and the retry function is used successfully, operation continues without clearing the frequency setting. | 276 |
| Compensation by addition, override compensation | When the operation using compensation by addition or override compensation is changed to the continuous operation after the current input is lost, compensation by addition or override compensation is disabled. The operations are enabled after restoration of current input. | 353 |
| Input filter time constant | The current before the filter time is applied is used for input loss detection. The current after the filter time is applied is used for continuous operation at the output frequency before the input loss. | 369 |
| PID control | PID calculation is stopped during current input loss. However, PID control is not disabled (the operation does not return to normal). During the pre-charge, end determination or fault determination by the pre-charge function is not performed when the current input is lost. The sleep function is prioritized even during current input loss. When the clearing condition of the sleep function is met during current input loss, continuous operation at the predetermined frequency is restored. | 419 |
| Power failure stop | The power failure stop function is prioritized even if current input loss is detected during power failure. After the power failure stop and re-acceleration, operation continues at the output frequency before the input loss. When the protective function E.LCI is selected when the current input is lost, E.LCI is activated after the power failure stop. | 478 |
| Traverse function | Traverse operation is performed based on the frequency even during continuous operation during current input loss. | 414 |

✓ Parameters referred to Pr.73 Analog input selection, Pr.267 Terminal 4 input selection □ page 349

5.9.8 Input terminal function selection

Use the following parameters to select or change the input terminal functions.

| Pr. | Name | Initial value | Initial signal | Setting range |
|-------------|-------------------------------------|------------------|---|--|
| 178 T700 | STF terminal function selection | 60 | STF (Forward rotation command) | 0 to 8, 10 to 14, 16, 18, 24, 25, 28, 37 to 40, 46 to 48, 50, 51, 57, 58, 60, 62, 64 to 67, 70 to 73, 77 to 81, 84, 94 to 98, 128, 129, 9999 |
| 179 T701 | STR terminal function selection | 61 | STR (Reverse rotation command) | 0 to 8, 10 to 14, 16, 18, 24, 25, 28, 37 to 40, 46 to 48, 50, 51, 57, 58, 61, 62, 64 to 67, 70 to 73, 77 to 81, 84, 94 to 98, 128, 129, 9999 |
| 180 T702 | RL terminal function selection | 0 | RL (Low-speed operation command) | |
| 181 T703 | RM terminal function selection | 1 | RM (Middle-speed operation command) | |
| 182 T704 | RH terminal function selection | 2 | RH (High-speed operation command) | |
| 183 T705 | RT terminal function selection | 3 | RT (Second function selection) | |
| 184 T706 | AU terminal function selection | 4 | AU (Terminal 4 input selection) | 0 to 8, 10 to 14, 16, 18, 24, 25, 28, 37 to 40, 46 |
| 185 T707 | JOG terminal function selection | 5 | JOG (Jog operation selection) | to 48, 50, 51, 57, 58, 62, 64 to 67, 70 to 73, 77 to 81, 84, 94 to 98, 128, 129, 9999 |
| 186 T708 | CS terminal function selection | 9999 | No function | |
| 187 | MRS terminal | 24 ^{*1} | MRS (Output stop) | |
| Т709 | function selection | 10 ^{*2} | X10 (Inverter run enable) | |
| 188 T710 | STOP terminal function selection | 25 | STP (STOP) (Start self-holding selection) | |
| 189 T711 | RES terminal function selection | 62 | RES (Inverter reset) | |
| | | Initial | | |

| Pr. | Name | Initial value | Setting range | Description |
|------|----------------------------|------------------|---------------|---|
| 699 | Input terminal filter 9 | 9999 | 5 to 50 ms | Set the time delay for the input terminal response. |
| T740 | input terminal filter 9999 | | 9999 | No filter for the input terminal |

*1 The initial value is for standard models and IP55 compatible models.

*2 The initial value is for separated converter types.

Input terminal function assignment

- Use Pr.178 to Pr.189 to set the functions of the input terminals.
- · Refer to the following table and set the parameters.

| Setting | Signal name | Fun | Related parameter | Refer to page | |
|---------|----------------|--|--|---|----------|
| 0 | RL | Pr.59 = 0 (initial value) | Pr.59 = 0 (initial value) Low-speed operation command | | 263 |
| | | Pr.59 ≠ 0 ^{*1} | Remote setting (setting clear) | Pr.59 | 234 |
| 1 | RM | Pr.59 = 0 (initial value) | Middle-speed operation command | Pr.4 to Pr.6, Pr.24 to Pr.27, Pr.232 to Pr.239 | 263 |
| | | Pr.59 ≠ 0 ^{*1} | Remote setting (deceleration) | Pr.59 | 234 |
| 2 | RH | Pr.59 = 0 (initial value) | High-speed operation command | Pr.4 to Pr.6, Pr.24 to Pr.27, Pr.232 to Pr.239 | 263 |
| | | Pr.59 ≠ 0 ^{*1} | Remote setting (acceleration) | Pr.59 | 234 |
| 3 | RT | Second function selection | | Pr.44 to Pr.51, Pr.450 to Pr.463, Pr.569, Pr.832, etc. | 377 |
| 4 | AU | Terminal 4 input selection | | Pr.267 | 349 |
| 5 | JOG | Jog operation selection | | Pr.15, Pr.16 | 261 |
| 6 | cs | Selection of automatic restart after flying start | er instantaneous power failure / | Pr.57, Pr.58, Pr.162 to Pr.165, Pr.299, Pr.611 | 466, 472 |
| 0 | 00 | Electronic bypass function | Pr.57, Pr.58, Pr.135 to Pr.139, Pr.159 | 404 | |
| 7 | ОН | External thermal relay input ^{*2} | | Pr.9 | 266 |

| Setting | Signal name | Function | Related parameter | Refer to page | |
|-----------------------|----------------|---|---|---------------|--|
| 8 | REX | 15-speed selection (Combination with multi-speeds of RL, RM, and RH) | Pr.4 to Pr.6, Pr.24 to Pr.27, Pr.232 to Pr.239 | 263 | |
| 10 | X10 | Inverter run enable (FR-HC2/FR-XC/FR-CV/FR-CC2 connection) | Pr.30, Pr.599 | 566 | |
| 11 | X11 | FR-HC2/FR-CC2 connection, instantaneous power failure detection | Pr.30 | 566 | |
| 12 | X12 | PU operation external interlock | Pr.79 | 240 | |
| 13 | X13 | External DC injection brake operation start | Pr.10 to Pr.12 | 560 | |
| 14 | X14 | PID control valid | Pr.127 to Pr.134, Pr.575 to Pr.577 | 419 | |
| 16 | X16 | PU/External operation switchover (External operation with X16-ON) | Pr.79, Pr.340 | 240 | |
| 18 | X18 | V/F switchover (V/F control with X18-ON) | Pr.80, Pr.81, Pr.800 | 177 | |
| | | Output stop | Pr.17 | 375 | |
| 24 | MRS | Electronic bypass function | Pr.57, Pr.58, Pr.135 to Pr.139, Pr.159 | 404 | |
| 25 | STP (STOP) | Start self-holding selection Pr.250 | | | |
| 28 | X28 | Start-time tuning start external input | Pr.95 | 400 | |
| 37 | X37 | Traverse function selection | Pr.592 to Pr.597 | 414 | |
| 38 | PDI1 | PID multistage set point setting 1 | | | |
| 39 | PDI2 | PID multistage set point setting 2 | Pr.1460 to Pr.1466 | 419 | |
| 40 | PDI3 | PID multistage set point setting 3 | | | |
| 46 | TRG | Trace trigger input | Pr.1020 to Pr.1047 | 486 | |
| 47 | TRC | Trace sampling start/end | Pr.1020 to Pr.1047 | 486 | |
| 48 | X48 | Power failure stop external | Pr.261 to Pr.266, Pr.294, Pr.668 | 478 | |
| 50 | SQ | Sequence start | Pr.414 | 483 | |
| 51 | X51 | Fault clear | Pr.414 | 483 | |
| 57 | JOGF | JOG forward rotation command | Pr.15, Pr.16 | 261 | |
| 58 | JOGR | JOG reverse rotation command | Pr.15, Pr.16 | 261 | |
| 60 | STF | Forward rotation command (assignable to the STF terminal (Pr.178) only) | Pr.250 | 563 | |
| 61 | STR | Reverse rotation command (assignable to the STR terminal (Pr.179) only) | Pr.250 | 563 | |
| 62 | RES | Inverter reset | Pr.75 | 196 | |
| 64 | X64 | PID forward/reverse action switchover | Pr.127 to Pr.134 | 419 | |
| 65 | X65 | PU/NET operation switchover (PU operation with X65-ON) | Pr.79, Pr.340 | 240 | |
| 66 | X66 | External/NET operation switchover (NET operation with X66-ON) | Pr.79, Pr.340 | 240 | |
| 67 | X67 | Command source switchover (command by Pr.338 or Pr.339 enabled with X67-ON) | Pr.338, Pr.339 | 251 | |
| 70 | X70 | DC feeding operation permission*3 | Pr.30 | 566 | |
| 71 | X71 | DC feeding cancel ^{*3} | Pr.30 | 566 | |
| 72 | X72 | PID P control switchover | Pr.127 to Pr.134, Pr.575 to Pr.577 | 419 | |
| 73 | X73 | Second PID P control switchover | Pr.127 to Pr.134, Pr.575 to Pr.577 | 419 | |
| 77 | X77 | Pre-charge end command | Pr.760 to Pr.764 | 445 | |
| 78 | X78 | Second pre-charge end command | Pr.765 to Pr.769 | 445 | |
| 79 | X79 | Second PID forward/reverse action switchover | Pr.753 to Pr.758 | 419 | |
| 80 | X80 | Second PID control valid | Pr.753 to Pr.758 | 419 | |
| 81 | PGT | PID gain tuning start/forced end | Pr.1211 to Pr.1219 | 437 | |
| 84 | X84 | Emergency drive execution command ^{*3} | Pr.514, Pr.515, Pr.523, Pr.524, Pr.1013 | 279 | |
| 94 | X94 | Control signal input for main circuit power supply MC | Pr.30, Pr.137, Pr.248, Pr.254 | 410 | |
| 95 | X95 | Converter unit fault input | Pr.57, Pr.58, Pr.135 to | 404 | |
| | X96 | Converter unit fault (E.OHT, E.CPU) input | Pr.139, Pr.159 | 404 | |
| 96 | | | | | |
| | X97 | Cleaning valid | Du 4400 4+ Du 4470 | 445 | |
| 97 | X97 X98 | Cleaning trigger | Pr.1469 to Pr.1479 | 415 | |
| 96 97 98 128 | | - | Pr.1469 to Pr.1479 Pr.6 | 415 263 | |

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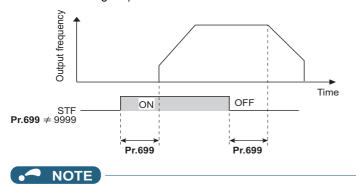
- *1 When Pr.59 Remote function selection ≠ "0", functions of the RL, RM, and RH signals are changed as shown in the table.
- *2 The OH signal is activated when the relay contact is open.
- *3 The setting is available for the standard structure model and the IP55 compatible model.

NOTE

- The same function can be assigned to two or more terminals. In this case, the logic of terminal input is OR.
- The priorities of the speed commands are defined as follows: JOG > multi-speed setting (RH, RM, RL, REX) > PID (X14).
- When the Inverter run enable (X10) signal is not assigned, or when the PU operation external interlock (X12) signal is not assigned while **Pr.79 Operation mode selection** = "7", the MRS signal performs the same function.
- The same terminals are used to assign the multi-speed (7-speed) setting and the remote setting. The multi-speed setting and the remote setting cannot be assigned separately.
- When the terminal assignment is changed using Pr.178 to Pr.189 (Input terminal function selection), wiring may be
 mistaken due to different terminal name and signal contents, or may affect other functions. Set parameters after confirming
 the function of each terminal.

Adjusting the response of input terminals (Pr.699)

• Response of the input terminals can be delayed in a range between 5 to 50 ms. (The following is the operation example of the STF signal.)



• The Pr.699 setting is invalid (no filter) for the following signals.

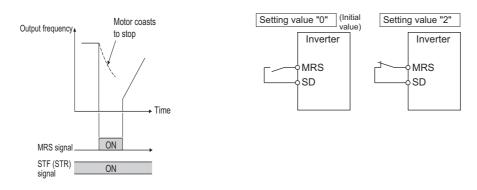
- Input signals which are already in the ON state when the power is turned ON
- Input signals used for the PLC function
- Inverter run enable (X10) signal

5.9.9 Inverter output shutoff

The inverter output can be shut off with the MRS signal. The logic of the MRS signal can also be selected.

| Pr. | Name | Initial value | Setting range | Description |
|------|---------------------|------------------|---------------|---|
| 17 | | | 0 | Normally open input |
| | | 0 | 2 | Normally closed input (NC contact input specification) |
| T720 | MRS input selection | | 4 | External terminal: Normally closed input (NC contact input specification) Communication: Normally open input |

Output shutoff signal (MRS signal)



- When the Output stop (MRS) signal is turned ON while operating the inverter, the inverter output is instantaneously shut off.
- · The response time of the MRS signal is within 2 ms.
- The MRS signal is used in the following cases.

| Application | Description |
|---|--|
| To stop the motor using a mechanical brake (e.g. electromagnetic brake) | The inverter output is shut off when the mechanical brake operates. |
| To provide interlock to disable the motor operation by the inverter | With the MRS signal ON, the motor cannot be driven by the inverter even if the start signal is input to the inverter. |
| To coast the motor to a stop | When the start signal is turned OFF, the inverter decelerates the motor to a stop in the preset deceleration time, but when the MRS signal is turned ON, the motor coasts to a stop. |

MRS signal logic inversion (Pr.17 = "2")

• When "2" is set in **Pr.17**, the input specification of the MRS signal is changed to normally closed (NC contact). The inverter will shut off the output when the MRS signal is turned OFF (when the contact is opened).

Assigning a different action for each MRS signal input via communication and external terminal (Pr.17 = "4")

• When **Pr.17** = "4", the MRS signal input from an external terminal is normally closed (NC contact), and the MRS signal input from communication is normally open (NO contact). This function is useful to perform operation via communication while keeping the ON state of the MRS signal input from the external terminal.

| External MRS | Communication MRS | Pr.17 setting | | | | | |
|--------------|---------------------|-------------------|-------------------|-------------------|--|--|--|
| | Communication witho | 0 | 2 | 4 | | | |
| OFF | OFF | Operation enabled | Output shutoff | Output shutoff | | | |
| OFF | ON | Output shutoff | Output shutoff | Output shutoff | | | |
| ON | OFF | Output shutoff | Output shutoff | Operation enabled | | | |
| ON | ON | Output shutoff | Operation enabled | Output shutoff | | | |

- NOTE

- The MRS signal is assigned to terminal MRS in the initial status. By setting "24" in any parameter from **Pr.178 to Pr.189 (Input terminal function selection)**, the MRS signal can be assigned to the other terminal.
- When using an external terminal to input the MRS signal, the MRS signal shuts off the output in any of the operation modes.
- The MRS signal is valid regardless of whether it is input through the external terminal or via network, but when the MRS signal is used as the Inverter run enable (X10) signal, input the signal through the external terminal.
- When the terminal assignment is changed using **Pr.178 to Pr.189 (Input terminal function selection)**, wiring may be mistaken due to different terminal name and signal contents, or may affect other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.178 to Pr.189 (Input terminal function selection) i page 373

5.9.10 Selecting the condition to activate the Second function selection (RT) signal

The second function can be selected using the RT signal. The condition to activate the second function can be also set.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|---------------------------------|---------------|---------------|---|
| | RT signal function | | 0 | The second function is immediately enabled when the RT signal is turned ON. |
| 155 T730 | validity condition selection | 0 | 10 | The function cannot be changed to the second function during acceleration/deceleration. When the signal is turned ON during acceleration/deceleration, the function is changed after the acceleration/deceleration is finished. |

• Turning ON the Second function selection (RT) signal enables the second functions.

• The following are the examples of the applications of the second functions.

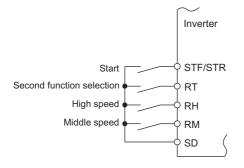
Switching between regular use and emergency use

Switching between heavy load and light load

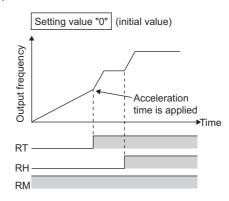
Changing the acceleration/deceleration time by break point acceleration/deceleration

Switching characteristics of main motor and sub motor

Connection diagram example for the second function



Example of the second acceleration/deceleration time



• When the RT signal is ON, second functions are selected. The following table shows the functions which can be changed to the second function.

| Function | First function Parameter number | Second function Parameter number | Refer to page |
|--|---|---|---------------|
| Torque boost | Pr.0 | Pr.46 | 551 |
| Base frequency | Pr.3 | Pr.47 | 552 |
| Acceleration time | Pr.7 | Pr.44 | 228 |
| Deceleration time | Pr.8 | Pr.44, Pr.45 | 228 |
| Electronic thermal O/L relay | Pr.9 | Pr.51 | |
| Free thermal | Pr.600 to Pr.604 | Pr.692 to Pr.696 | 266 |
| Motor permissible load level ^{*1} | Pr.607 | Pr.608 | |
| Stall prevention | Pr.22 | Pr.48, Pr.49 | 290 |
| Applied motor ^{*1} | Pr.71 | Pr.450 | 379 |
| Motor constant ^{*1} | Pr.80 to Pr.84, Pr.90 to Pr.94, Pr.298, Pr.702, Pr.706, Pr.707, Pr.711, Pr.712, Pr.717, Pr.721, Pr.724, Pr.725, Pr.859 | Pr.453 to Pr.457, Pr.560, Pr.458 to Pr.462, Pr.738 to Pr.747, Pr.860 | 383, 392 |
| Excitation current low-speed scaling factor | Pr.85, Pr.86 | Pr.565, Pr.566 | 555 |
| Speed control gain (Advanced magnetic flux vector) | Pr.89 | Pr.569 | 180 |
| Offline auto tuning ^{*1} | Pr.96 | Pr.463 | 383, 392 |
| Online auto tuning ^{*1} | Pr.95 | Pr.574 | 400 |
| PID control | Pr.127 to Pr.134 | Pr.753 to Pr.758 | 419 |
| PID pre-charge function | Pr.760 to Pr.764 | Pr.765 to Pr.769 | 445 |
| Speed control gain | Pr.820, Pr.821 | Pr.830, Pr.831 | 190 |
| Analog input filter | Pr.822 | Pr.832 | 355 |
| Torque control gain | Pr.824, Pr.825 | Pr.834, Pr.835 | 190 |
| Torque detection filter | Pr.827 | Pr.837 | 193 |

*1 The function can be changed by switching the RT signal ON/OFF while the inverter is stopped. If a signal is switched during operation, the operation method changes after the inverter stops. (**Pr.450** ≠ 9999)

• The RT signal is assigned to terminal RT in the initial status. By setting "3" in any parameter from **Pr.178 to Pr.189 (Input terminal function selection)**, the RT signal can be assigned to the other terminal.

• Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

A Parameters referred to

Pr.178 to Pr.189 (Input terminal function selection) 373

5.10 (C) Motor constant parameters

| Purpose | | Parameter to set | | Refer to page |
|--|---------------------------------|--|--|---------------|
| To select the motor to be used | Applied motor | P.C100, P.C200 | Pr.71, Pr.450 | 379 |
| To maximize the performance of the induction motor | Offline auto tuning | P.C000, P.C100 to P.C105, P.C107, P.C108, P.C110, P.C120 to P.C126, P.C200 to P.C205, P.C207, P.C208, P.C210, P.C220 to P.C226 | Pr.9, Pr.51, Pr.71, Pr.80 to Pr.84, Pr.90 to Pr.94, Pr.96, Pr.450, Pr.453 to Pr.463, Pr.684, Pr.707, Pr.724, Pr.744, Pr.745, Pr.859, Pr.860 | 383 |
| To maximize the performance of the PM motor | PM motor offline auto tuning | P.C000, P.C100 to P.C108, P.C110, P.C120, P.C122, P.C123, P.C126, P.C130 to P.C133, P.C135, P.C150, P.C182, P.C185, P.C200 to P.C208, P.C210, P.C220, P.C222, P.C223, P.C226, P.C230 to P.C233, P.C235, P.C282, P.C285 | Pr.9, Pr.51, Pr.71, Pr.80, Pr.81, Pr.83, Pr.84, Pr.90, Pr.92, Pr.93, Pr.96, Pr.450, Pr.453, Pr.454, Pr.456 to Pr.458, Pr.460, Pr.461, Pr.463, Pr.684, Pr.702, Pr.706, Pr.707, Pr.711, Pr.712, Pr.717, Pr.721, Pr.724, Pr.725, Pr.738 to Pr.747, Pr.788, Pr.859, Pr.860, Pr.1002, Pr.1412, Pr.1413 | 392 |
| To perform high accuracy operation without being affected by temperature and high-torque/ultra-low speed | Online auto tuning | P.C111, P.C211 | Pr.95, Pr.574 | 400 |

5.10.1 Applied motor

By setting the applied motor type, the thermal characteristic appropriate for the motor can be selected.

When using a constant-torque or PM motor, the electronic thermal O/L relay function is set according to the motor.

When the Advanced magnetic flux vector control or PM motor control is selected, the motor constant necessary for control (SF-PR, SF-JR, SF-HR, SF-JRCA, SF-HRCA, MM-EFS, MM-THE4, etc.) is also selected at the same time.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|----------------------|---------------|--|--|
| 71 C100 | Applied motor | 0 | 0 to 6, 13 to 16, 20, 23, 24, 40, 43, 44, 50, 53, 54, 70, 73, 74, 210, 213, 214, 240, 243, 244, 8090, 8093, 8094, 9090, 9093, 9094 | By selecting a motor, the thermal characteristic and motor constant of each motor are set. |
| 450 C200 | Second applied motor | 9999 | 0, 1, 3 to 6, 13 to 16, 20, 23, 24, 40, 43, 44, 50, 53, 54, 70, 73, 74, 210, 213, 214, 240, 243, 244, 8090, 8093, 8094, 9090, 9093, 9094 | Set this parameter when using the second motor (the same specifications as Pr.71). |
| | | | 9999 | The function is disabled. |

Setting the applied motor

• Refer to the following list and set the parameters according to the applied motor.

| Pr.71 Pr.450 | | Motor | | r constant value range when | Electronic thermal O/L relay function | | |
|-------------------------|----------------------------|---|-----------------------------------|--|---------------------------------------|---------------------|----|
| | 11.400 | Wotor | performin | g offline auto tuning (increment) | Standard | Constant -torque | РМ |
| 0 (Pr.71 ini | itial | Standard motor (such as SF-JR) | | | 0 | | |
| value) | | | - | 55) and Pr.859 (Pr.860) | | | |
| 1 | | Constant-torque motor (SF-JRCA, etc.) | | , 9999 (0.01 A) ^{*1} | | 0 | |
| | | Standard motor (such as SF-JR) | | A, 9999 (0.1 A) ^{*2} | | | |
| 2 | — | Adjustable 5 points V/F (Refer to page | | 58), Pr.91 (Pr.459) | 0 | | |
| | | 558.) Mitsubishi Electric standard motor (SF- | | 9999 $(0.001 \Omega)^{*1}$ | | | |
| 20 | | JR 4P 1.5kW or lower) | | nΩ, 9999 (0.01 mΩ) ^{*2} 60), Pr.93 (Pr.461) (Induction | | 0 | |
| 40 | | Mitsubishi Electric high-efficiency | motor) | | 0 | | |
| 40 | | motor SF-HR | • 0 to 6000 | mH, 9999 (0.1 mH) ^{*1} | | | |
| 50 | | Mitsubishi Electric constant-torque | | ηΗ, 9999 (0.01 mH) ^{*2} | | 0 | |
| | | motor SF-HRCA | | 60), Pr.93 (Pr.461) (PM motor) | | - | |
| 70 | | Mitsubishi Electric high-performance energy-saving motor SF-PR | | וH, 9999 (0.01 mH) ^{*1} | | 0 | |
| | | IPM motor (MM-EFS (1500 r/min | | H, 9999 (0.001 mH) ^{*2} | | | |
| 210 ^{*3} | | specification), MM-THE4) | Pr.94 (Pr.40 | | | | 0 |
| *3 | | IPM motor (MM-EFS 3000 r/min | | %, 9999 (0.1%) ^{*1} %, 9999 (0.01%) ^{*2} | | | |
| 240 ^{*3} | | specification) | • 0% to 100 Pr.706 (Pr. | | | | 0 |
| 8090 | | IPM motor (other than MM-EFS or MM- THE4) | | mV (rad/s), 9999 (0.1 mV (rad/s)) | | 0 | |
| 9090 | | SPM motor | | | | 0 | |
| 3 (4) ^{*4} | | Standard motor (such as SF-JR) | | | 0 | | |
| 13 (14) ^{*4} | | Constant-torque motor (SF-JRCA, etc.) | | | | 0 | |
| . , | | Mitsubishi Electric standard motor (SF- | | | | | |
| 23 (24) ^{*4} | | JR 4P 1.5kW or lower) | | | | 0 | |
| 43 (44) ^{*4} | | Mitsubishi Electric high-efficiency motor SF-HR | | | 0 | | |
| 53 (54) ^{*4} | | Mitsubishi Electric constant-torque motor SF-HRCA | Pr.91 (Pr.4 | 55), Pr.859 (Pr.860), Pr.90 (Pr.458), 59), Pr.92 (Pr.460), Pr.93 (Pr.461), | | 0 | |
| 73 (74) ^{*4} | | Mitsubishi Electric high-performance energy-saving motor SF-PR | Internal data | 52), Pr.706 (Pr.738) ata value 0 to 65534, 9999 (1) increment can be changed in | | 0 | |
| 213 (214 |)*3*4 | IPM motor (MM-EFS (1500 r/min specification), MM-THE4) | Pr.684. | | | | 0 |
| 243 (244 |)*3*4 | IPM motor (MM-EFS 3000 r/min specification) | | | | | |
| 8093 (80 | 94) ^{*4} | IPM motor (other than MM-EFS or MM-THE4) | | | | 0 | |
| 9093 (90 | 94) ^{*4} | SPM motor | | | | 0 | |
| | - | | | Pr.82 (Pr.455) and Pr.859 (Pr.860) | | | |
| 5 | | Standard motor | 144. | • 0 to 500 A, 9999 (0.01 A) ^{*1} | 0 | | |
| | | | Wye connection | • 0 to 3600 A, 9999 (0.1 A) ^{*2} | | | |
| 15 | | Constant-torque motor | Sonneouoli | Pr.90 (Pr.458), Pr.91 (Pr.459) | | 0 | |
| | | · | | • 0 to 50 Ω, 9999 (0.001 Ω) ^{*1} | | | |
| 6 | | Standard motor | | • 0 to 400 mΩ, 9999 (0.01 mΩ) ^{*2} Pr.92 (Pr.460), Pr.93 (Pr.461) | 0 | | |
| | | | Delta | • 0 to 50 Ω, 9999 (0.001 Ω) ^{*1} | | | |
| 16 | | Constant-torque motor | connection Pr.94 (Pr.462) | | | 0 | |
| 10 | | | | 0 to 500 Ω, 9999 (0.01 Ω)^{*1} | | Ŭ | |
| | | | | • 0 to 100 Ω, 9999 (0.01 Ω) ^{*2} | | | |
| _ | 9999 (initial value) | No second applied motor | | | | | |

*1 For the FR-F820-02330(55K) or lower and FR-F840-01160(55K) or lower.

*2 For the FR-F820-03160(75K) or higher and FR-F840-01800(75K) or higher.

*3 The setting is available for the standard structure model or the separated converter type.

- NOTE

 Regardless of the Pr.71 (Pr.450) setting, offline auto tuning can be performed according to Pr.96 (Pr.463) Auto tuning setting/status. (Refer to page 383 for offline auto tuning.)

Using two types of motors (RT signal, Pr.450)

- When using two types of motors with one inverter, set **Pr.450 Second applied motor**.
- The setting value "9999" (initial value) disables the second motor.
- If **Pr.450** \neq 9999, the following parameters will be enabled by turning ON the Second function selection (RT) signal.

| Function | RT signal ON (second motor) | RT signal OFF (first motor) |
|---|-----------------------------|-----------------------------|
| Electronic thermal O/L relay | Pr.51 | Pr.9 |
| Applied motor | Pr.450 | Pr.71 |
| Motor capacity | Pr.453 | Pr.80 |
| Number of motor poles | Pr.454 | Pr.81 |
| Motor excitation current | Pr.455 | Pr.82 |
| Rated motor voltage | Pr.456 | Pr.83 |
| Rated motor frequency | Pr.457 | Pr.84 |
| Motor constant (R1) | Pr.458 | Pr.90 |
| Motor constant (R2) | Pr.459 | Pr.91 |
| Motor constant (L1)/d-axis inductance (Ld) | Pr.460 | Pr.92 |
| Motor constant (L2)/q-axis inductance (Lq) | Pr.461 | Pr.93 |
| Motor constant (X) | Pr.462 | Pr.94 |
| Auto tuning setting/status | Pr.463 | Pr.96 |
| Frequency search gain | Pr.560 | Pr.298 |
| Online auto tuning selection | Pr.574 | Pr.95 |
| Induced voltage constant (phi f) | Pr.738 | Pr.706 |
| Motor Ld decay ratio | Pr.739 | Pr.711 |
| Motor Lq decay ratio | Pr.740 | Pr.712 |
| Starting resistance tuning compensation | Pr.741 | Pr.717 |
| Starting magnetic pole position detection pulse width | Pr.742 | Pr.721 |
| Maximum motor frequency | Pr.743 | Pr.702 |
| Motor inertia (integer) | Pr.744 | Pr.707 |
| Motor inertia (exponent) | Pr.745 | Pr.724 |
| Motor protection current level | Pr.746 | Pr.725 |
| Torque current/Rated PM motor current | Pr.860 | Pr.859 |

NOTE

- The RT signal is the Second function selection signal. The RT signal also enables other second functions. (Refer to page 377.)
- The RT signal is assigned to terminal RT in the initial status. Set "3" in one of **Pr.178 to Pr.189 (Input terminal function** selection) to assign the RT signal to another terminal.
- Changing the terminal assignment using **Pr.178 to Pr.189 (input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Automatic change of torque boost for the SF-PR motor

 When the SF-PR motor is selected (Pr.71 = "70, 73, or 74"), the Pr.0 Torque boost is automatically changed to enable output of the 6 Hz 150% torque under V/F control by setting Pr.81 Number of motor poles according to the number of the SF-PR motor poles.

• NOTE

- When selecting the automatic change of torque boost for the SF-PR motor, set Pr.14 Load pattern selection = "0".
- When the Pr.0 setting is changed from its initial value, the automatic change is not performed.

Automatic change of Pr.0 Torque boost and Pr.12 DC injection brake operation voltage

• When initial values are set in Pr.0 and Pr.12, the Pr.0 and Pr.12 settings are automatically changed to the values in the following table by changing the Pr.71 setting.

| Inverter | | Pr.0 value (%) after automatic change | | | | | | | Pr.12 value (%) after automatic change | | |
|------------------------|------------------------|---------------------------------------|-----------------|-----------|-----------|-----------|---------------------|-------------------------------|--|-----|--|
| | | Standard | Constant- | | SF-PR | *3 | | Standard | Constant- | SF- | |
| | motor*1 | torque motor ^{*2} | Pr.81 ≠ 2, 4, 6 | Pr.81 = 2 | Pr.81 = 4 | Pr.81 = 6 | motor ^{*1} | torque motor ^{*2} | PR ^{*3} | | |
| 00046(0.75K) | 00023(0.75K) | 6 | 6 | 4 | 7.4 | 6 | 6.4 | 4 | 4 | 4 | |
| 00077(1.5K) | 00038(1.5K) | 4 | 4 | 3 | 5.8 | 5 | 3.7 | 4 | 4 | 2.5 | |
| 00105(2.2K) | 00052(2.2K) | 4 | 4 | 2.5 | 6 | 4.5 | 3.3 | 4 | 4 | 2.5 | |
| 00167(3.7K) | 00083(3.7K) | 4 | 4 | 2.5 | 6.4 | 4.5 | 4.2 | 4 | 4 | 2.5 | |
| 00250(5.5K) | 00126(5.5K) | 3 | 2 | 2 | 4.5 | 3.7 | 3.3 | 4 | 2 | 2 | |
| 00340(7.5K) | 00170(7.5K) | 3 | 2 | 2 | 4.4 | 4.5 | 3.8 | 4 | 2 | 2 | |
| 00490(11K) | 00250(11K) | 2 | 2 | 1.5 | 3.5 | 3.3 | 3.5 | 2 | 2 | 1.5 | |
| 00630(15K) | 00310(15K) | 2 | 2 | 1.5 | 4.5 | 3 | 3.5 | 2 | 2 | 1.5 | |
| 00770(18.5K) | 00380(18.5K) | 2 | 2 | 1.5 | 4 | 3.2 | 3 | 2 | 2 | 1.5 | |
| 00930(22K) | 00470(22K) | 2 | 2 | 1.5 | 2.5 | 3.4 | 3 | 2 | 2 | 1 | |
| 01250(30K) | 00620(30K) | 2 | 2 | 1 | 3 | 2 | 2.5 | 2 | 2 | 1 | |
| 01540(37K) | 00770(37K) | 2 | 2 | 1 | 2 | 2.5 | 2.6 | 2 | 2 | 1 | |
| 01870(45K) | 00930(45K) | 1.5 | 1.5 | 1 | 2 | 2 | 2.4 | 2 | 2 | 1 | |
| 02330(55K) | 01160(55K) | 1.5 | 1.5 | 0.7 | 2 | 2 | 0.7 | 2 | 2 | 1 | |
| 03160(75K)or higher | 01800(75K)or higher | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |

*1 Pr.71 = "0, 2 to 6, 20, 23, 24, 40, 43, or 44" (standard motor)

*2 **Pr.71** = "1, 13 to 16, 50, 53, or 54" (constant-torque motor)

*3 **Pr.71** = "70, 73, or 74" (SF-PR)



- When the Pr.0 and Pr.12 settings are changed from their initial values, the automatic change is not performed.
- When the SF-PR motor is selected (Pr.71 = "70, 73, or 74"), the output current may become large due to a small load by setting Pr.81 Number of motor poles according to the number of the SF-PR motor poles.
- · When the SF-PR motor is used, the output current tends to increase compared with the case where the SF-JR or SF-HR motor is used. Depending on the load conditions, the output current may increase even though the torque boost value has been automatically changed. When the protective function such as the electronic thermal O/L relay (E.THT, E.THM) or stall prevention (OL, E.OLT) is activated, adjust the Pr.0 Torque boost according to the load.

≜ CAUTION

Make sure to set this parameter correctly according to the motor used. Incorrect setting may cause the motor and the inverter to overheat and burn.

Parameters referred to

- Pr.0 Torque boost ☞ page 551 Pr.12 DC injection brake operation voltage ☞ page 560 Pr.14 Load pattern selection ☞ page 554 Pr.96 Auto tuning setting/status ☞ page 554
- Pr.100 to Pr.109 (Adjustable 5 points V/F) F page 558
- Pr.178 to Pr.189 (Input terminal function selection) F page 373
- Pr.684 Tuning data unit switchover F page 383

5.10.2 Offline auto tuning for an induction motor

Magnetic flux

The offline auto tuning enables the optimal operation of a motor.

• Under Advanced magnetic flux vector control, automatic measurement of motor constants (offline auto tuning) enables optimal operation of motors even when motor constants vary, when a motor of another company is used, or when the wiring distance is long.

For the offline auto tuning for a PM motor, refer to page 392.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|--------------------------------|-------------------------|--|---|
| 684 | Tuning data unit | 0 | 0 | Internal data converted value |
| C000 | switchover | U | 1 | The value is indicated in A, Ω , mH, or %. |
| 71 C100 | Applied motor | 0 | 0 to 6, 13 to 16, 20, 23, 24, 40, 43, 44, 50, 53, 54, 70, 73, 74, 210, 213, 214, 240, 243, 244, 8090, 8093, 8094, 9090, 9093, 9094 | By selecting a motor, the thermal characteristic and motor constant of each motor are set. |
| 80 | | | 0.4 to 55 kW ^{*1} | Set the applied motor capacity. |
| C101 | Motor capacity | 9999 | 0 to 3600 kW ^{*2} | |
| | | | 9999 | V/F control |
| 81 | Number of motor | 9999 | 2, 4, 6, 8, 10, 12 | Set the number of motor poles. |
| C102 | poles | | 9999 | V/F control |
| 9 | Electronic | Inverter rated | 0 to 500 A ^{*1} | Set the rated motor current. |
| C103 | thermal O/L relay | current | 0 to 3600 A ^{*2} | |
| 83 C104 | Rated motor voltage | 200/400 V ^{*3} | 0 to 1000 V | Set the rated motor voltage (V). |
| 84 | Rated motor | 9999 | 10 to 400 Hz | Set the rated motor frequency (Hz). |
| C105 | frequency | 5555 | 9999 | The setting value of Pr.3 Base frequency is used. |
| 707 C107 | Motor inertia (integer) | 9999 | 10 to 999, 9999 | Set the motor inertia. 9999: The constant value of Mitsubishi Electric motor (SF-JR, |
| 724 C108 | Motor inertia (exponent) | 9999 | 0 to 7, 9999 | SF-HR, SF-JRCA, or SF-HRCA and so on) is used. |
| | | | 0 | No offline auto tuning |
| 96 | Auto tuning | 0 | 1 | Offline auto tuning is performed without the motor rotating. |
| C110 | setting/status | 0 | 11 | Offline auto tuning is performed without the motor rotating (V/F control, IPM motor MM-EFS/MM-THE4). (Refer to page 474.) |
| | | | 101 | Offline auto tuning is performed with the motor rotating. |
| 90 | Motor constant | 9999 | 0 to 50 Ω, 9999 ^{*1*4} | |
| C120 | (R1) | 5555 | 0 to 400 mΩ, 9999 ^{*2*4} | |
| 91 | Motor constant | 9999 | 0 to 50 Ω, 9999 ^{*1*4} | |
| C121 | (R2) | 9999 | 0 to 400 mΩ, 9999 ^{*2*4} | |
| 92 | Motor constant | 9999 | 0 to 6000 mH, 9999 ^{*1*4} | |
| C122 | (L1)/d-axis inductance (Ld) | 9999 | 0 to 400 mH, 9999 ^{*2*4} | Tuning data |
| 93 | Motor constant | | 0 to 6000 mH, 9999 ^{*1*4} | (The value measured by offline auto tuning is automatically set.) |
| C123 | (L2)/q-axis inductance (Lq) | 9999 | 0 to 400 mH, 9999 ^{*2*4} | 9999: The constant value of Mitsubishi Electric motor (SF-PR, SF-JR, SF-HR, SF-JRCA, SF-HRCA and so on) is used. |
| 94 C124 | Motor constant (X) | 9999 | 0 to 100%, 9999 ^{*4} | |
| 82 | Motor excitation | 9999 | 0 to 500 A, 9999 ^{*1*4} | |
| C125 | C125 current | | 0 to 3600 A, 9999 ^{*2*4} | |
| 859 | Torque current/ | 0000 | 0 to 500 A, 9999 ^{*1*4} | |
| C126 | Rated PM motor current | 9999 | 0 to 3600 A, 9999 ^{*2*4} | |
| 298 | Frequency search | 9999 | 0 to 32767 | The offline auto tuning automatically sets the gain required for the frequency search. |
| A711 | gain | | 9999 | The constant value of Mitsubishi Electric motor (SF-PR, SF-JR, SF-HR, SF-JRCA, SF-HRCA and so on) is used. |

| Pr. | Name | Initial value | Setting range | Description |
|-------------|---|-------------------------|--|---|
| 450 C200 | Second applied motor | 9999 | 0, 1, 3 to 6, 13 to 16, 20, 23, 24, 40, 43, 44, 50, 53, 54, 70, 73, 74, 210, 213, 214, 240, 243, 244, 8090, 8093, 8094, 9090, 9093, 9094 | Set this parameter when using the second motor (the same specifications as Pr.71). |
| | | | 9999 | The function is disabled. |
| 453 | Second motor | | 0.4 to 55 kW ^{*1} | Set the capacity of the second motor. |
| C201 | capacity | 9999 | 0 to 3600 kW ^{*2} | |
| | | | 9999 | V/F control |
| 454 | Number of second motor | 9999 | 2, 4, 6, 8, 10, 12 | Set the number of poles of the second motor. |
| C202 | poles | 0000 | 9999 | V/F control |
| | | | 0 to 500 A ^{*1} | This function is enabled when the RT signal is ON. |
| 51 C203 | Second electronic thermal O/L relay | 9999 | 0 to 3600 A ^{*2} | Set the rated motor current. |
| | | | 9999 | Second electronic thermal O/L relay disabled. |
| 456 C204 | Rated second motor voltage | 200/400 V ^{*3} | 0 to 1000 V | Set the rated voltage (V) of the second motor. |
| 457 | Rated second | 9999 | 10 to 400 Hz | Set the rated frequency (Hz) of the second motor. |
| C205 | motor frequency | | 9999 | The Pr.84 Rated motor frequency setting is used. |
| 744 C207 | Second motor inertia (integer) | 9999 | 10 to 999, 9999 | Set the inertia of the second motor. 9999: The constant value of Mitsubishi Electric motor (SF-PR, |
| 745 C208 | Second motor inertia (exponent) | 9999 | 0 to 7, 9999 | SF-JR, SF-HR, SF-JRCA, SF-HRCA and so on) is used. |
| | | | 0 | No auto tuning for the second motor. |
| 463 | Second motor auto tuning | 0 | 1 | Offline auto tuning is performed without the second motor rotating. |
| C210 | setting/status | | 11 | Offline auto tuning is performed without the motor rotating (V/F control, IPM motor MM-EFS/MM-THE4). (Refer to page 474.) |
| | | | 101 | Offline auto tuning is performed with the second motor rotating. |
| 458 | Second motor | 9999 | 0 to 50 Ω, 9999 ^{*1*4} | |
| C220 | constant (R1) | | 0 to 400 mΩ, 9999 ^{*2*4} | |
| 459 | Second motor | 9999 | 0 to 50 Ω, 9999 ^{*1*4} | |
| C221 | constant (R2) | | 0 to 400 mΩ, 9999 ^{*2*4} | |
| 460 | Second motor | | 0 to 6000 mH, 9999 ^{*1*4} | |
| 400 C222 | constant (L1) / d- axis inductance (Ld) | 9999 | 0 to 400 mH, 9999 ^{*2*4} | Turken data af the second materia |
| | Second motor | | 0 to 6000 mH, 9999 ^{*1*4} | Tuning data of the second motor (The value measured by offline auto tuning is automatically |
| 461 C223 | constant (L2) / q- axis inductance | 9999 | | set.) |
| 0220 | (Lq) | | 0 to 400 mH, 9999 ^{*2*4} | 9999: The constant value of Mitsubishi Electric motor (SF-PR, SF-JR, SF-HR, SF-JRCA, SF-HRCA and so on) is used. |
| 462 C224 | Second motor constant (X) | 9999 | 0 to 100%, 9999 ^{*4} | |
| 455 | Second motor | 9999 | 0 to 500 A, 9999 ^{*1*4} | |
| C225 | | | 0 to 3600 A, 9999 ^{*2*4} | |
| | Second motor | | 0 to 500 A, 9999*1*4 | |
| 860 C226 | torque current/ Rated PM motor current | 9999 | 0 to 3600 A, 9999*2*4 | |
| 500 | Second | | 0 to 32767 | The offline auto tuning automatically sets the gain required for the frequency search of the second motor. |
| 560 A712 | frequency search gain | 9999 | 9999 | The constant value of Mitsubishi Electric motor (SF-PR, SF-JR, SF-HR, SF-JRCA, SF-HRCA and so on) is used for the second motor. |

*1 For the FR-F820-02330(55K) or lower and FR-F840-01160(55K) or lower.

*2 For the FR-F820-03160(75K) or higher and FR-F840-01800(75K) or higher.

*3 The initial value differs according to the voltage class (200 V / 400 V).

 $^{\star}4$ $\,$ The setting range and unit change according to the $\ensuremath{\mbox{Pr.71}}$ (Pr.450) setting.



- The function is enabled under Advanced magnetic flux vector control.
- By using the offline auto tuning function, the optimum operation characteristics are obtained for a motor other than Mitsubishi Electric standard motors (SF-JR 0.4 kW or higher), high-efficiency motors (SF-HR 0.4 kW or higher), Mitsubishi Electric constant-torque motors (SF-JRCA 4P, SF-HRCA 0.4 kW to 55 kW), or Mitsubishi Electric high-performance energy-serving motor (SF-PR), such as an induction motor of other manufacturers, SF-JRC, or SF-TH, or with a long wiring length (30 m or longer).
- Tuning is enabled even when a load is connected to the motor.
- Offline auto tuning is performed without the motor rotating (**Pr.96** = "1") or with the motor rotating (**Pr.96** = "101"). The tuning is more accurate when the motor rotates.
- Reading/writing of the motor constants tuned by offline auto tuning are enabled. The offline auto tuning data (motor constants) can be copied to another inverter using the operation panel.
- · The offline auto tuning status can be monitored on the operation panel or the parameter unit.

Before performing offline auto tuning

Check the following points before performing offline auto tuning:

- A value other than "9999" is set in Pr.80 and Pr.81, and Advanced magnetic flux vector control is selected.
- A motor is connected. (Check that the motor is not rotated by an external force during tuning.)
- For the motor capacity, the rated motor current should be equal to or less than the rated inverter current. (The motor capacity must be 0.4 kW or higher.) If a motor with substantially low rated current compared with the inverter rated current, however, is used, speed and torque accuracies may deteriorate due to torque ripples, etc. Set the rated motor current to about 40% or higher of the inverter rated current.
- Tuning is not available for a high-slip motor, high-speed motor, or special motor.
- The maximum frequency is 400 Hz.
- The motor may rotate slightly even if offline auto tuning is performed without the motor rotating (Pr.96 Auto tuning setting/ status = "1"). (The slight motor rotation does not affect the tuning performance.)
 Fix the motor securely with a mechanical brake, or before tuning, make sure that it is safe even if the motor rotates. (Caution is required especially in vertical lift applications.)
- Check the following points for offline auto tuning with the motor rotating (Pr.96 Auto tuning setting/status = "101").

Torque is not sufficient during tuning.

The motor can be rotated up to the speed close to the rated speed.

The mechanical brake is released.

• Offline auto tuning is not performed correctly when the surge voltage suppression filter (FR-ASF-H/FR-BMF-H) is inserted between the inverter and motor. Be sure to remove it before performing tuning.

Setting

• To perform tuning, set the following parameters about the motor.

| First motor Pr. | Second motor Pr. | Name | Initial value | Description |
|-----------------------|------------------------|--------------------------------|-----------------------------|--|
| 80 | 453 | Motor capacity | 9999 (V/F control) | Set the motor capacity (kW). |
| 81 | 454 | Number of motor poles | 9999 (V/F control) | Set the number of motor poles (2 to 12). |
| 9 | 51 | Electronic thermal O/L relay | Inverter rated current | Set the rated motor current (A). |
| 83 | 456 | Rated motor voltage | 200 V / 400 V ^{*1} | Set the rated motor voltage (V) printed on the motor's rating plate. |
| 84 | 457 | Rated motor frequency | 9999 | Set the rated motor frequency (Hz). When the setting is "9999", the Pr.3 Base frequency setting is used. |
| 71 | 450 | Applied motor | 0 (standard motor) | Set this parameter according to the motor. Three types of motor constant setting ranges, units and tuning data can be stored according to settings. |
| 96 | 463 | Auto tuning setting/ status | 0 | Set "1" or "101". 1: Tuning is performed without the motor rotating. (Excitation noise occurs at this point.) 101: Tuning is performed with the motor rotating. The motor can rotate up to the speed near the rated motor frequency. |

*1 The initial value differs according to the voltage class (200/400 V).

*2 Set **Pr.71 Applied motor** according to the motor to be used and the motor constant setting range. According to the **Pr.71** setting, the range of the motor constant parameter setting values and units can be changed. (For other setting values of **Pr.71**, refer to page 379.)

| | | Pr.71 setting | | | |
|--|---|--|--|--|--|
| | Motor | Motor constant parameter mH, %, and A unit setting | Motor constant parameter internal data setting | Motor constant parameter Ω, mΩ, and A unit setting | |
| Mitsubishi Electric | SF-JR, SF-TH | 0 (initial value) | 3 (4) | — | |
| standard motor | SF-JR 4P 1.5 kW or lower | 20 | 23 (24) | — | |
| Mitsubishi Electric | SF-HR | 40 | 43 (44) | — | |
| Mitsubishi Electric high-efficiency motor Mitsubishi Electric constant-torque motor Mitsubishi Electric high-performance energy-saving motor Other manufacturer's standard motor | Others | 0 (initial value) | 3 (4) | — | |
| Mitsubishi Electric | SF-JRCA 4P, SF-TH (constant- torque) | 1 | 13 (14) | — | |
| constant-torque motor | SF-HRCA | 50 | 53 (54) | — | |
| | Others (SF-JRC, etc.) | 1 | 13 (14) | — | |
| high-performance | SF-PR | 70 | 73 (74) | _ | |
| | _ | 0 (initial value) | 3 (4) | 5 (wye connection motor) 6 (delta connection motor) | |
| Other manufacturer's constant-torque motor | _ | 1 | 13 (14) | 15 (wye connection motor) 16 (delta connection motor) | |

- When Pr.11 DC injection brake operation time = "0" or Pr.12 DC injection brake operation voltage = "0", offline auto tuning is performed at the initial setting of Pr.11 or Pr.12.
- If "wye connection" or "delta connection" is incorrectly selected in **Pr.71**, Advanced magnetic flux vector control is not performed properly.
- For tuning accuracy improvement, set the following parameters when the motor constants are known in advance.

| First motor Pr. | Second motor Pr. | Name | Mitsubishi Electric motor (SF-JR, SF-HR, SF-JRCA, or SF- HRCA) | Other motors |
|--------------------|---------------------|--------------------------|---|--|
| 707 | 744 | Motor inertia (integer) | 0000 (initial value) | Motor inertia ^{*3} |
| 724 | 745 | Motor inertia (exponent) | 9999 (initial value) | Jm = Pr.707 × 10^(-Pr.724) (kg⋅m²) |

*3 The setting is valid only when a value other than "9999" is set in both Pr.707 (Pr.744) and Pr.724 (Pr.745).

Performing tuning

Point P

• Before performing tuning, check the monitor display of the operation panel or parameter unit if the inverter is in the state ready for tuning. The motor starts by turning ON the start command while tuning is unavailable.

• In the PU operation mode, press **FWD** / **REV** on the operation panel.

For External operation, turn ON the start command (STF signal or STR signal). Tuning starts.



- Satisfy the required inverter start conditions to start offline auto tuning. For example, stop the input of the MRS signal.
- To force tuning to end, use the MRS or RES signal or STOP on the

on the operation panel.

- (Turning OFF the start signal (STF signal or STR signal) also ends tuning.)
- During offline auto tuning, only the following I/O signals are valid (initial value).
 Input terminals <valid signals>: STP (STOP), OH, MRS, RT, RES, STF, STR, S1, and S2
 Output terminals: RUN, OL, IPF, FM/CA, AM, A1B1C1, and So (SO)
- When the rotation speed and the output frequency are selected for terminals FM/CA and AM, the progress status of offline auto tuning is output in 15 steps from FM/CA and AM.
- Do not perform ON/OFF switching of the Second function selection (RT) signal during offline auto tuning. Auto tuning will not be performed properly.
- When the offline auto tuning with motor rotation is selected (**Pr.96 Auto tuning setting/status** = "101"), take caution and ensure safety against the rotation of the motor.
- Since the Inverter running (RUN) signal turns ON when tuning is started, pay close attention especially when a sequence which releases a mechanical brake by the RUN signal has been designed.
- When executing offline auto tuning, input the operation command after switching ON the main circuit power (R/L1, S/L2, T/L3) of the inverter.
- While Pr.79 Operation mode selection = "7", turn ON the PU operation external interlock (X12) signal for tuning in the PU operation mode.
- During tuning, the monitor is displayed on the operation panel as follows.

| Tuning status | Operation panel (| FR-DU08) display | LCD operation panel (FR-LU08) display | | |
|--------------------------|--|--|---|---|--|
| runnig status | Pr.96 = 1 | Pr.96 = 101 | Pr.96 = 1 | Pr.96 = 101 | |
| (1) Setting | PU - MON - M - EXT - PRM - NET - RRUN | HI HI HI HI HI HI HI HI HI HI | AutoTune 12:34 TUNE 1 STOP PU PREV NEXT | AutoTune 12:34 TUNE 1 101 STOP PU PREV NEXT | |
| (2) During tuning | PU -MON -M -KT -PRIM -M | HI - PU - MON - IN - DU - POIN - NET - ROIN | AutoTune 12:34 TUNE IIIIII 2 STF FWD PU PREV NEXT | AutoTune 12:34 TUNE '102 STF FWD PU PREV NEXT | |
| (3) Normal completion | PU - MON - M - PU - PRM - M - REM - PRM - M - NET - PRM - M - REM - REM - M - REM - R | HU MON PM - KAT PRAN PM NOTE SET ESC SOND | AutoTune 12:34 TUNE Completed 3 STF STOP PU PREV NEXT | AutoTune 12:34 TINE Completed 103 STF STOP PU PREV NEXT | |

· Note: Offline auto tuning time (with the initial setting)

| Offline auto tuning setting | Time |
|---|---|
| No motor rotation (Pr.96 = "1") | About 25 to 120 s (The time depends on the inverter capacity and motor type.) |
| With motor rotation (Pr.96 = "101") | About 40 s (The following offline auto tuning time is set according to the acceleration/deceleration time setting. Offline auto tuning time = acceleration time + deceleration time + about 30 s) |

• When offline auto tuning ends, press on the operation panel during PU operation. For External operation, turn OFF

the start signal (STF signal or STR signal).

This operation resets the offline auto tuning, and the PU's monitor display returns to the normal indication.

(Without this operation, next operation cannot be started.)

- The motor constants measured once during offline auto tuning are stored as parameters and their data are held until offline auto tuning is performed again. However, the tuning data is cleared when performing All parameter clear.
- Changing **Pr.71 (Pr.450)** after tuning completion will change the motor constant. For example, if "3" is set in **Pr.71** after tuning is performed with **Pr.71** = "0", the tuning data becomes invalid. To use the tuned data, set "0" again in **Pr.71**.

• If offline auto tuning has ended in error (see the following table), motor constants are not set. Perform an inverter reset and perform tuning again.

| Error display | Error cause | Countermeasures |
|---------------|---|---|
| 8 | Forced end | Set Pr.96 = "1 or 101" and try again. |
| 9 | Inverter protective function operation | Make the setting again. |
| 91 | The current limit (stall prevention) function is activated. | Set the acceleration/deceleration time longer. Set Pr.156 Stall prevention operation selection = "1". |
| 92 | The converter output voltage fell to 75% of the rated voltage. | Check for the power supply voltage fluctuation. Check the Pr.83 Rated motor voltage setting. |
| 93 | Calculation error. The motor is not connected. | Check the Pr.83 and Pr.84 settings. Check the motor wiring and make the setting again. |
| 94 | Rotation tuning frequency setting error (The frequency command for the tuning was given to exceed the maximum frequency setting, or to be in the frequency jump range.) | Check the Pr.1 Maximum frequency and Pr.31 to Pr.36 Frequency jump settings. |

- When tuning is ended forcibly by pressing FIOP tuning does not end properly. (The motor constants have not been set.) Perform an inverter reset and perform tuning again.
- When the rated power supply of the motor is 200/220 V (400/440 V) 60 Hz, set the rated motor current multiplied by 1.1 in **Pr.9 Electronic thermal O/L relay** after tuning is complete.
- For a motor with a PTC thermistor, thermal protector, or other thermal detector, set "0" (motor overheat protection by inverter invalid) in **Pr.9** to protect the motor from overheating.

NOTE

- An instantaneous power failure occurring during tuning will result in a tuning error. After power is restored, the inverter starts normal operation. Therefore, when the STF (STR) signal is ON, the motor starts forward (reverse) rotation.
- Any fault occurring during tuning is handled as in the normal operation. However, if the retry function is set, no retry is performed.
- The set frequency monitor displayed during the offline auto tuning is 0 Hz.

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- Note that the motor may start running suddenly.
- For performing offline auto tuning with the motor rotating in vertical lift applications, etc., caution is required to avoid falling due to insufficient torque.

Changing the motor constants

- The motor constants can be set directly when the motor constants are known in advance, or by using the data measured during offline auto tuning.
- According to the **Pr.71 (Pr.450)** setting, the range of the motor constant parameter setting values and units can be changed. The changed settings are stored in the EEPROM as the motor constant parameters.

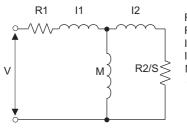
Changing the motor constants (when setting the Pr.92 and Pr.93 motor constants in units of mH)

• Set Pr.71 as follows.

| Motor | Pr.71 setting | |
|---|--------------------------|-------------------|
| Miteuchishi Electric standard meter | SF-JR | 0 (initial value) |
| Mitsubishi Electric standard motor Mitsubishi Electric high-efficiency motor | SF-JR 4P 1.5 kW or lower | 20 |
| | SF-HR | 40 |
| Mitsubishi Electric constant-torque motor | SF-JRCA 4P | 1 |
| Milisubishi Electric constant-torque motor | SF-HRCA | 50 |
| Mitsubishi Electric high-performance energy-saving motor | SF-PR | 70 |

• Use the following formula to find the Pr.94 setting value and set a desired value as the motor constant parameter.

The setting value of **Pr.94** =
$$(1 - \frac{M^2}{L1 \times L2}) \times 100(\%)$$



R1: Primary resistance R2: Secondary resistance I1: Primary leakage inductance I2: Secondary leakage inductance M: Excitation inductance S: Slip L1= I1+ M: Primary inductance L2= I2+ M: Secondary inductance

Equivalent circuit diagram of the motor

| First motor Pr. | Second motor Pr. | Name | Setting range | Setting increments | Initial value |
|--------------------|---------------------|--|----------------------------------|-----------------------|---------------|
| 82 | 455 | Motor excitation current (no load | 0 to 500 A, 9999 ^{*1} | 0.01 A ^{*1} | |
| 02 | 455 | current) | 0 to 3600 A, 9999 ^{*2} | 0.1 A ^{*2} | |
| 90 | 459 | Mater constant (D1) | 0 to 50 Ω, 9999 ^{*1} | 0.001 Ω ^{*1} | |
| 90 | 458 | Motor constant (R1) | 0 to 400 mΩ, 9999 ^{*2} | 0.01 mΩ ^{*2} | |
| 91 | 450 | Mater constant (D2) | 0 to 50 Ω, 9999 ^{*1} | 0.001 Ω ^{*1} | |
| 91 | 459 | Motor constant (R2) | 0 to 400 mΩ, 9999 ^{*2} | 0.01 mΩ ^{*2} | |
| 92 | 460 | Motor constant (L1)/d-axis inductance (Ld) | 0 to 6000 mH, 9999 ^{*1} | 0.1 mH ^{*1} | |
| 92 | 460 | | 0 to 400 mH, 9999 ^{*2} | 0.01 mH ^{*2} | 9999 |
| 00 | 464 | Motor constant (L2)/q-axis | 0 to 6000 mH, 9999 ^{*1} | 0.1 mH ^{*1} | |
| 93 461 | 401 | inductance (Lq) | 0 to 400 mH, 9999 ^{*2} | 0.01 mH ^{*2} | |
| 94 | 460 | Mater constant (X) | 00/ 1 1000/ 0000 | 0.1% ^{*1} | |
| 94 462 | 402 | Motor constant (X) | 0% to 100%, 9999 | 0.01% ^{*2} | 1 |
| 859 86 | 969 | Torque current/Rated PM motor | 0 to 500 A, 9999 ^{*1} | 0.01 A ^{*1} | |
| | 800 | current | 0 to 3600 A, 9999 ^{*2} | 0.1 A ^{*2} | |
| 298 | 560 | Frequency search gain | 0 to 32767, 9999 | 1 | |

*1 For the FR-F820-02330(55K) or lower, and FR-F840-01160(55K) or lower.

*2 For the FR-F820-03160(75K) or higher, and FR-F840-01800(75K) or higher.

🗖 NOTE

• If "9999" is set, tuning data will be invalid and the constant values for Mitsubishi Electric motors (SF-PR, SF-JR, SF-HR, SF-JRCA, SF-HRCA and so on) are used.

Changing the motor constants (when setting motor constants in the internal data of the inverter)

• Set Pr.71 as follows.

| Moto | Pr.71 setting | |
|--|-------------------------------------|---------|
| | SF-JR, SF-TH | 3 (4) |
| Mitsubishi Electric standard motor | SF-JR 4P 1.5 kW or lower | 23 (24) |
| Mitsubishi Electric high-efficiency motor | SF-HR | 43 (44) |
| | Others | 3 (4) |
| | SF-JRCA 4P, SF-TH (constant-torque) | 13 (14) |
| Mitsubishi Electric constant-torque motor | SF-HRCA | 53 (54) |
| | Others (SF-JRC, etc.) | 13 (14) |
| Mitsubishi Electric high-performance energy- saving motor | SF-PR | 73 (74) |
| Other manufacturer's standard motor | — | 3 (4) |
| Other manufacturer's constant-torque motor | — | 13 (14) |

• Set desired values as the motor constant parameters. The display units of the read motor constants can be changed with **Pr.684 Tuning data unit switchover**. Setting **Pr.684** = "1" disables parameter setting changes.

| Einst motor | Second | | Pr.684 = 0 (in | itial value) | Pr.684 = | 1 | Initial |
|--------------------|-----------|--------------------------|------------------|-----------------------|----------------------------------|-----------------------|------------------|
| First motor Pr. | motor Pr. | Name | Setting range | Setting increments | Range indication | Unit indication | Initial value |
| 82 | 455 | Motor excitation current | | | 0 to 500 A, 9999 ^{*1} | 0.01 A ^{*1} | |
| 02 | 400 | | | | 0 to 3600 A, 9999 ^{*2} | 0.1 A ^{*2} | |
| 90 | 458 | Motor constant (R1) | | | 0 to 50 Ω, 9999 ^{*1} | 0.001 Ω ^{*1} | |
| 90 | 400 | | | | 0 to 400 mΩ, 9999 ^{*2} | 0.01 mΩ ^{*2} | |
| 91 | 459 | Motor constant (R2) | | | 0 to 50 Ω, 9999 ^{*1} | 0.001 Ω ^{*1} | |
| 91 | 459 IV | | | | 0 to 400 mΩ, 9999 ^{*2} | 0.01 mΩ ^{*2} | |
| 92 | 460 | Motor constant (L1)/d- | 0 to ***, 9999 | 1 | 0 to 6000 mH, 9999 ^{*1} | 0.1 mH ^{*1} | |
| 52 | 400 | axis inductance (Ld) | 0.00 , 0000 | , | 0 to 400 mH, 9999 ^{*2} | 0.01 mH ^{*2} | 9999 |
| 93 | 461 | Motor constant (L2)/q- | | | 0 to 6000 mH, 9999 ^{*1} | 0.1 mH ^{*1} | |
| 90 | 401 | axis inductance (Lq) | | | 0 to 400 mH, 9999 ^{*2} | 0.01 mH ^{*2} | |
| 94 | 462 | | | | 0 to 100%, 9999 | 0.1% ^{*1} | |
| 34 | 402 | Motor constant (X) | | | 0 10 100 %, 9999 | 0.01% ^{*2} | |
| 859 | 860 | Torque current/Rated | | | 0 to 500 A, 9999 ^{*1} | 0.01 A ^{*1} | |
| 039 | 000 | PM motor current | | | 0 to 3600 A, 9999 ^{*2} | 0.1 A ^{*2} | |
| 298 | 560 | Frequency search gain | 0 to 32767, 9999 | 1 | 0 to 32767, 9999 | 1 | |

*1 For the FR-F820-02330(55K) or lower, and FR-F840-01160(55K) or lower.

*2 For the FR-F820-03160(75K) or higher, and FR-F840-01800(75K) or higher.

- As the motor constants measured in the offline auto tuning have been converted into internal data (****), refer to the following setting example when making setting.
 - Setting example: To slightly increase the **Pr.90** value (5%) When "2516" is displayed for **Pr.90**, set 2642 (2516 × 1.05 = 2641.8) in **Pr.90**. (The value displayed has been converted into a value for internal use. Therefore, simple addition of a value to the displayed value does not bring the desired effect.)
- If "9999" is set, tuning data will be invalid and the constant values for Mitsubishi Electric motors (SF-PR, SF-JR, SF-HR, SF-JRCA, SF-HRCA and so on) are used.

\clubsuit Changing the motor constants (when setting the Pr.92, Pr.93, and Pr.94 motor constants in units of Ω)

• Set Pr.71 as follows.

| Applied motor | Pr.71 setting | | |
|-----------------------|----------------------|------------------------|--|
| Applied motor | Wye connection motor | Delta connection motor | |
| Standard motor | 5 | 6 | |
| Constant-torque motor | 15 | 16 | |

· Set desired values as the motor constant parameters.

Iq = torque current, I100 = rated current, I0 = no load current

$$Iq = \sqrt{100^2 - 10^2}$$

| Firstmotor Pr. | Second motor Pr. | Name | Setting range | Setting increments | Initial value |
|-------------------|---------------------|-------------------------------|----------------------------------|-----------------------|---------------|
| 82 | 455 | Motor excitation current (no | 0 to 500 A, 9999 ^{*1} | 0.01 A ^{*1} | |
| 02 | 400 | load current) | 0 to 3600 A, 9999 ^{*2} | 0.1 A ^{*2} | |
| 90 | 458 | Motor constant (r1) | 0 to 50 Ω, 9999 ^{*1} | 0.001 Ω ^{*1} | |
| 90 | 400 | | 0 to 400 mΩ, 9999 ^{*2} | 0.01 mΩ ^{*2} | |
| 91 | 459 | Motor constant (r2) | 0 to 50 Ω, 9999 ^{*1} | 0.001 Ω ^{*1} | |
| 31 | 439 | | 0 to 400 mΩ, 9999 ^{*2} | 0.01 mΩ ^{*2} | |
| 02 | 92 460 | Motor constant (x1) | 0 to 50 Ω, 9999 ^{*1} | 0.001 Ω ^{*1} | 9999 |
| 92 | | | 0 to 3600 mΩ, 9999 ^{*2} | 0.1 mΩ ^{*2} | |
| 93 | 461 | Motor constant (x2) | 0 to 50 Ω, 9999 ^{*1} | 0.001 Ω ^{*1} | |
| 90 | 401 | | 0 to 3600 mΩ, 9999 ^{*2} | 0.1 mΩ ^{*2} | |
| 94 | 94 462 | Motor constant (xm) | 0 to 500 Ω, 9999 ^{*1} | - 0.01 Ω | |
| 54 | 402 | | 0 to 100 Ω, 9999 ^{*2} | 0.01 12 | |
| 859 | 859 860 | Torque current/Rated PM motor | 0 to 500 A, 9999 ^{*1} | 0.01 A ^{*1} | |
| 009 | 000 | current | 0 to 3600 A, 9999 ^{*2} | 0.1 A ^{*2} | |
| 298 | 560 | Frequency search gain | 0 to 32767, 9999 | 1 | |

*1 For the FR-F820-02330(55K) or lower, and FR-F840-01160(55K) or lower.

*2 For the FR-F820-03160(75K) or higher, and FR-F840-01800(75K) or higher.

- If "wye connection" or "delta connection" is incorrectly selected in Pr.71, Advanced magnetic flux vector control is not performed properly.
- If "9999" is set, tuning data will be invalid and the constant values for Mitsubishi Electric motors (SF-PR, SF-JR, SF-HR, SF-JRCA, SF-HRCA and so on) are used.

Tuning the second motor

- When one inverter switches the operation between two different motors, set the second motor in **Pr.450 Second applied motor**. (Refer to page 379.) In the initial setting, no second motor is applied.
- Turning ON the RT signal enables the parameter settings for the second motor as follows.

| Function | RT signal-ON (second motor) | RT signal-OFF (first motor) |
|--|--------------------------------|--------------------------------|
| Motor capacity | Pr.453 | Pr.80 |
| Number of motor poles | Pr.454 | Pr.81 |
| Motor excitation current | Pr.455 | Pr.82 |
| Rated motor voltage | Pr.456 | Pr.83 |
| Rated motor frequency | Pr.457 | Pr.84 |
| Motor constant (R1) | Pr.458 | Pr.90 |
| Motor constant (R2) | Pr.459 | Pr.91 |
| Motor constant (L1)/d-axis inductance (Ld) | Pr.460 | Pr.92 |
| Motor constant (L2)/q-axis inductance (Lq) | Pr.461 | Pr.93 |
| Motor constant (X) | Pr.462 | Pr.94 |
| Auto tuning setting/status | Pr.463 | Pr.96 |
| Frequency search gain | Pr.560 | Pr.298 |



- The RT signal is assigned to terminal RT in the initial status. Set "3" in one of **Pr.178 to Pr.189 (Input terminal function** selection) to assign the RT signal to another terminal.
- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

5.10.3 Offline auto tuning for a PM motor (motor constant tuning)

PM

The offline auto tuning enables the optimal operation of a PM motor.

 Automatic measurement of motor constants (offline auto tuning) enables optimal operation of motors for PM motor control even when motor constants vary or when the wiring distance is long. IPM and SPM motors other than the MM-EFS or MM-THE4 IPM motor can also be used.

For the offline auto tuning under Advanced magnetic flux vector control, refer to page 383.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|-----------------------------|-------------------------|---|---|
| 684 | Tuning data unit | 0 | 0 | Internal data converted value |
| C000 | switchover | | 1 | The value is indicated in A, Ω , mH, or mV. |
| 71 C100 | Applied motor | 0 | 0 to 6, 13 to 16, 20, 23, 24, 40, 43, 44, 50, 53, 54, 70, 73, 74, 210, 213, 214, 240, 243, 244, 8090, 8093, 8094, 9090, 9093, 9094 | By selecting a motor, the thermal characteristic and motor constant of each motor are set. |
| | | | 0.4 to 55 kW ^{*1} | Set the applied motor capacity. |
| 80 C101 | Motor capacity | 9999 | 0 to 3600 kW ^{*2} | Set the applied motor capacity. |
| 0.01 | | | 9999 | V/F control |
| 81 | Number of motor | 0000 | 2, 4, 6, 8, 10, 12 | Set the number of motor poles. |
| C102 | poles | 9999 | 9999 | V/F control |
| 9 | Electronic thermal O/ | Inverter | 0 to 500 A ^{*1} | |
| C103 | L relay | rated current | 0 to 3600 A ^{*2} | Set the rated motor current. |
| 83 C104 | Rated motor voltage | 200/400 V ^{*3} | 0 to 1000 V | Set the rated motor voltage (V). |
| | | | 10 to 400 Hz | Set the rated motor frequency (Hz). |
| 84 C105 | | | 9999 | The MM-EFS or MM-THE4 constant is used when the IPM motor MM-EFS or MM-THE4 is selected, and the inverter internal data is used when a PM motor other than MM-EFS or MM-THE4 is selected. Use the correct setting according to the motor specification. |
| | | | 0 to 400 Hz | Set the permissible speed (frequency) of the motor. |
| 702 C106 | Maximum motor frequency | 9999 | 9999 | The maximum frequency of MM-EFS/MM-THE4 is used when the IPM motor MM-EFS or MM-THE4 is selected, and the Pr.84 setting is used when a PM motor other than the MM-EFS or MM-THE4 is selected. |
| 707 C107 | Motor inertia (integer) | 9999 | 10 to 999, 9999 | Set the motor inertia. 9999: Uses MM-EFS/MM-THE4 inertia for the IPM motor MM- |
| 724 C108 | Motor inertia (exponent) | 9999 | 0 to 7, 9999 | EFS/MM-THE4. |
| | | | 0, 101 | No offline auto tuning |
| 96 C110 | Auto tuning setting/ | 0 | 1 | Offline auto tuning is performed without the motor rotating (motor other than IPM motor MM-EFS or MM-THE4). |
| C110 status | | | 11 | Offline auto tuning is performed without the motor rotating (V/F control, IPM motor MM-EFS/MM-THE4). |

| Pr. | Name | Initial value | Setting range | Description |
|--------------|---|-------------------------|---|---|
| 90 | Motor constant (R1) | 9999 | 0 to 50 Ω, 9999 ^{*1*4} | |
| C120 | | 3333 | 0 to 400 mΩ, 9999 ^{*2*4} | Tuning data |
| 92 | Motor constant (L1)/d- | 9999 | 0 to 500 mH, 9999 ^{*1*4} | (The value measured by offline auto tuning is automatically |
| C122 | axis inductance (Ld) | 3333 | 0 to 50 mH, 9999 ^{*2*4} | set.) 9999: The MM-EFS/MM-THE4 constant is used when the IPM |
| 93 | Motor constant (L2)/q- | 9999 | 0 to 500 mH, 9999 ^{*1*4} | motor MM-EFS/MM-THE4 is selected, and the inverter internal |
| C123 | axis inductance (Lq) | 5555 | 0 to 50 mH, 9999 ^{*2*4} | data is used when a PM motor other than the MM-EFS or MM- THE4 is selected. |
| 859 | Torque current/Rated | 9999 | 0 to 500 A, 9999 ^{*1*4} | |
| C126 | PM motor current | | 0 to 3600 A, 9999 ^{*2*4} | |
| 706 | Induced voltage | | 0 to 5000 mV (rad/s) ^{*4} | Set this parameter according to the PM motor specifications. |
| C130 | constant (phi f) | 9999 | 9999 | The value calculated from the parameter setting for motor constant is used. |
| 1412 C135 | Motor induced voltage constant (phi | 9999 | 0 to 2 | Set the exponent n when the induced voltage constant phi f (Pr.706) is multiplied by 10 ⁿ . |
| 0135 | f) exponent | | 9999 | No exponent setting |
| 711 C131 | Motor Ld decay ratio | 9999 | 0% to 100%, 9999 | Tuning data |
| 712 C132 | Motor Lq decay ratio | 9999 | 0% to 100%, 9999 | (The value measured by offline auto tuning is automatically set.) |
| 717 C182 | Starting resistance tuning compensation | 9999 | 0% to 200%, 9999 | 9999: The MM-EFS/MM-THE4 constant is used when the IPM motor MM-EFS/MM-THE4 is selected, and the inverter internal |
| 721 C185 | Starting magnetic pole position detection pulse width | 9999 | 0 to 6000 μs, 10000 to 16000 μs, 9999 | data is used when a PM motor other than the MM-EFS or MM- THE4 is selected. |
| | | | 100% to 500% | Set the maximum current (OCT) level of the motor. |
| 725 C133 | Motor protection current level | 9999 | 9999 | The MM-EFS/MM-THE4 constant is used when the IPM motor MM-EFS or MM-THE4 is selected, and 200% is used when a PM motor other than the MM-EFS or MM-THE4 is selected. |
| 1002 | Lq tuning target | | 50% to 150% | Adjust the target current during tuning. |
| C150 | current adjustment coefficient | 9999 | 9999 | 100% |
| 450 C200 | 450 Second applied motor | | 0, 1, 3 to 6, 13 to 16, 20, 23, 24, 40, 43, 44, 50, 53, 54, 70, 73, 74, 210, 213, 214, 240, 243, 244, 8090, 8093, 8094, 9090, 9093, 9094 | Set this parameter when using the second motor (the same specifications as Pr.71). |
| | | | 9999 | The function is disabled. |
| 453 C201 | Second motor capacity | 9999 | 0.4 to 55 kW ^{*1} 0 to 3600 kW ^{*2} | Set the capacity of the second motor. |
| | | | 9999 | V/F control |
| 454 C202 | Number of second | 9999 | 2, 4, 6, 8, 10, 12 | Set the number of poles of the second motor. |
| C202 | motor poles Second electronic | | 9999 0 to 500 A ^{*1} | V/F control Set the rated current of the second motor. |
| C203 | thermal O/L relay | 9999 | 0 to 3600 A ^{*2} | |
| 450 | D-4-d- | | 9999 | The second electronic thermal O/L relay is disabled. |
| 456 C204 | Rated second motor voltage | 200/400 V ^{*3} | 0 to 1000 V | Set the rated voltage (V) of the second motor. |
| | | | 10 to 400 Hz | Set the rated frequency (Hz) of the second motor. |
| 457 C205 | | | 9999 | For the second motor, the MM-EFS/MM-THE4 constant is used when the IPM motor MM-EFS/MM-THE4 is selected, and the inverter internal data is used when a PM motor other than MM-EFS or MM-THE4 is selected. Use the correct setting according to the motor specification. |
| | | | 0 to 400 Hz | Set the permissible speed (frequency) of the second motor. |
| 743 C206 | Second motor maximum frequency | 9999 | 9999 | The maximum frequency of MM-EFS/MM-THE4 is used when the IPM motor MM-EFS or MM-THE4 is selected, and the Pr.457 setting is used when a PM motor other than the MM- EFS or MM-THE4 is selected. |

| Pr. | Name | Initial value | Setting range | Description |
|--------------|--|------------------|--|---|
| 744 C207 | Second motor inertia (integer) | 9999 | 10 to 999, 9999 | Set the inertia of the second motor. 9999: The MM-EFS/MM-THE4 inertia is used for the IPM motor |
| 745 C208 | Second motor inertia (exponent) | 9999 | 0 to 7, 9999 | MM-EFS/MM-THE4. |
| | | | 0, 101 | No auto tuning for the second motor. |
| 463 C210 | Second motor auto tuning setting/status | 0 | 1 | Offline auto tuning is performed without the motor rotating (motor other than IPM motor MM-EFS or MM-THE4). |
| | | | 11 | Offline auto tuning is performed without the motor rotating (V/F control, IPM motor MM-EFS/MM-THE4). |
| 458 | Second motor | 9999 | 0 to 50 Ω, 9999 ^{*1*4} | |
| C220 | constant (R1) | 0000 | 0 to 400 mΩ, 9999 ^{*2*4} | |
| 460 | Second motor | 9999 | 0 to 500 mH, 9999 ^{*1*4} | Tuning data of the second motor (The value measured by offline auto tuning is automatically |
| C222 | constant (L1) / d-axis inductance (Ld) | 9999 | 0 to 50 mH, 9999 ^{*2*4} | set.) 9999: The MM-EFS/MM-THE4 constant is used when the IPM |
| 461 | Second motor constant (L2) / q-axis | 9999 | 0 to 500 mH, 9999 ^{*1*4} | motor MM-EFS/MM-THE4 is selected, and the inverter internal |
| C223 | inductance (Lq) | 9999 | 0 to 50 mH, 9999 ^{*2*4} | data is used when a PM motor other than the MM-EFS or MM- THE4 is selected. |
| 860 | Second motor torque current/Rated PM | 9999 | 0 to 500 A, 9999 ^{*1*4} | |
| C226 | motor current | | 0 to 3600 A, 9999 ^{*2*4} | |
| 738 | Second motor | | 0 to 5000 mV (rad/s) ^{*4} | Set this parameter according to the PM motor specifications. |
| C230 | induced voltage constant (phi f) | 9999 | 9999 | The value calculated from the parameter setting for motor constant is used. |
| 1413 | Second motor | | 0 to 2 | Set the exponent n when the induced voltage constant phi f |
| 1413 C235 | induced voltage constant (phi f) | 9999 | | (Pr.738) is multiplied by 10 ⁿ . |
| | exponent | | 9999 | No exponent setting |
| 739 C231 | Second motor Ld decay ratio | 9999 | 0% to 100%, 9999 | |
| 740 C232 | Second motor Lq decay ratio | 9999 | 0% to 100%, 9999 | Tuning data of the second motor (The value measured by offline auto tuning is automatically |
| 741 C282 | Second starting resistance tuning compensation | 9999 | 0% to 200%, 9999 | set.) 9999: The MM-EFS/MM-THE4 constant is used when the IPM motor MM-EFS/MM-THE4 is selected, and the inverter internal data is used when a PM motor other than the MM-EFS or MM- |
| 742 C285 | Second motor magnetic pole detection pulse width | 9999 | 0 to 6000 µs, 10000 to 16000 µs, 9999 | THE4 is selected. |
| | Second motor | | 100% to 500% | Set the maximum current (OCT) level of the second motor. |
| 746 C233 | 746 protection current | | 9999 | The MM-EFS/MM-THE4 constant is used when the IPM motor MM-EFS or MM-THE4 is selected, and 200% is used when a PM motor other than the MM-EFS or MM-THE4 is selected. |

*1 For the FR-F820-02330(55K) or lower and FR-F840-01160(55K) or lower.

*2 For the FR-F820-03160(75K) or higher and FR-F840-01800(75K) or higher.

*3 The initial value differs according to the voltage class (200 V / 400 V).

*4 The setting range and unit change according to the **Pr.71 (Pr.450)** setting.

Point P

• The settings are valid under PM motor control.

• The offline auto tuning enables the operation with SPM motors and IPM motors other than the MM-EFS or MM-THE4. (When a PM motor other than the IPM motor MM-EFS or MM-THE4 is used, always perform offline auto tuning.)

· Tuning is enabled even when a load is connected to the motor.

• Reading/writing of the motor constants tuned by offline auto tuning are enabled. The offline auto tuning data (motor constants) can be copied to another inverter using the operation panel.

• The offline auto tuning status can be monitored on the operation panel or the parameter unit.

Before performing offline auto tuning

Check the following points before performing offline auto tuning:

- The PM motor control is selected.
- A motor is connected. (Check that the motor is not rotated by an external force during tuning.)
- For the motor capacity, the rated motor current should be equal to or less than the rated inverter current. (The motor capacity must be 0.4 kW or higher.)

If a motor with substantially low rated current compared with the inverter rated current, however, is used, speed and torque accuracies may deteriorate due to torque ripples, etc. Set the rated motor current to about 40% or higher of the inverter rated current.

- The maximum frequency under PM motor control is 400 Hz.
- The motor may rotate slightly even if offline auto tuning is performed without the motor rotating (Pr.96 Auto tuning setting/ status = "1 or 11"). (It does not affect the tuning performance.)
 Fix the motor securely with a mechanical brake, or before tuning, make sure that it is safe even if the motor rotates.

(Caution is required especially in vertical lift applications.)

• Tuning may be disabled depending on the motor characteristics.

Settings

• To perform tuning, set the following parameters about the motor.

| First motor Pr. | Second motor Pr. | Name | Setting for a PM motor other than MM-EFS or MM-THE4 | Setting for MM-EFS or MM-THE4 |
|--------------------|---------------------|------------------------------|--|-------------------------------------|
| 80 | 453 | Motor capacity | Motor capacity (kW) | |
| 81 | 454 | Number of motor poles | Number of motor poles (2 to 12) | Set by IPM parameter initialization |
| 9 | 51 | Electronic thermal O/L relay | Rated motor current (A) | (Refer to page 183.) |
| 84 | 457 | Rated motor frequency | Rated motor frequency (Hz) | |
| 83 | 456 | Rated motor voltage | Rated motor voltage (V) | Initial value (200 V or 400 V) |
| 71 | 450 | Applied motor | 8090, 8093 (IPM motor) | 210, 213 ^{*1*2} |
| | | | 9090, 9093 (SPM motor) ^{*1} | 240, 243 ^{*1*3} |
| 96 | 463 | Auto tuning setting/status | 1 | 11 |

*1 Set **Pr.71 Applied motor** according to the motor to be used. According to the **Pr.71** setting, the range of the motor constant parameter setting values and units can be changed. (For other setting values of **Pr.71**, refer to page 379.)

*2 Setting value for the MM-EFS (1500 r/min specification) or the MM-THE4.

*3 Setting value for the MM-EFS (3000 r/min specification).

| | | Pr.71 setting | | |
|-----------|---|--|---|--|
| | Motor | Motor constant parameter Ω , mH, and A unit setting | Motor constant parameter internal data setting | |
| | MM-EFS (1500 r/min specification) / MM-THE4 | 210 | 213 (214) | |
| IPM motor | MM-EFS (3000 r/min specification) | 240 | 243 (244) | |
| | Other than MM-EFS/MM-THE4 | 8090 | 8093 (8094) | |
| SPM motor | | 9090 | 9093 (9094) | |

NOTE

• Under PM motor control, tuning cannot be performed even when **Pr.96** = "101". When the MM-EFS or MM-THE4 is set to the applied motor, tuning cannot be performed even when **Pr.96** = "1 or 101".

• For tuning accuracy improvement, set the following parameters when the motor constants are known in advance.

| First motor Pr. | Second motor Pr. | Name | Setting for a PM motor other than MM- EFS/MM-THE4 | Setting for MM-EFS/MM-THE4 |
|--------------------|---------------------|--------------------------------|--|----------------------------|
| 702 | 743 | Maximum motor frequency | Maximum motor frequency (Hz) | 9999 (initial value) |
| 707 | 744 | Motor inertia (integer) | Motor inertia ^{*1} | 0000 (initial value) |
| 724 | 745 | Motor inertia (exponent) | Jm = Pr.707 × 10^(-Pr.724) (kg⋅m²) | 9999 (initial value) |
| 725 | 746 | Motor protection current level | Maximum current level of the motor (%) | 9999 (initial value) |

*1 The setting is valid only when a value other than "9999" is set in both Pr.707 (Pr.744) and Pr.724 (Pr.745).

Performing tuning

Point P

- Before performing tuning, check the monitor display of the operation panel or parameter unit if the inverter is in the state ready for tuning. The motor starts by turning ON the start command while tuning is unavailable.
- In the PU operation mode, press **FWD** / **REV** on the operation panel.

For External operation, turn ON the start command (STF signal or STR signal). Tuning starts.

• Satisfy the required inverter start conditions to start offline auto tuning. For example, stop the input of the MRS signal.

- To force tuning to end, use the MRS or RES signal or **STOP** on the operation panel. (Turning OFF the start signal (STF signal or STR signal) also ends tuning.)
- During offline auto tuning, only the following I/O signals are valid (initial value).
 Input terminals <valid signals>: STP (STOP), OH, MRS, RT, RES, STF, STR, S1, and S2
 Output terminals: RUN, OL, IPF, FM/CA, AM, A1B1C1, and So (SO)
- When the rotation speed and the output frequency are selected for terminals FM/CA and AM, the progress status of offline auto tuning is output in 15 steps from FM/CA and AM.
- Do not perform ON/OFF switching of the Second function selection (RT) signal during offline auto tuning. Auto tuning will not be performed properly.
- A motor with 14 or more poles cannot be tuned.
- Since the Inverter running (RUN) signal turns ON when tuning is started, pay close attention especially when a sequence which releases a mechanical brake by the RUN signal has been designed.
- When executing offline auto tuning, input the operation command after switching ON the main circuit power (R/L1, S/L2, T/L3) of the inverter.
- While **Pr.79 Operation mode selection** = "7", turn ON the PU operation external interlock (X12) signal to tune in the PU operation mode.
- During tuning, the monitor is displayed on the operation panel as follows.

| Pr.96 (Pr.463) | 1 | 11 | 1 | 11 |
|--------------------------|---|--|---|--|
| setting | Operation panel (| FR-DU08) display | LCD operation pane | el (FR-LU08) display |
| (1) Setting | PU - MON - MA -EXT - PRM - NOT - PMM | PU - MON - M -EXT - PRM - M - NET - RAUN - M | AutoTune 12:34 TUNE 1 STOP PU PREV NEXT | AutoTune 12:34 TUNE 11 STOP PU PREV NEXT |
| (2) During tuning | | H - RU - MON - M - RU - RUN - M | AutoTune 12:34 TUNE 2 STF FWD PU PREV NEXT | AutoTune 12:34 TUNE 12 UNIUNI 12 STF FWD PU PREV NEXT |
| (3) Normal completion | PEXT PRUN THE PRUNT THE PRUN THE PRUNT THE PRUN THE PRUNT | | AutoTune 12:34 TUNE Completed 3 STF STOP PU PREV NEXT | AutoTune 12:34 TUNE Completed 13 STF STOP PU PREV NEXT |

• When offline auto tuning ends, press STOP on the operation panel during PU operation. For External operation, turn OFF

the start signal (STF signal or STR signal). This operation resets the offline auto tuning, and the PU's monitor display returns to the normal indication. (Without this operation, next operation cannot be started.)

- The motor constants measured once during offline auto tuning are stored as parameters and their data are held until offline auto tuning is performed again. However, the tuning data is cleared when performing All parameter clear.
- Changing **Pr.71** after tuning completion will change the motor constant. For example, if the **Pr.71** setting is changed to "8093" after tuned with **Pr.71** = "8090", the tuning data become invalid. To use the tuned data, set "8090" again in **Pr.71**.

• If offline auto tuning has ended in error (see the following table), motor constants are not set. Perform an inverter reset and perform tuning again.

| Error display | Error cause | Countermeasures |
|---------------|---|--|
| 8 | Forced end | Set Pr.96 (Pr.463) ="1 or 11" and try again. |
| 9 | Inverter protective function operation | Make the setting again. |
| 92 | The converter output voltage fell to 75% of the rated voltage. | Check for the power supply voltage fluctuation. Check the Pr.83 Rated motor voltage setting. |
| 93 | Calculation error. The motor is not connected. | Check the motor wiring and make the setting again. |
| 94 | Rotation tuning frequency setting error. (The frequency command for the tuning was given to exceed the maximum frequency setting, or to be in the frequency jump range.) | Check the Pr.1 Maximum frequency and Pr.31 to Pr.36 Frequency jump settings. |

• When tuning is ended forcibly by pressing STOP or turning OFF the start signal (STF or STR) during tuning, offline auto

tuning does not end properly. (The motor constants have not been set.) Perform an inverter reset and perform tuning again.

• NOTE

- An instantaneous power failure occurring during tuning will result in a tuning error.
- After power is restored, the inverter starts normal operation. Therefore, when the STF (STR) signal is ON, the motor starts forward (reverse) rotation.
- Any fault occurring during tuning is handled as in the normal operation. However, if the retry function is set, no retry is performed even when a protective function that performs a retry is activated.
- The set frequency monitor displayed during the offline auto tuning is 0 Hz.

• Note that the motor may start running suddenly.

Parameters updated by tuning results after tuning

| First motor Pr. | Second motor Pr. | Name | Other than MM-EFS/ MM-THE4 Pr.96 (Pr.463) = 1 | MM-EFS/MM-THE4 Pr.96 (Pr.463) = 11 | Description |
|--------------------|---------------------|---|---|---------------------------------------|---|
| 90 | 458 | Motor constant (R1) | 0 | 0 | Resistance per phase |
| 92 | 460 | Motor constant (L1)/d-axis inductance (Ld) | 0 | _ | d-axis inductance |
| 93 | 461 | Motor constant (L2)/q-axis inductance (Lq) | 0 | _ | q-axis inductance |
| 711 | 739 | Motor Ld decay ratio | 0 | — | d-axis inductance decay ratio |
| 712 | 740 | Motor Lq decay ratio | 0 | — | q-axis inductance decay ratio |
| 717 | 741 | Starting resistance tuning compensation | 0 | 0 | |
| 721 | 742 | Starting magnetic pole position detection pulse width | 0 | _ | When the setting value is 10000 or more: With polarity inversion for compensation, voltage pulse (Pr. setting minus 10000) µs |
| 859 | 860 | Torque current/Rated PM motor current | 0 | _ | |
| 96 | 463 | Auto tuning setting/status | 0 | 0 | |

Tuning adjustment (Pr.1002)

• The overcurrent protective function may be activated during Lq tuning for an easily magnetically saturated motor (motor with a large Lq decay ratio). In such case, adjust the target flowing current used for tuning with **Pr.1002 Lq tuning target** current adjustment coefficient.

Changing the motor constants

- The motor constants can be set directly when the motor constants are known in advance, or by using the data measured during offline auto tuning.
- According to the **Pr.71 (Pr.450)** setting, the range of the motor constant parameter setting values and units can be changed. The changed settings are stored in the EEPROM as the motor constant parameters.

Changing the motor constants (when setting motor constants in units of Ω, mH, or A)

• Set Pr.71 as follows.

| | Pr.71 setting | |
|-----------|---|------|
| | MM-EFS (1500 r/min specification) / MM-THE4 | 210 |
| IPM motor | MM-EFS (3000 r/min specification) | 240 |
| | Other than MM-EFS/MM-THE4 | 8090 |
| SPM motor | | 9090 |

· Set desired values as the motor constant parameters.

| First motor Pr. | Second motor Pr. | Name | Setting range | Setting increments | Initial value |
|--------------------|---------------------|---|---------------------------------|------------------------|---------------|
| 90 | 458 | Motor constant (R1) | 0 to 50 Ω, 9999 ^{*1} | 0.001 Ω ^{*1} | |
| 30 | 450 | | 0 to 400 mΩ, 9999 ^{*2} | 0.01 mΩ ^{*2} | |
| 92 | 460 | Motor constant (L1)/d-axis inductance (Ld) | 0 to 500 mH, 9999 ^{*1} | 0.01 mH ^{*1} | |
| 92 400 1 | | 0 to 50 mH, 9999 ^{*2} | 0.001 mH ^{*2} | | |
| 93 | 461 | Motor constant (L2)/q-axis inductance (Lq) | 0 to 500 mH, 9999 ^{*1} | 0.01 mH ^{*1} | |
| 93 | 401 | | 0 to 50 mH, 9999 ^{*2} | 0.001 mH ^{*2} | 9999 |
| 706 | 738 | Induced voltage constant (phi f) | 0 to 5000 mV (rad/s), 9999 | 0.1 mV (rad/s) | |
| 859 | 860 | Torque current/Rated PM motor current | 0 to 500 A, 9999 ^{*1} | 0.01 A ^{*1} | |
| 039 | | 0 to 3600 A, 9999 ^{*2} | 0.1 A ^{*2} | | |
| 1412 | 1413 | Motor induced voltage constant (phi f) exponent | 0 to 2, 9999 | 1 | |

*1 For the FR-F820-02330(55K) or lower, and FR-F840-01160(55K) or lower.

*2 For the FR-F820-03160(75K) or higher, and FR-F840-01800(75K) or higher.

- NOTE

• If "9999" is set, tuning data will be invalid. The MM-EFS or MM-THE4 constant is used for the IPM motor MM-EFS or MM-THE4, and the inverter internal constant is used for a PM motor other than MM-EFS or MM-THE4.

- To change a motor induced voltage constant of PM motors, the setting in Pr.706 Induced voltage constant (phi f) or Pr.738 Second motor induced voltage constant (phi f) must be changed. If the constant after the change exceeds the setting range of Pr.706 or Pr.738 (0 to 5000 mV (rad/s)), set Pr.1412 Motor induced voltage constant (phi f) exponent or Pr.1413 Second motor induced voltage constant (phi f) exponent. Set a value in the exponent n in the formula, Pr.706 (Pr.738) × 10ⁿ [mV (rad/s)], to set the induced voltage constant (phi f).
- When **Pr.71 (Pr.450)** = "8093, 8094, 9093, or 9094", or **Pr.1412 (Pr.1413)** = "9999", the motor induced voltage constant is as set in **Pr.706 (Pr.738)**. (No exponent setting)

Changing the motor constants (when setting a motor constants in the internal data of the inverter)

• Set Pr.71 as follows.

| | Motor | | |
|-----------|---|-------------|--|
| | MM-EFS (1500 r/min specification) / MM-THE4 | 213 (214) | |
| IPM motor | MM-EFS (3000 r/min specification) | 243 (244) | |
| | Other than MM-EFS/MM-THE4 | 8093 (8094) | |
| SPM motor | | 9093 (9094) | |

• Set desired values as the motor constant parameters. The displayed increments of the read motor constants can be changed with **Pr.684 Tuning data unit switchover**. Setting **Pr.684** = "1" disables parameter setting changes.

| First motor | Second | | Pr.684 = 0 (ini | tial value) | Pr.684 = | 1 | Initial | |
|-------------|------------------|---|----------------------|---------------------------------|---------------------------------|--------------------------------|------------------------|------|
| Pr. | motor Pr. | Name | Setting range | Setting increments | Setting range | Setting increments | value | |
| 90 | 458 | Motor constant (R1) | | | 0 to 50 Ω, 9999 ^{*1} | 0.001 Ω ^{*1} | | |
| 30 | 400 | | | | 0 to 400 mΩ, 9999 ^{*2} | 0.01 mΩ ^{*2} | | |
| 92 | 460 | Motor constant (L1)/d- | | | 0 to 500 mH, 9999 ^{*1} | 0.01 mH ^{*1} | | |
| 92 | 400 | axis inductance (Ld) | _ | | 0 to 50 mH, 9999 ^{*2} | 0.001 mH ^{*2} | | |
| 93 | 461 | Motor constant (L2)/q- axis inductance (Lq) Induced voltage constant (phi f) | | | 0 to 500 mH, 9999 ^{*1} | 0.01 mH ^{*1} | | |
| 90 | 401 | | axis inductance (Lq) | 0 to ***, 9999 | 1 | 0 to 50 mH, 9999 ^{*2} | 0.001 mH ^{*2} | 9999 |
| 706 | 738 | | 0.00 , 0000 | | 0 to 5000 mV (rad/s), 9999 | 0.1 mV (rad/s) | 0000 | |
| 859 | 860 | Torque current/Rated | | | 0 to 500 A, 9999 ^{*1} | 0.01 A ^{*1} | | |
| 039 | PM motor current | | | 0 to 3600 A, 9999 ^{*2} | 0.1 A ^{*2} | | | |
| 1412 | 1413 | Motor induced voltage constant (phi f) exponent | | | 0 to 2, 9999 | 1 | | |

*1 For the FR-F820-02330(55K) or lower, and FR-F840-01160(55K) or lower.

*2 For the FR-F820-03160(75K) or higher, and FR-F840-01800(75K) or higher.

NOTE

 As the motor constants measured in the offline auto tuning have been converted into internal data (****), refer to the following setting example when making setting. (The value displayed has been converted into a value for internal use. Therefore, simple addition of a value to the displayed value does not bring the desired effect.)

Setting example: to slightly increase the **Pr.90** value (5%)

When "2516" is displayed for **Pr.90**, set 2642 (2516 × 1.05 = 2641.8) in **Pr.90**.

- To change a motor induced voltage constant of PM motors, the setting in Pr.706 Induced voltage constant (phi f) or Pr.738 Second motor induced voltage constant (phi f) must be changed. If the constant after the change exceeds the setting range of Pr.706 or Pr.738 (0 to 5000 mV (rad/s)), set Pr.1412 Motor induced voltage constant (phi f) exponent or Pr.1413 Second motor induced voltage constant (phi f) exponent. Set a value in the exponent n in the formula, Pr.706 (Pr.738) × 10ⁿ [mV (rad/s)], to set the induced voltage constant (phi f).
- When Pr.71 (Pr.450) = "8093, 8094, 9093, or 9094", or Pr.1412 (Pr.1413) = "9999", the motor induced voltage constant is as set in Pr.706 (Pr.738). (No exponent setting)

Parameters referred to

Pr.9 Electronic thermal O/L relay 🖙 page 266 Pr.71 Applied motor 🖙 page 379 Pr.178 to Pr.189 (Input terminal function selection) 🖙 page 373

[•] If "9999" is set, tuning data will be invalid. The MM-EFS or MM-THE4 constant is used for the IPM motor MM-EFS or MM-THE4, and the inverter internal constant is used for a PM motor other than MM-EFS or MM-THE4.

5.10.4 Online auto tuning

Magnetic flux

If online auto tuning is selected under Advanced magnetic flux vector control, favorable torque accuracy is retained by adjusting temperature even when the resistance value varies due to increase in the motor temperature.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|---------------------------------|---------------|---------------|---|
| 95 | Online auto tuning selection | 0 | 0 | No online auto tuning |
| C111 | C111 | U | 1 | Online auto tuning is performed at startup. |
| 574 C211 | Second motor online auto tuning | 0 | 0, 1 | Select online auto tuning for the second motor. (The settings are the same as those in Pr.95 .) |

Online auto tuning at startup (Pr.95/Pr.574 = "1")

- By promptly tuning the motor status at startup, accurate operation without being affected by motor temperature is achieved. Also high torque can be provided at very low speed and stable operation is possible.
- Under Advanced magnetic flux vector control (**Pr.80 Motor capacity, Pr.81 Number of motor poles**), select the online auto tuning at startup.
- Make sure to perform offline auto tuning before performing online auto tuning.

Operating procedure

- **1.** Perform offline auto tuning. (Refer to page 383.)
- 2. Check that Pr.96 Auto tuning setting/status = "3 or 103" (offline auto tuning completion).
- **3.** Set **Pr.95 Online auto tuning selection** = "1" (online auto tuning at start). Online auto tuning is enabled at the next start.
- **4.** Check that the following parameters are set before starting operation.

| Pr. | Description |
|-----|--|
| 9 | Rated motor current or electronic thermal O/L relay |
| 71 | Applied motor |
| 80 | Motor capacity (with the rated motor current equal to or less than the inverter rated current) ^{*1} |
| 81 | Number of motor poles |

*1 If a motor with substantially low rated current compared with the inverter rated current is used, speed and torque accuracies may deteriorate due to torque ripples, etc. Set the rated motor current to about 40% or higher of the inverter rated current.

5. In the PU operation mode, press **FWD** / **REV** on the operation panel. For External operation, turn ON the start command (STF signal or STR signal).

- When performing online auto tuning at startup for a lift, consider using an external terminal. The tuning takes about 500 ms at the most after starting. However, during this time, it is possible that not enough torque is provided and caution is required to prevent the object from dropping. Use of the Start-time tuning start external input (X28) signal is recommended to perform tuning. (Refer to page 401.)
- Perform online auto tuning at startup when the motor is stopped.
- The online auto tuning is disabled when the MRS signal is being input, the setting speed is **Pr.13 Starting frequency** or lower (V/F control, Advanced magnetic flux vector control), an inverter fault is occurring, or the inverter's startup condition is not satisfied.
- · Online auto tuning does not operate during deceleration and restart from DC injection brake operation.
- It is disabled during JOG operation.
- If automatic restart after instantaneous power failure is selected, automatic restart is prioritized. (Online auto tuning at startup is not performed during frequency search.)

If automatic restart after instantaneous power failure is used together, perform online auto tuning while stopping operation with the X28 signal. (Refer to page 401.)

- Zero current detection and output current detection are enabled during online auto tuning.
- The RUN signal is not output during online auto tuning. The RUN signal is turned ON at operation startup.
- If the time between the inverter stop and restart is within 4 seconds, tuning is performed at startup but its result will not be applied.

Online auto tuning at startup using the external terminal (Pr.95/Pr.574 = "1", X28 signal, Y39 signal)

- Before turning ON the start signal (STF or STR), online auto tuning can be performed by turning ON the Start-time tuning start external input (X28) signal in a stopped status in order to minimize the startup delay by tuning at start.
- Perform offline auto tuning and set "1" (tuning at start) in Pr.95.
- When the Start time tuning completion (Y39) signal is OFF, tuning at start can be performed with the X28 signal.
- The tuning takes about 500 ms at the most.
- To use the X28 signal, set "28" in any parameter from Pr.178 to Pr.189 (Input terminal function selection) to assign the function to an input terminal.
- To use the Y39 signal, set "39 (positive logic) or 139 (negative logic)" in any parameter from **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function to an output terminal.

Output frequency (Hz) Time ON X28 signal Tuning status Completed at starting Tune Y39 signal Start signal While the motor is stopped While the X28 signal is OFF Tuning is performed at start when X28 signal is OFF ON ON (even when Y39 is ON) ON ON ON OFF X28 Signal OFF X28 Signal . × Tune 🖌 Tune Tune Tune Tune Tune Tuning status Tuning status Completed Completed Completed Completed Completed at starting at starting Secondary magnetic Secondary magnetic flux exists a few seconds flux exists a few seconds Secondary magnetic Secondary magnetic flux exists a fee flux exists a few se ON ON ON --OFF Y39 signal OFF Y39 signal Y39 signal is OFF when the motor is stopped and X28 is turned OFF. However if the Tuning is not ed if the performed if the Y39 signal is ON secondary magnetic flux exists after motor stop, the signal remains ON. OFF Start signal OFF Start signal Output frequency 0Hz Time While the X28 signal is ON Switching motor Second motor Motor First moto First motor X28 Signal OFF switching Tuning is not performed at start since X28 signal RT signal and Y39 signal is ON. 🕇 Tune Tuning status OFF X28 signal Completed at starting Tune ON Completed Tuning status OFF Y39 signal Y39 turns OFF when the at starting driven motor is switched ON ON to the second motor OFF Y39 signal OFF Start signal Y39 turns ON due to the residual second a few seconds magnetic flux at the flux exists Start OFF first motor signal Output frequency 0Hz Output Time frequency 0H:

Time



- The Y39 signal remains ON after the motor is stopped as long as the second flux remains.
- · The X28 signal is disabled while the Y39 signal is ON.
- · The STF and STR signals are enabled after completing tuning at start.
- The Inverter running (RUN) signal is not turned ON during online auto tuning. The RUN signal is turned ON after starting up.
- The setting is invalid under V/F control or PM motor control.
- Changing the terminal assignment using Pr.178 to Pr.189 (Input terminal function selection) or Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

Tuning the second motor (Pr.574)

- · When one inverter switches the operation between two different motors, set the second motor in Pr.450 Second applied motor. (In the initial setting, no second motor is applied. (Refer to page 379.))
- Perform tuning using Pr.574 Second motor online auto tuning.
- **Pr.574** is enabled when the Second function selection (RT) signal is turned ON.

| Pr. | Description |
|-----|--|
| 450 | Applied motor |
| 453 | Motor capacity (with the rated motor current equal to or less than the inverter rated current) ^{*1} |
| 454 | Number of motor poles |

*1 If a motor with substantially low rated current compared with the inverter rated current is used, speed and torque accuracies may deteriorate due to torque ripples, etc. Set the rated motor current to about 40% or higher of the inverter rated current.

NOTE

- The RT signal is the Second function selection signal. The RT signal also enables other second functions. (Refer to page 373.) The RT signal is assigned to terminal RT in the initial status. Set "3" in one of Pr.178 to Pr.189 (Input terminal function selection) to assign the RT signal to another terminal.
- Changing the terminal assignment using Pr.178 to Pr.189 (input terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

- Pr.9 Electronic thermal O/L relay 3 page 266

- Pr.9 Electronic ulerinal or reaging and a second se
- Pr.178 to Pr.189 (Input terminal function selection) 🖙 page 373 Pr.190 to Pr.196 (Output terminal function selection) 🖙 page 330

5.11 (A) Application parameters

| Purpose | | Parameter to set | | Refer to page |
|---|---|---|---|------------------|
| To operate by switching between the inverter and the commercial power supply operation | Electronic bypass function | P.A000 to P.A005 | Pr.135 to Pr.139, Pr.159 | 404 |
| To reduce the standby power | Self power management | P.A002, P.A006, P.A007, P.E300 | Pr.30, Pr.137, Pr.248, Pr.254 | 410 |
| To count the number of inverter starting times | Start count monitor | P.A170, P.A171 | Pr.1410, Pr.1411 | 413 |
| To strengthen or weaken the frequency at a constant cycle | Traverse operation | P.A300 to P.A305 | Pr.592 to Pr.597 | 414 |
| To remove stains on the impellers or fans of pumps by repeating a forward/ reverse rotation | Cleaning function | P.A420 to P.A430 | Pr.1469 to Pr.1479 | 415 |
| | Multi-pump function (Advanced PID function) | P.A400 to P.A414, P.A442 | Pr.578 to Pr.591, Pr.1370, Pr.1376 | 450 |
| | PID Pre-charge function | P.A616 to P.A620, P.A626, P.A656 to P.A660, P.A666 | Pr.760 to Pr.769, Pr.1132, Pr.1133 | 445 |
| | PID display adjustment | P.A600, P.A630 to P.A633, P.A670 to P.A673 | Pr.759, C42 to C45 (Pr.934, Pr.935), Pr.1136 to Pr.1139 | 442 |
| To perform process control, such as for the pump flow volume and air volume | PID control | P.A442, P.A457, P.A601 to P.A607, P.A610 to P.A615, P.A621 to P.A625, P.A640 to P.A644, P.A650 to P.A655, P.A661 to P.A665, P.A683 to P.A689 | Pr.127 to Pr.134, Pr.553, Pr.554, Pr.575 to Pr.577, Pr.609, Pr.610, Pr.753 to Pr.758, Pr.1015, Pr.1134, Pr.1135, Pr.1140, Pr.1141, Pr.1143 to Pr.1149, Pr.1346, Pr.1370, Pr.1460 to Pr.1466 | 419 |
| | PID control enhanced functions | P.A440 to P.A457, P.A627 to P.A629, P.F031 | Pr.111, Pr.1346, Pr.1361 to Pr.1375, Pr.1377 to Pr.1381 | 459 |
| To set the constant optimal for PID control | PID gain tuning | P.A690 to P.A698 | Pr.1211 to Pr.1219 | 437 |
| To continue operating at analog current input loss | 4 mA input check | P.A680 to P.A682 | Pr.573, Pr.777, Pr.778 | 369 |
| | Automatic restart after instantaneous power failure / flying start function for induction motors | P.A700 to P.A705, P.A710 to P.F003 | Pr.57, Pr.58, Pr.162 to Pr.165, Pr.299, Pr.611 | 466 |
| To restart without stopping the motor at instantaneous power failure | Frequency search accuracy improvement (V/F control, offline auto tuning) | P.A700, P.A711, P.A712, P.C110, P.C210 | Pr.96, Pr.162, Pr.298, Pr.463, Pr.560 | 474 |
| | Automatic restart after instantaneous power failure / flying start function for IPM motors | P.A700, P.A702, P.F003 | Pr.57, Pr.162, Pr.611 | 472 |
| To decelerate the motor to a stop at power failure | Power failure time deceleration-to-stop function | P.A730 to P.A735, P.A785 | Pr.261 to Pr.266, Pr.294 | 478 |
| To operate with sequence program | PLC function | P.A800 to P.A805, P.A811 to P.A859 | Pr.414 to Pr.417, Pr.498, Pr.675, Pr.1150 to Pr.1199 | 483 |
| To store the inverter running status to a USB memory device | Trace function | P.A900 to P.A906, P.A910 to P.A920, P.A930 to P.A939 | Pr.1020 to Pr.1047 | 486 |

5.11.1 Electronic bypass function

Magnetic flux

The inverter contains complicated sequence circuits for switching between the commercial power supply operation and inverter operation. Therefore, interlock operation of the magnetic contactor for switching can be easily performed by simply inputting start, stop, and automatic switching selection signals.

| Pr. | Name | Initial value | Setting range | Description |
|-----------------------------------|---|------------------|---------------|---|
| | | | 0 | Coasting time differs according to the inverter capacity.*1 |
| 57 A702 | Restart coasting time | 9999 | 0.1 to 30 s | Set the waiting time for the inverter to perform a restart after restoring power due to an instantaneous power failure. |
| | | | 9999 | No restart |
| 58 A703 | Restart cushion time | 1 s | 0 to 60 s | Set the voltage cushion time for restart. |
| 135 | Electronic bypass | 0 | 0 | Without electronic bypass sequence |
| A000 | sequence selection | 0 | 1 | With electronic bypass sequence |
| 136 A001 | MC switchover interlock time | 1 s | 0 to 100 s | Set the operation interlock time for MC2 and MC3. |
| 137 A002 | Start waiting time | 0.5 s | 0 to 100 s | Set a time period that is a little longer than the time period from the ON signal input to the actual pick-up operation of MC3 (0.3 to 0.5 s). |
| | | | 0 | Inverter output stop (motor coasting) at inverter failure |
| 138Bypass selection at aA003fault | | 0 | 1 | Automatic switchover to commercial power supply operation at inverter failure. (Switchover is not possible when an external thermal relay (E.OHT) or CPU fault (E.CPU) is occurring.) |
| | Automatic switchover frequency from inverter to bypass operation | | 0 to 60 Hz | Set the frequency where the inverter operation is switched to commercial power supply operation. The inverter operation is performed from a start to Pr.139 setting, then it switches automatically to the commercial power supply operation when the output frequency is equal to or above Pr.139 . |
| 139 A004 | | 9999 | 8888 | When the FR-A8AVP is installed, the phase-synchronized bypass switching function is enabled. (For details, refer to the FR-A8AVP Instruction Manual.) When the FR-A8AVP is not installed, the operation is the same as the one when the setting is "9999". |
| | | | 9999 | Without automatic switchover |
| A005 | Automatic switchover frequency range from bypass to inverter operation | 9999 | 0 to 10 Hz | Set the frequency where the commercial power supply operation, which has been switched from the inverter operation with Pr.139 , switches back to inverter operation. When the frequency command becomes less than (Pr.139 - Pr.159), the motor switches automatically to inverter operation and operates at the frequency of the frequency command. Turning OFF a inverter start command (STF/STR) also switches the operation to the inverter operation. |
| | | | 9999 | To switch the commercial power supply operation, which has been switched from the inverter operation with Pr.139 , to the inverter operation again, the inverter start command (STF/STR) is turned OFF. The operation switches to the inverter operation, and the motor decelerates to a stop. |

*1 The coasting time when **Pr.57** = "0" is as shown below (when the initial value is set in **Pr.162 Automatic restart after instantaneous power** failure selection).

FR-F820-00077(1.5K) or lower and FR-F840-00038(1.5K) or lower: 0.5 s

FR-F820-00105(2.2K) to FR-F820-00340(7.5K) and FR-F840-00052(2.2K) to FR-F840-00170(7.5K): 1 s FR-F820-00490(11K) to FR-F820-02330(55K) and FR-F840-00250(11K) to FR-F840-01160(55K): 3.0 s FR-F820-02460(75K) or biology and FR F840-01200(75K) or

FR-F820-03160(75K) or higher and FR-F840-01800(75K) or higher: 5.0 s

Electronic bypass sequence function

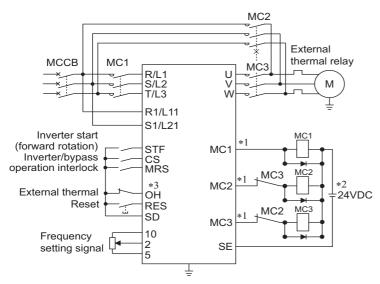
• When operating the motor at 60 Hz (or 50 Hz), the motor can be more efficiently operated with a commercial power supply. In addition, if the motor cannot be stopped for a long period of time even for an inverter maintenance and inspection, it is recommended that a commercial power supply circuit be installed. When switching between inverter operation and commercial power supply operation, commercial power supply may be
accidentally applied to the output side of the inverter. To avoid such situation, provide an interlock where the magnetic
contactor at the commercial power supply side turns ON at turn OFF of the magnetic contactor at the inverter output side.
The inverter's electronic bypass sequence that outputs timing signals for the magnetic contactors can act as a complicated
interlock between the commercial power supply operation and the inverter operation.

- NOTE

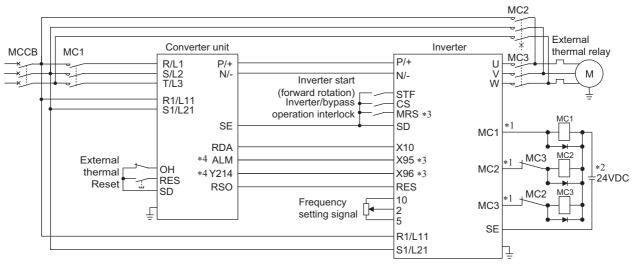
• Note that a PM motor cannot be driven by the commercial power supply.

Connection diagram

• A typical connection diagram of the electronic bypass sequence is shown below.



Standard models and IP55 compatible models



Separated converter type

*1 Be careful of the capacity of the sequence output terminals. The applied terminals differ by the settings of Pr.190 to Pr.196 (Output terminal function selection).

| Output terminal capacity | Output terminal permissible load |
|--|----------------------------------|
| Open collector output of inverter (RUN, SU, IPF, OL, FU) | 24 VDC 0.1 A |
| Inverter relay output (A1-C1, B1-C1, A2-B2, B2-C2) | 230 VAC 0.3 A |
| Relay output option (FR-A8AR) | 30 VDC 0.3 A |

*2 When connecting a DC power supply, insert a protective diode.

When connecting an AC power supply, use the relay output option (FR-A8AR), and use contact outputs.

*3 The applied terminals differ by the settings of Pr.180 to Pr.189 (Input terminal function selection)

*4 To use the signal, assign the function to the output terminal **Pr.190 to Pr.195 (Output terminal function selection)** of the converter unit. Always set the negative logic for the ALM signal.



- To use the electronic bypass function, the wiring terminals R1/L11 and S1/L21 must be connected to a separate power source that does not go through MC1. Be sure to connect using a separate power supply.
- Be sure to provide a mechanical interlock for MC2 and MC3.
- Operation of magnetic contactor (MC1, MC2, MC3)

| | | Operation status | | | | | |
|-----------------------|---|--|------------------------------|---|--|--|--|
| Magnetic contactor | Installation location | During commercial power supply operation | During inverter operation | During inverter fault | | | |
| MC1 | Between power supply and inverter input side | Shorted | Shorted | Open (short by reset) | | | |
| MC2 | Between power supply and motor | Shorted | Open | Open (Selected by Pr.138 . Always open when the external thermal relay is operating.) | | | |
| MC3 | Between inverter output side and motor | Open | Shorted | Open | | | |

• The input signals are as shown below.

| Signal | Applied terminal | Function | Operation status | MC operation ^{*8} | | | |
|-----------------------------|---|--|---|----------------------------|-----|-----------|--|
| Signal | Applied terminal | Function | Operation status | MC1 ^{*6} | MC2 | MC3 | |
| MRS MRS*1 Selects whether o | | Selects whether or not | ts whether or not ON Electronic bypass operation available | | _ | _ | |
| MING | MRS ^{*1} | operation is available. ^{*2} | OFF Electronic bypass operation not available | 0 | × | No change | |
| | | Inverter/commercial power | ON Inverter operation | 0 | × | 0 | |
| CS | CS | supply operation switchover ^{*3} | OFF Commercial power supply operation | 0 | 0 | × | |
| | | Inverter operation command | ON Forward rotation (reverse rotation) | 0 | × | 0 | |
| STF (STR) | | OFF Stop | 0 | × | 0 | | |
| | Set "7" in any | | ON Motor normal | 0 | — | — | |
| OH | parameter from Pr.180 to Pr.189. | External thermal relay input | OFF Motor fault | × | × | × | |
| RES | RES | On smalling status as st | ON Reset | No change | × | No change | |
| REO | RE3 | Operation status reset ^{*5} | OFF Normal operation | 0 | — | — | |
| | | | X95 signal OFF, X96 signal OFF Converter fault (E.OHT, E.CPU) | × | × | × | |
| X95/X96 | Set "95 or 96" in any parameter from | Converter unit fault / Converter unit fault (E.OHT, | X95 signal ON, X96 signal ON Converter normal | 0 | _ | _ | |
| | Pr.180 to Pr.189. | E.CPU) | X95 signal OFF, X96 signal ON Converter fault (other than E.OHT or E.CPU) | × | *7 | × | |

*1 For separated converter types, the X10 signal is assigned to the terminal MRS in the initial setting. For the MRS signal, set "24" to any of **Pr.180** to **Pr.189** (Input terminal function selection) to assign the function to another terminal.

*2 When the MRS signal is OFF, neither the commercial power supply operation nor the inverter operation can be performed.

*3 Terminal CS is initially set to "no function". To enable the CS signal, set "6" in **Pr.186 CS terminal function selection** to assign the function to a terminal. The CS signal operates only when the MRS signal is ON.

*4 STF (STR) operates only when the MRS and CS signals are both ON.

*5 The RES signal can be used for reset input acceptance with **Pr.75 Reset selection/disconnected PU detection/PU stop selection**. When the RES signal and another input signal are simultaneously input, the MC operation by the RES signal has a higher priority.

*6 MC1 turns OFF at an inverter fault.

*7 When Pr.138 = "0 (electronic bypass invalid at a fault)", MC2 is OFF. When Pr.138 = "1 (electronic bypass valid at a fault)", MC2 is ON.

*8 MC operation is as shown below.

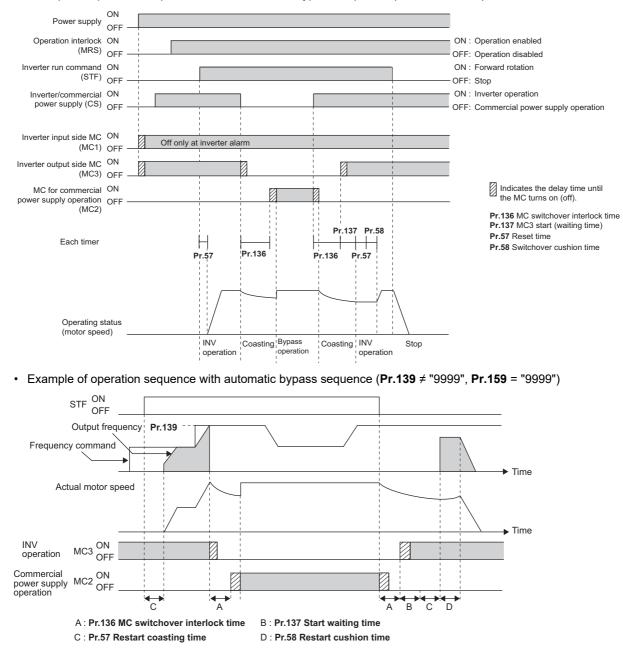
| Notation | MC operation | | | | | |
|---|---|--|--|--|--|--|
| 0 | ON | | | | | |
| × | OFF | | | | | |
| During inverter operation: MC2-OFF, MC3-ON | | | | | | |
| During commercial power supply operation: MC2-ON, MC3-OFF | | | | | | |
| No change | The operation status before changing the signal state to ON or OFF is held. | | | | | |

· The output signals are as shown below.

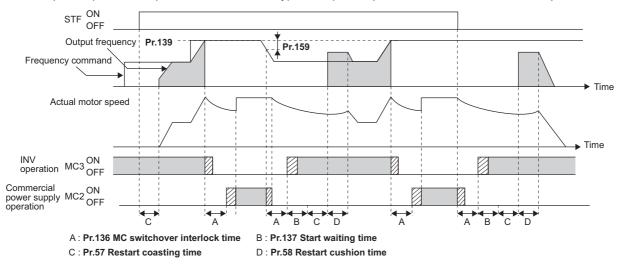
| Signal | Applied terminal (Pr.190 to Pr.196 setting) | Description |
|--------|--|--|
| MC1 | 17 | Operation output signal of the magnetic contactor MC1 on the inverter's input side. |
| MC2 | 18 | Operation output signal of the magnetic contactor MC2 for the commercial power supply operation. |
| MC3 | 19 | Operation output signal of the magnetic contactor MC3 on the inverter's output side. |

Electronic bypass operation sequence

• Example of operation sequence without automatic bypass sequence (Pr.139 = "9999")

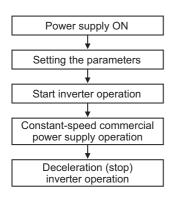


• Example of operation sequence with automatic bypass sequence (Pr.139 ≠ "9999", Pr.159 ≠ "9999")



Operating procedure

Operation flowchart



- Pr.135 = "1"
 Pr.136 = 2.0 s
- **Pr.137** = 1.0 s (Set the time until MC3 is actually turned ON and the inverter and motor are electrically connected. If the time is short, the restart may not function properly.)
- **Pr.57** = 0.5 s
- **Pr.58** = 0.5 s (Always set this to switchover from the commercial power supply operation to the inverter operation.)

Signal operation after setting parameters

| Status | MRS | CS | STF | MC1 | MC2 | MC3 | Remarks |
|---|--------------|--------------|----------------------|--|--------------|--------------------|--|
| Power ON | OFF (OFF) | OFF (OFF) | OFF (OFF) | $\begin{array}{l} OFF \to ON \\ (OFF \to \\ ON) \end{array}$ | OFF (OFF) | OFF→ON (OFF→ON) | External operation mode (PU operation mode) |
| At start (Inverter) | OFF→ON | OFF→ON | OFF→ON | ON | OFF | ON | |
| During constant-speed operation (commercial power supply) | ON | ON→OFF | ON | ON | OFF→ON | ON→OFF | MC2 turns ON after MC3 turns OFF. Delay time is 2 s (while coasting). |
| For deceleration, switched to the inverter operation (inverter) | ON | OFF→ON | ON | ON | ON→OFF | OFF→ON | MC3 turns ON after MC2 turns OFF. Delay time is 4 s (while coasting). |
| Stop | ON | ON | $ON \rightarrow OFF$ | ON | OFF | ON | |



- Connect the control power (R1/L11, S1/L21) in front of the input-side MC1. If the control power is connected behind the inputside MC1, the electronic bypass sequence function will not operate.
- The electronic bypass sequence function is enabled only when Pr.135 = "1" and the inverter is in either External operation mode, PU/External combined operation mode 1 (Pr.79 = "3"), or Network operation mode. MC1 and MC3 turn ON when Pr.135 = "1" and in an operation mode other than mentioned above.
- MC3 turns ON when the MRS and CS signals are ON and the STF (STR) signals OFF. If the motor was coasted to a stop from commercial power supply operation at the previous stop, the motor starts running only after waiting the time set in **Pr.137**.
- Inverter operation is only available when the MRS, STF (STR), and CS signals are ON. In all other cases (when the MRS signal is ON), commercial power supply operation is available.
- When the CS signal is OFF, the motor switches to the commercial power supply operation. However, when the STF (STR) signal is OFF, the motor decelerates to a stop during inverter operation.
- From the point where MC2 and MC3 are both turned OFF, there is a delay time set with **Pr.136**, till MC2 or MC3 is turned ON.
- Even when the electronic bypass sequence is enabled (**Pr.135** = "1"), the **Pr.136** and **Pr.137** settings are ignored in PU operation mode.

In addition, the input terminals (STF, CS, MRS, OH) return to perform their normal functions.

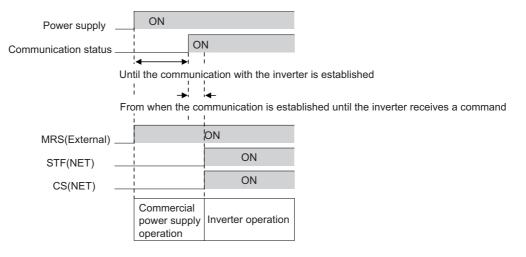
- When the electronic bypass sequence function (**Pr.135** = "1") and PU operation interlock function (**Pr.79** = "7") are used at the same time, the MRS signal is shared with the PU operation external interlock if the X12 signal is not assigned. (The inverter operation is available when the MRS and CS signals are ON.)
- Set the acceleration time to the level that does not activate the stall prevention operation.
- If switching to the commercial power supply operation while a failure such as an output short circuit has occurred between the magnetic contactor MC3 and the motor, the damage may further spread. If a failure has occurred between the MC3 and the motor, a protection circuit such as using the OH signal input must be provided.
- Changing the terminal functions with **Pr.178 to Pr.189** and **Pr.190 to Pr.196** may affect other functions. Set parameters after confirming the function of each terminal.
- Switching with the electronic bypass sequence is not available during retry. Switching occurs after the retry. When the electronic bypass is valid at a fault (**Pr.138** = "1"), switching occurs also during retry.
- When the electronic bypass sequence function and the retry function of the converter unit are used at the same time for the separated converter type, set 101 or more in the number of retries at fault occurrence (**Pr.67**) on the converter unit side. When a value less than 100 is set, the ALM signal does not turn ON until the retry count is exceeded. In this case, the electronic bypass at a fault is not performed until the retry count is exceeded.

Precautions for electronic bypass sequence function

• The response time of the inverter to the signals depends on the command source, NET or External.

After the communication with the inverter is established, the motor operation is performed according to the command via NET. The commercial power supply operation with the motor is performed when the MRS signal turns ON before the communication is established. It is recommended to turn the MRS signal ON after the communication is established.

Example: the response time of the inverter to the signals in the Network operation mode (power-ON). The command source is External for the MRS signal and NET for the STF (STR) and CS signals.



Operation in combination with the self power management function for the separated converter type

• When the self power management function is used with the separated converter type, the input signal operations are as follows.

| X95 X96 | | X94 | MC operation ^{*3} | | | |
|---------------------------|---|---|----------------------------|-----|-----|--|
| (Converter unit fault) | (Converter unit fault (E.OHT, E.CPU)) | (Control signal for main circuit power supply MC) | MC1 | MC2 | MC3 | Converter status |
| OFF | OFF | ON | °*2 | × | × | Converter fault (E.OHT (Pr.248 = "2")) |
| OFF OI | OFF | OFF | × | × | × | Converter fault (E.OHT (Pr.248 = "1"), E.CPU) |
| ON | ON | ON | ° ^{*2} | — | — | Converter normal |
| OFF | ON | ON | ° ^{*2} | *1 | × | Converter fault (other than the circuit failure fault or E.OHT) (Pr.248 = "2") |
| | | OFF | × | *1 | × | Converter fault (other than E.OHT or E.CPU) |

*1 When Pr.138 = "0 (electronic bypass invalid at a fault)", MC2 is OFF. When Pr.138 = "1 (electronic bypass valid at a fault)", MC2 is ON.

*2 The self power management operation is followed.

*3 MC operation is as shown below.

| Notation | MC operation | | | | | | |
|----------|---|--|--|--|--|--|--|
| 0 | ON | | | | | | |
| × | OFF | | | | | | |
| _ | During inverter operation: MC2-OFF, MC3-ON During commercial power supply operation: MC2-ON, MC3-OFF | | | | | | |

Parameters referred to

Pr.11 DC injection brake operation time 🖙 page 560 Pr.57 Restart coasting time 🖙 page 466, page 472 Pr.58 Restart cushion time 🖙 page 466 Pr.79 Operation mode selection 🖙 page 240

Pr.178 to Pr.189 (Input terminal function selection) 🖙 page 373 Pr.190 to Pr.196 (Output terminal function selection) page 330

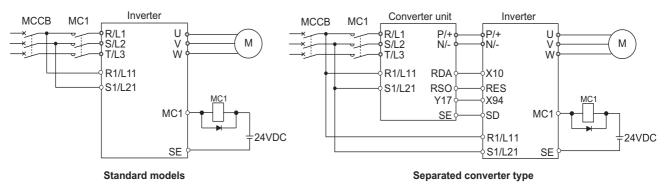
5.11.2 Self power management

By turning ON the magnetic contactor (MC) on the input side before the motor is started and turning OFF the MC after the motor is stopped, power is not supplied to the main circuit, reducing the standby power.

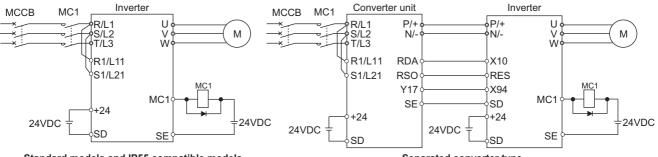
| Pr. | Name | Initial value | Setting range | Description |
|-------------|---------------------------------|------------------|---|--|
| | | | 0 | Self power management function disabled |
| 248 A006 | Self power management selection | 0 | 1 | Self power management function enabled (main circuit OFF at protective function activation) |
| 1000 | | | 2 | Self power management function enabled (main circuit OFF at protective function activation due to a circuit failure) |
| 137 A002 | Start waiting time | 0.5 s | 0 to 100 s | Set a time period that is a little longer than the time period from the ON signal input to the actual pick-up operation of MC1 (0.3 to 0.5 s). |
| 254 | | 600 s | 1 to 3600 s | Set the waiting time until the main circuit power supply is turned OFF after the motor is stopped. |
| A007 | | | 9999 | The main circuit power supply is turned OFF only when the protective function selected by Pr.248 is activated. |
| 30 | Regenerative function | for the | | Power supply to the inverter: AC (terminals R, S, and T) When power is supplied only to the control circuit, and then switched to be supplied to both the control and main circuits, inverter reset is not performed. |
| E300 | | 0 | 0 to 2, 10, 11, 20, 21, 102, 110, 111, 120, 121 | For other settings, refer to page 566. |

Connection diagram

• Terminal R1, S1 inputs



• 24 V external power supply input

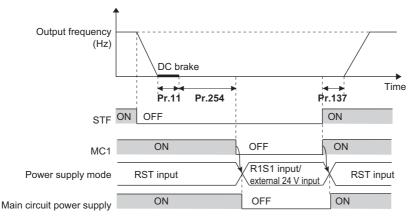


Standard models and IP55 compatible models

Separated converter type

Operation of the self power management function

- This function controls the magnetic contactor (MC) on the input side using the output relay to reduce the standby power during inverter stop. With the terminals R1/L11 and S1/L21 (refer to page 69) and 24 V external power supply input (refer to page 73), the main circuit power supply and control circuit power supply are separated, and the MC for main circuit power supply is controlled by the electronic bypass MC1 signal.
- Set Pr.248 Self power management selection = "1 or 2", Pr.30 Regenerative function selection ≠ "20, 21, 120, or 121" (other than DC feeding mode 2), and Pr.190 to Pr.196 (Output terminal function selection) = "17 (positive logic)" to assign the Electronic bypass MC1 (MC1) signal to an output terminal.
- After the inverter is stopped and the time set in Pr.11 DC injection brake operation time and Pr.254 Main circuit power OFF waiting time have passed, turning OFF the MC1 signal releases the MC on the input side (main circuit power supply OFF). Set Pr.254 to prevent frequent MC operation.
- Turning ON the start signal turns ON the MC1 signal and closes the MC on the input side (main circuit power supply ON). After the time set in **Pr.137 Start waiting time** has passed, the inverter starts. Set time slightly longer (about 0.3 to 0.5 second) than the time period from the MC1-ON to the actual pick-up operation of the MC is turned ON in **Pr.137**.



5

• When the protective function of the inverter is activated, the MC1 signal is immediately turned OFF according to the **Pr.248** setting. (The MC1 signal is turned OFF before the time set in **Pr.254** has passed.)

When **Pr.248** = "1", the MC1 signal is turned OFF when the protective function is activated due to any cause.

When **Pr.248** = "2", the MC1 signal is turned OFF only when the protective function is activated due to an error resulted from a failure in the inverter circuit or a wiring error (refer to the following table). (For the fault details, refer to page 594.)

| Fault type |
|--|
| Inrush current limit circuit fault (E.IOH) |
| CPU fault (E.CPU) |
| CPU fault (E.6) |
| CPU fault (E.7) |
| Parameter storage device fault (control circuit board) (E.PE) |
| Parameter storage device fault (main circuit board) (E.PE2) |
| Internal storage device fault (E.PE6) |
| 24 VDC power fault (E.P24) |
| Operation panel power supply short circuit/RS-485 terminals power supply short circuit (E.CTE) |
| Output side earth (ground) fault overcurrent (E.GF) |
| Output phase loss (E.LF) |
| Internal circuit fault (E.BE) |
| Internal circuit fault (E.13/E.PBT) |

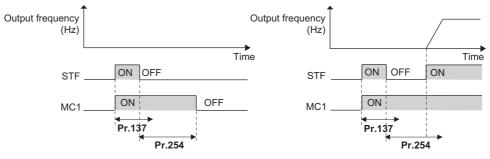
• To enable the self power management function for the separated converter type, enable the self power management function also on the converter unit side. To activate the self power management function when a converter unit fault occurs, connect the terminal to which the Y17 signal of the converter unit is assigned and the terminal to which X94 signal of the inverter is assigned.

| Y17 output signal (on the converter unit side) | MC1 output signal (inverter side) | MC1 output signal actual operation | Main circuit power supply |
|---|--------------------------------------|------------------------------------|---------------------------|
| OFF | OFF | OFF | Stop |
| OFF | ON | OFF | Stop |
| ON | OFF | OFF | Stop |
| ON | ON | ON | Supplied |

 To use the X94 signal, set "94" in any parameter from Pr.178 to Pr.189 (Input terminal function selection) to assign the function to an input terminal.



- When the start signal is turned OFF before the time set in Pr.137 has passed after the start signal is turned ON, the inverter does not start and the MC1 signal is turned OFF after the time set in Pr.254 has passed.
 - If the start signal is turned ON again before the time set in Pr.254 has passed, the inverter immediately starts outputting.



- At inverter reset, the status of the MC1 signal is held and operation of the magnetic contactor is not performed.
- When the inverter stops the output due to, for example, the Output stop (MRS) signal, the MC1 signal is turned OFF after the time set in **Pr.254** has passed.
- During the stop, turning ON the External DC injection brake operation start (X13) signal turns ON the MC1 signal.
- To avoid inverter reset when supplying power to the main circuit is started when power is supplied only to the control circuit, set 100 or more in **Pr.30**. (For the separated converter type, setting **Pr.30** of the converter unit is also required.)
- When supplying power to the main circuit is started when power is supplied only to the control circuit, there is a slight waiting time before starting.
- Repeated operation of the magnetic contactor due to frequent start and stop or activation of the protective function may shorten the inverter life.
- Changing the terminal assignment using Pr.178 to Pr.189 (Input terminal function selection) or Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

帐 Parameters referred to 🚿

Pr.11 DC injection brake operation time is page 560

Pr.30 Regenerative function selection F page 566

Pr.190 to Pr.196 (Output terminal function selection) F page 330

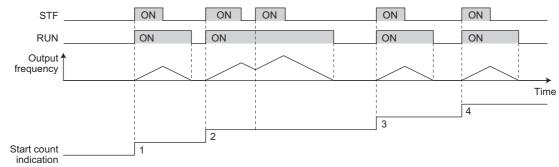
5.11.3 Start count monitor

The inverter starting times can be counted.

Confirming the starting times can be used to determine the timing of the maintenance, or can be used as a reference for system inspection or parts replacement.

| Pr. | Name | Initial value | Setting range | Description |
|--------------|-------------------------------|---------------|---------------|--|
| 1410 A170 | Starting times lower 4 digits | 0 | 0 to 9999 | Displays the lower four digits of the number of the inverter starting times. |
| 1411 A171 | Starting times upper 4 digits | 0 | 0 to 9999 | Displays the upper four digits of the number of the inverter starting times. |

• Every start signal input (the RUN signal ON) while the inverter output is stopped is counted as the inverter starting time.



• The lower four digits of the number of starting times is displayed in **Pr.1410 Starting times lower 4 digits**, and the upper four digits of the number of starting times is displayed in **Pr.1411 Starting times upper 4 digits**.

• The maximum count is "999999999". When "99999999" is exceeded on the monitor, the monitor value is reset to 0.

| | Display data | Monitor display |
|-------|--------------------------------|-----------------|
| 10000 | Pr.1410 (Lower digits monitor) | ۵ |
| 10000 | Pr.1411 (Upper digits monitor) | 1 |
| 100 | Pr.1410 (Lower digits monitor) | 100 |
| | Pr.1411 (Upper digits monitor) | ۵ |

NOTE

- Any value can be set in Pr.1410 or Pr.1411. Set "0" to clear the number on the monitor.
- Starting during offline auto tuning is not counted.
- The counting is enabled even if the RUN signal is not assigned to an output terminal.
- For the RUN signal, refer to page 330.
- Starting during the test operation (**Pr.800** = "9 or 109") is not counted.

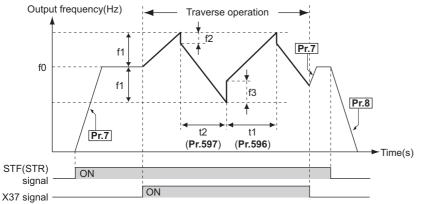
5.11.4 Traverse function

The traverse operation, which oscillates the frequency at a constant cycle, is available.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|---|---------------|---------------|--|
| | | | 0 | Traverse function invalid |
| 592 A300 | Traverse function selection | 0 | 1 | Traverse function valid only in External operation mode |
| 7000 | selection | | 2 | Traverse function valid regardless of the operation mode |
| 593 A301 | Maximum amplitude amount | 10% | 0% to 25% | Level of amplitude during traverse operation |
| 594 A302 | Amplitude compensation amount during deceleration | 10% | 0% to 50% | Compensation amount during amplitude inversion (from acceleration to deceleration) |
| 595 A303 | Amplitude compensation amount during acceleration | 10% | 0% to 50% | Compensation amount during amplitude inversion (from deceleration to acceleration) |
| 596 A304 | Amplitude acceleration time | 5 s | 0.1 to 3600 s | Time period of acceleration during traverse operation |
| 597 A305 | Amplitude deceleration time | 5 s | 0.1 to 3600 s | Time period of deceleration during traverse operation |

• Setting Pr.592 Traverse function selection = "1 or 2" enables the traverse function.

Assigning the Traverse function selection (X37) signal to the input terminal enables the traverse function only when the X37 signal is ON. (When the X37 signal is not assigned, the traverse function is always available.) To input the X37 signal, set "37" in any parameter from Pr.178 to Pr.189 (Input terminal function selection) to assign the function to a terminal.



- f0: set frequency
- f1: amplitude amount from the set frequency (f0 \times Pr.593/100)
- f2: compensation amount at transition from acceleration to deceleration (f1 × Pr.594/100)
- f3: compensation amount at transition from deceleration to acceleration (f1 × Pr.595/100)
- t1: time from acceleration during traverse operation (Time from (f0 – f1) to (f0 + f1)) (**Pr.596**)
- t2: time from deceleration during traverse operation (Time from (f0 + f1) to (f0 - f1)) (Pr.597)
- The motor accelerates to the set frequency f0 according to the normal Pr.7 Acceleration time at turn ON of the start command (STF or STR).

- When the output frequency reaches f0 and the X37 signal turns ON, the inverter begins traverse operation and accelerates to f0 + f1. The acceleration time at this time is according to the **Pr.596** setting. (If the X37 signal turns ON before the output frequency reaches f0, traverse operation begins after the output frequency reaches f0.)
- After the inverter accelerates the motor to f0 + f1, this is compensated with f2 (f1 × **Pr.594**), and the motor decelerates to f0 f1. The deceleration time at this time is according to the **Pr.597** setting.
- After the inverter decelerates the motor to f0 f1, this is compensated with f3 (f1 × Pr.595), and the motor accelerates again to f0 + f1.
- When the X37 signal turns OFF during traverse operation, the inverter accelerates/decelerates the motor to f0 according to the normal acceleration/deceleration time (**Pr.7, Pr.8**). If the start command (STF or STR) is turned OFF during traverse operation, the inverter decelerates the motor to a stop according to the normal deceleration time (**Pr.8**).

- NOTE

- If the set frequency (f0) and traverse operation parameters (**Pr.593 to Pr.597**) are changed during traverse operation, this is applied in operations after the output frequency reaches f0 before the change was made.
- If the output frequency exceeds **Pr.1 Maximum frequency** or **Pr.2 Minimum frequency** during traverse operation, the output frequency is clamped at the maximum/minimum frequency when the set pattern exceeds the maximum/minimum frequency.
- When the traverse function and S-pattern acceleration/deceleration (**Pr.29** ≠ "0") are selected, S-pattern acceleration/ deceleration operation occurs only in the range operated at the normal acceleration/deceleration time (**Pr.7, Pr.8**). Acceleration/deceleration during traverse operation is performed linearly.
- If stall prevention activates during traverse operation, traverse operation stops and normal operation begins. When stall
 prevention operation is completed, the inverter accelerates/decelerates to f0 at the normal acceleration/deceleration time
 (Pr.7, Pr.8). After the output frequency reaches f0, the traverse operation begins again.
- If the value of the amplitude inversion compensation amount (**Pr.594**, **Pr.595**) is too large, an overvoltage trip or stall prevention occurs, and pattern operation cannot be performed as set.
- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.3 Base frequency 3 page 552

Pr.178 to Pr.189 (Input terminal function selection) 🗐 page 373 Pr.190 to Pr.196 (Output terminal function selection) 🗐 page 330

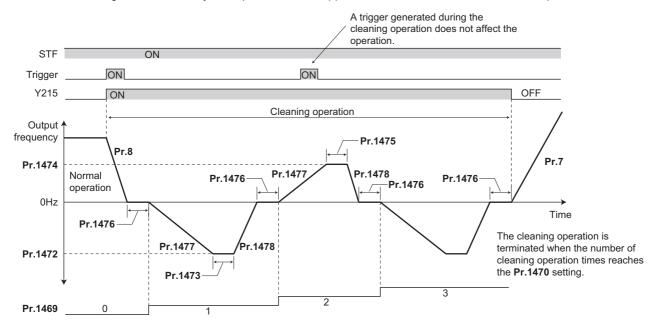
5.11.5 Cleaning function

This is a function to remove stains or foreign matter on the impellers or fans of pumps by setting a forward/reverse rotation sequence.

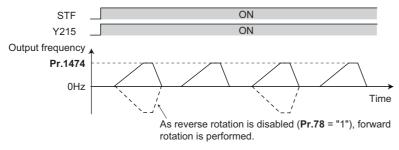
| Pr. | Name | Initial value | Setting range | Description |
|--------------|---|---------------|---------------|---|
| 1469 A420 | Number of cleaning times monitor | 0 | 0 to 255 | Displays the number of cleaning times. (Read-only) |
| 1470 A421 | Number of cleaning times setting | 0 | 0 to 255 | Set the number of cleaning times. |
| 1471 A422 | Cleaning trigger selection | 0 | 0 to 15 | Select the condition to start cleaning. |
| 1472 A423 | Cleaning reverse rotation frequency | 30 Hz | 0 to 590 Hz | Set the reverse rotation frequency for cleaning operation. |
| 1473 A424 | Cleaning reverse rotation operation time | 5 s | 0 to 3600 s | Set the operating time after the cleaning forward rotation frequency is reached. |
| 1474 | Cleaning forward rotation | 9999 | 0 to 590 Hz | Set the forward rotation frequency for cleaning operation. |
| A425 | frequency | | 9999 | As set in Pr.1472 . |
| 1475 A426 | Cleaning forward rotation | 9999 | 0 to 3600 s | Set the operating time after the cleaning forward rotation frequency is reached. |
| A420 | operation time | | 9999 | As set in Pr.1473 . |
| 1476 A427 | Cleaning stop time | 5 s | 0 to 3600 s | Set the stop time when the rotation is switched from forward to reverse or from reverse to forward. |
| 1477 | Cleaning acceleration time | 9999 | 0 to 3600 s | Set the acceleration time for cleaning. |
| A428 | | 5555 | 9999 | Acceleration time for normal operation. |
| 1478 | Cleaning deceleration time | 9999 | 0 to 3600 s | Set the deceleration time for cleaning. |
| A429 | | 3333 | 9999 | Deceleration time for normal operation. |
| 1479 | Cleaning time trigger | 0 | 0 | Time trigger disabled |
| A430 | | U | 0.1 to 6000 h | Cleaning is performed at a set time interval. |

Outline of the cleaning operation

- Setting a number in Pr.1470 Number of cleaning times setting enables the cleaning function.
- The cleaning operation is started when the trigger set in **Pr.1471** or **Pr.1479** occurs, or when the X98 signal turns ON. When the cleaning is started initially, the operation in the opposite direction to the start command is performed.



- When the number of times of cleaning operation is an odd number, the operation in the opposite direction to the start command is performed. When the number of cleaning times is an even number, the operation in the start command direction is performed.
- When the motor rotation direction is restricted in Pr.78 Reverse rotation prevention selection, rotation is performed not
 in the prohibited direction but in the permitted direction.



- Use Pr.1472 Cleaning reverse rotation frequency and Pr.1474 Cleaning forward rotation frequency to set the running frequency for cleaning operation, and use Pr.1473 Cleaning reverse rotation operation time and Pr.1475 Cleaning forward rotation operation time to set the operating time after the cleaning running frequency is reached.
- Use Pr.1477 Cleaning acceleration time and Pr.1478 Cleaning deceleration time to set the acceleration/deceleration time for cleaning operation.
- The Y215 signal turns ON during cleaning operation. For the Y215 signal, set "215 (positive logic)" or "315 (negative logic)" in any parameter from Pr.190 to Pr.196 (Output terminal function selection) to assign the function.

Cleaning trigger selection (Pr.1471, Pr.1479, X98 signal)

• Use **Pr.1471 Cleaning trigger selection** to select the trigger to start cleaning operation. As set in **Pr.1471**, cleaning operation is started when any of the applicable trigger conditions is satisfied.

| Pr.1471 | Trigger factor | Value in | each bit | Remarks | |
|---------|-----------------------|-------------------|------------------|--|--|
| setting | Thyger factor | 0 | 1 | Reliaiks | |
| Bit 0 | Start trigger | Trigger disabled. | Trigger enabled. | Turning ON of the start command is defined as a trigger. *1*6*7 | |
| Bit 1 | Output current | Trigger disabled. | Trigger enabled. | Turning ON of the Y12 signal is defined as a trigger. ^{*2*5} | |
| Bit 2 | PID upper/lower limit | Trigger disabled. | Trigger enabled. | Turning ON of the FUP, FDN, FUP2, or FDN2 signal is defined as a trigger. ^{*3*5} | |
| Bit 3 | Load warning | Trigger disabled. | Trigger enabled. | Turning ON of the LUP or LDN signal is defined as a trigger. ^{*4*5} | |
| _ | X98 signal input | _ | | Turning ON of X98 signal is defined as a trigger. (This trigger is always enabled by assigning the X98 signal to an input terminal.) | |
| — | Time trigger | — | | When Pr.1479 \neq "0", the trigger is enabled. | |

*1 The ON state at power-ON or inverter reset is not regarded as a trigger.

*2 Use Pr.150 and Pr.151 to set the detection level. (Refer to page 339.)

*3 Use **Pr.131**, **Pr.132**, **Pr.1143**, and **Pr.1144** to set the detection level. When the frequency reflection is not provided for the PID setting, or when the function is disabled, a trigger does not occur. (Refer to page 419.)

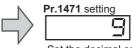
*4 Set the load characteristics fault detection function. When the function is disabled, a trigger does not occur. (Refer to page 298.)

*5 The output signal can be used as a trigger if the signal is not assigned to a terminal.

- *6 When the automatic restart after instantaneous power failure is set for every start, or when the online auto tuning is enabled, cleaning is started upon completion of the set operations.
- *7 While the self power management is enabled, the start trigger is disabled.
- Convert a bit image (binary) of the trigger factor into a decimal value, and set the value in Pr.1471.

bit 15 0,0,0,00,0,000,0001001 bit 0 Start trigger bit 1 Output current trigger

o: Trigger enabled, ×: Trigger disabled



Set the decimal converted value of the bit image.

| bit 2 PID | upper/lower | limit trigger |
|-----------|-------------|---------------|
| | | |

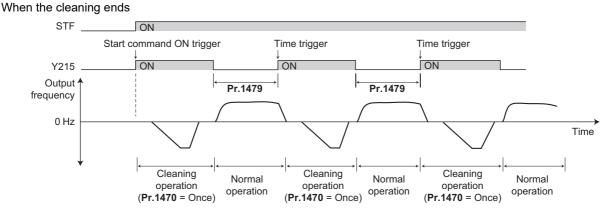
bit 3 Load warning trigger

| Pr.1 | 471 | bit 3 | bit 2 | bit 1 | bit 0 | Pr.1 | 471 | bit 3 | bit 2 | bit 1 | bit 0 |
|---------|--------|-------|-------|-------|-------|---------|--------|-------|-------|-------|-------|
| Decimal | Binary | DIUS | DIL 2 | DILI | DILO | Decimal | Binary | DIUS | | וות | DILU |
| 15 | 1111 | 0 | 0 | 0 | 0 | 7 | 0111 | × | 0 | 0 | 0 |
| 14 | 1110 | 0 | 0 | 0 | × | 6 | 0110 | × | 0 | 0 | × |
| 13 | 1101 | 0 | 0 | × | 0 | 5 | 0101 | × | 0 | × | 0 |
| 12 | 1100 | 0 | 0 | × | × | 4 | 0100 | × | 0 | × | × |
| 11 | 1011 | 0 | × | 0 | 0 | 3 | 0011 | × | × | 0 | 0 |
| 10 | 1010 | 0 | × | 0 | × | 2 | 0010 | × | × | 0 | × |
| 9 | 1001 | 0 | × | × | 0 | 1 | 0001 | × | × | × | 0 |
| 8 | 1000 | 0 | × | × | × | 0 | 0000 | × | × | × | × |

• Turning ON of the X98 signal can be used as a trigger to start the cleaning operation. For the X98 signal input, set "98" in any parameter from **Pr.178 to Pr.189** to assign the function.

When using the cleaning function for the purpose of periodic maintenance in such applications that require continuous
pump operation for a long time, use a time trigger. The time trigger is enabled by setting a time period before starting the
cleaning operation in Pr.1479 Cleaning time trigger. The timer starts when the timer starting condition is satisfied, and
the cleaning operation is performed at a time interval set in Pr.1479.

Starting conditions of the timer for a time trigger
 When the start command turns ON



Cleaning operation by the cleaning signal (X97 signal)

- When X97 signal is assigned to an input terminal, the cleaning operation can be finished when the cleaning signal (X97) is turned from ON to OFF.
- For the X97 signal input, set "97" in any parameter from Pr.178 to Pr.189 to assign the function.

| Pr.1470 setting | X97 s | signal | Cleaning operation | Cleaning end condition | |
|-----------------|--------------|----------|--------------------|--|--|
| F1.1470 Setting | Assignment | ON/OFF | Cleaning operation | cleaning end condition | |
| 0 | Optional | Optional | Disabled | — | |
| | Not assigned | — | Enabled | After cleaning is performed for the number of times set in Pr.1470 . | |
| Other than 0 | Assigned | OFF | Disabled | — | |
| Other than 0 | | ON | Enabled | After cleaning is performed for the number of times set in Pr.1470. When X97 signal turns OFF. | |

NOTE

- When a trigger occurs during the following operations, the cleaning operation is started upon completion of the following operations.
- Automatic restart after instantaneous power failure, online auto tuning at startup
- The following functions are disabled during cleaning operation.

PID control automatic switchover frequency, PID control sleep function, pre-charge fault, determination of pre-charge ending with parameters, PID gain tuning, switchover to the commercial power supply operation with the automatic switchover frequency of the inverter (**Pr.139**), automatic switchover of auxiliary motors of the multi-pump function, output stop function (**Pr.522**), restart at every start during cleaning

- When the stall prevention is activated during acceleration of the cleaning function, the operation is shifted to the cleaning deceleration operation.
- If the number of cleaning times set in **Pr.1470** is an even number, the operation is shifted to the normal operation after the cleaning forward/reverse operation time (**Pr.1473/Pr.1475**) of the final cleaning operation has elapsed.
- Changing the terminal assignment with **Pr.178 to Pr.189** and **Pr.190 to Pr.196** may affect other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.178 to Pr.189 (Input terminal function selection) F page 373 Pr.190 to Pr.196 (Output terminal function selection) r page 330

Pr.7 Acceleration time, Pr.8 Deceleration time 3 page 228

5.11.6 PID control

Process control such as flow rate, air volume or pressure are possible on the inverter.

A feedback system can be configured and PID control can be performed using the terminal 2 input signal or parameter setting value as the set point and the terminal 4 input signal as the feedback value.

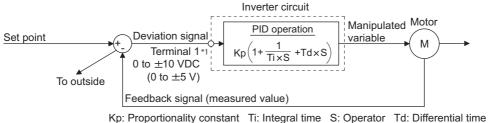
| Pr. | Name | Initial value | Setting range | Description |
|---------------------|--|---------------|---|--|
| 127 | PID control automatic | | 0 to 590 Hz | Set the value at which control is automatically switched to PID |
| A612 | switchover frequency | 9999 | | control. |
| 128 A610 | PID action selection | 0 | 9999 0, 10, 11, 20, 21, 50, 51, 60, 61, 70, 71, 80, 81, 90, 91, 100, 101, 1000, 1001, 1010, 1011, 2000, 2001, 2010, 2011 | No PID control automatic switchover function Select how to input the deviation value, measured value and set point, and forward and reverse action. |
| 129 A613 | PID proportional band | 100% | 0.1% to 1000% | If a narrow proportional band is set (small parameter setting value), the manipulated amount changes considerably by slight changes in the measured value. As a result, response improves as the proportional band becomes narrower, though stability worsens as shown by the occurrence of hunting. Gain Kp=1/proportional band |
| | | | 9999 | No proportional control |
| 130 A614 | PID integral time | 1 s | 0.1 to 3600 s | With deviation step input, this is the time (Ti) used for obtaining the same manipulated amount as proportional band (P) by only integral (I) action. Arrival to the set point becomes quicker the shorter an integral time is set, though hunting is more likely to occur. |
| | | | 9999 | No integral control |
| 131 A601 | PID upper limit | 9999 | 0% to 100% | Set the upper limit. The FUP signal is output when the feedback value exceeds this setting. The maximum input (20 mA/5 V/10 V) of the measured value is equivalent to 100%. |
| | | | 9999 | No function |
| 132 A602 | PID lower limit | 9999 | 0% to 100% | Set the lower limit. The FDN signal is output when the measured value falls below the setting range. The maximum input (20 mA/5 V/ 10 V) of the measured value is equivalent to 100%. |
| | | | 9999 | No function |
| 133 | PID action set point | 9999 | 0% to 100% | Set the set point during PID control. |
| A611 134 A615 | PID differential time | 9999 | 9999 0.01 to 10 s | Set point set by Pr.128 . With deviation ramp input, this is the time (Td) used for obtaining the manipulated amount only by proportional action (P). Response to changes in deviation increase greatly as the differential time increases. |
| | | | 9999 | No differential control |
| 553 A603 | PID deviation limit | 9999 | 0% to 100% | The Y48 signal is output when the absolute value of the deviation exceeds the deviation limit value. |
| | | | 9999 | No function |
| 554 A604 | PID signal operation selection | 0 | 0 to 7, 10 to 17 | The action when the upper or lower limit for a measured value input is detected or when a limit for the deviation is detected can be selected. The operation for PID output suspension function can be selected. |
| 575 A621 | Output interruption detection time | 1 s | 0 to 3600 s | When the output frequency after PID calculation stays less than the Pr.576 setting for the time set in Pr.575 or more, the inverter operation is suspended. |
| | | | 9999 | No output interruption function |
| 576 A622 | Output interruption detection level | 0 Hz | 0 to 590 Hz | Set the frequency at which output interruption is performed. |
| 577 A623 | Output interruption cancel level | 1000% | 900% to 1100% | Level at which the PID output suspension function is released. Set " Pr.577 - 1000%". |
| | | | 1 | Input of set point, deviation value from terminal 1 |
| 609 | PID set point/deviation | 0 | 2 | Input of set point, deviation value from terminal 2 |
| A624 | input selection | 2 | 3 | Input of set point, deviation value from terminal 4 |
| | | | 4 | Input of set point, deviation value via communication |
| | | | 5 | Input of set point, deviation value by PLC function |

| Pr. | Name | Initial value | Setting range | Description | | |
|--------------|--|---------------|---------------|---|---|--|
| | | | 1 | Terminal 1 input | | |
| | | | 2 | Terminal 2 input | | |
| | | | 3 | Terminal 4 input | Direct input of the measured value | |
| | | | 4 | Communication input | | |
| 610 | PID measured value | 3 | 5 | PLC function input | | |
| A625 | input selection | 5 | 101 | Terminal 1 input | | |
| | | | 102 | Terminal 2 input | Input of the aguare reat of the | |
| | | | 103 | Terminal 4 input | Input of the square root of the measured value | |
| | | | 104 | Communication input | | |
| | | | 105 | PLC function input | | |
| | | | 0 | Integral stopped at the limit, cleared during output interru | manipulation range of ±100%, integral ption | |
| | | | 1 | Integral continued at the limi integral cleared during output | t, manipulation range of ±100%, it interruption | |
| 1015 | Integral stop selection at | 0 | 2 | Integral stopped at the limit, manipulation range of 0 to 100%, integral cleared during output interruption | | |
| A607 | limited frequency | U | 10 | Integral stopped at the limit, manipulation range of ±100%, integral stopped during output interruption | | |
| | | | 11 | Integral continued at the limit, manipulation range of ±100%, integral stopped during output interruption | | |
| | | | 12 | Integral stopped at the limit, manipulation range of 0 to 100%, integral stopped during output interruption | | |
| 1346 | PID lower limit operation | 9999 | 0 to 900 s | Set the time from when the measured value input falls below the Pr.132 setting until the FDN signal is output. | | |
| A457 | detection time | | 9999 | As set in Pr.1370 . | | |
| 1370 A442 | Detection time for PID limiting operation | 0 s | 0 to 900 s | | neasured value input exceeds the il the FUP or FDN signal is output. | |
| 1460 A683 | PID multistage set point 1 | | | | | |
| 1461 A684 | PID multistage set point 2 | | | | | |
| 1462 A685 | PID multistage set point 3 | | | | | |
| 1463 A686 | PID multistage set point 4 | 9999 | 0% to 100% | Seven set points can be set PDI1, PDI2, and PDI3 signal 9999: Not selected | according to the combination of the ls. | |
| 1464 A687 | PID multistage set point 5 | | | 5555. INOL SELECIEU | | |
| 1465 A688 | PID multistage set point 6 | | | | | |
| 1466 A689 | PID multistage set point 7 | | | | | |

| Pr. | Name | Initial value | Setting range | D | Description |
|--------------|---|---------------|---|--|---|
| 753 A650 | Second PID action selection | 0 | 0, 10, 11, 20, 21, 50, 51, 60, 61, 70, 71, 80, 81, 90, 91, 100, 101, 1000, 1001, 1010, 1011, 2000, 2001, 2010, 2011 | Refer to Pr.128 . | |
| 754 A652 | Second PID control automatic switchover frequency | 9999 | 0 to 590 Hz, 9999 | Refer to Pr.127 . | |
| 755 A651 | Second PID action set point | 9999 | 0% to 100%, 9999 | Refer to Pr.133 . | |
| 756 A653 | Second PID proportional band | 100 | 0.1% to 1000%, 9999 | Refer to Pr.129 . | |
| 757 A654 | Second PID integral time | 1 s | 0.1 to 3600 s, 9999 | Refer to Pr.130 . | |
| 758 A655 | Second PID differential time | 9999 | 0.01 to 10 s, 9999 | Refer to Pr.134 . | |
| 1140 A664 | Second PID set point/ deviation input selection | 2 | 1 to 5 | Refer to Pr.609 . | Set the second PID control. For how to enable the second PID |
| 1141 A665 | Second PID measured value input selection | 3 | 1 to 5, 101 to 105 | Refer to Pr.610 . | control, refer to page 435. |
| 1143 A641 | Second PID upper limit | 9999 | 0% to 100%, 9999 | Refer to Pr.131 . | |
| 1144 A642 | Second PID lower limit | 9999 | 0% to 100%, 9999 | Refer to Pr.132 . | |
| 1145 A643 | Second PID deviation limit | 9999 | 0% to 100%, 9999 | Refer to Pr.553 . (The Y205 signal is output.) | |
| 1146 A644 | Second PID signal operation selection | 0 | 0 to 7, 10 to 17 | Refer to Pr.554 . | |
| 1147 A661 | Second output interruption detection time | 1 s | 0 to 3600 s, 9999 | Refer to Pr.575 . | |
| 1148 A662 | Second output interruption detection level | 0 Hz | 0 to 590 Hz | Refer to Pr.576 . | |
| 1149 A663 | Second output interruption cancel level | 1000% | 900% to 1100% | Refer to Pr.577 . | |

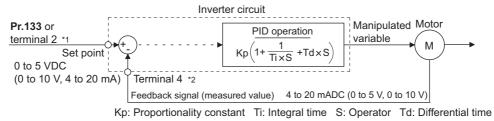
Basic configuration of PID control

■ Pr.128 = "10, 11" (deviation value signal input)



*1 Set "0" to **Pr.868 Terminal 1 function assignment**. When **Pr.868** ≠ "0", PID control is invalid.

■ Pr.128 = "20, 21" (measured value input)



*1 Note that the input of terminal 1 is added to the set point of terminal 2 as a set point.

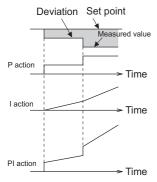
*2 Set "0" to Pr.858 Terminal 4 function assignment. When Pr.858 ≠ "0", PID control is invalid.

PID action outline

■ PI action

PI action is a combination of proportional action (P) and integral action (I), and applies a manipulated amount according to the size of the deviation and transition or changes over time.

[Example of action when the measured value changes in a stepped manner]

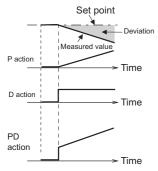


(Note) PI action is the result of P and I actions being added together.

■ PD action

PD action is a combination of proportional action (P) and differential action (D), and applies a manipulated amount according to the speed of the deviation to improve excessive characteristics.

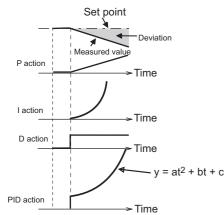
[Example of action when the measured value changes proportionately]



(Note) PD action is the result of P and D actions being added together.

■ PID action

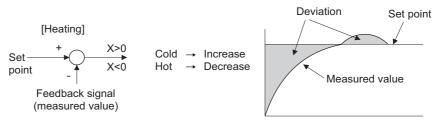
PID action is a combination of PI and PD action, which enables control that incorporates the respective strengths of these actions.



(Note) PID action is the result of all P, I and D actions being added together.

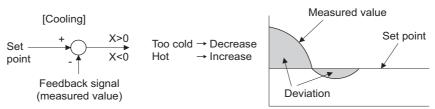
Reverse action

When deviation X = (set point - measured value) is a plus value, the manipulated amount (output frequency) is increased, and when the deviation is a minus value, the manipulated amount is decreased.



Forward action

When deviation X = (set point - measured value) is a minus value, the manipulated amount (output frequency) is increased, and when the deviation is a plus value, the manipulated amount is decreased.

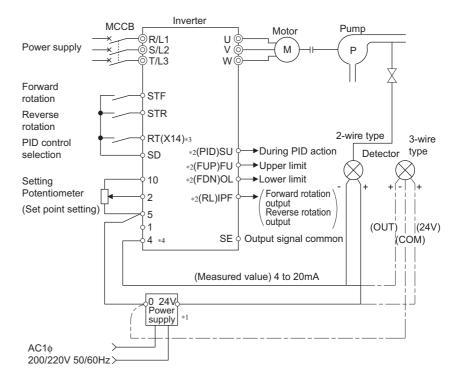


Relationship between deviation and manipulated amount (output frequency)

| PID action setting | Deviation | | | |
|--------------------|-----------|-------|--|--|
| FID action setting | Plus | Minus | | |
| Reverse action | 7 | И | | |
| Forward action | И | 7 | | |

Connection diagram

- · Sink logic
- Pr.128 = 20
- Pr.183 = 14
- Pr.191 = 47
- Pr.192 = 16
- Pr.193 = 14
- Pr.194 = 15



- *1 Prepare a power supply matched to the power supply specifications of the detector.
- *2 The applied output terminals differ by the settings of Pr.190 to Pr.196 (Output terminal function selection).
- *3 The applied input terminals differ by the settings of Pr.178 to Pr.189 (Input terminal function selection)
- *4 The AU signal need not be input.

Selection of deviation value, measured value and set point input method, and PID action method (Pr.128, Pr.609, Pr.610)

- Using **Pr.128**, select the input method for the PID set point, measured value detected by the meter, and externally calculated deviation. Also, select forward or reverse action.
- Switch the power voltage/current specifications of terminals 2 and 4 by Pr.73 Analog input selection or Pr.267 Terminal 4 input selection to match the specification of the input device. After changing the Pr.73 or Pr.267 settings, check the voltage/current input selection switch. Incorrect setting may cause a fault, failure or malfunction. (Refer to page 349 for the setting.)

| Pr.128 setting | Pr.609 Pr.610 | PID action | Set point input | Measured value input | Deviation input |
|-------------------|------------------|---|--|---|---|
| 0 | | PID invalid | — | — | — |
| 10 | | Reverse action | | | Terminal 1 |
| 11 | Invalid | Forward action | _ | _ | |
| 20 | | Reverse action | Terminal 2 or Pr.133 ^{*1} | Terminal 4 | |
| 21 | | Forward action | Terminal 2 of Pr.133 | | _ |
| 50 | | Reverse action | | _ | Communication ^{*2} |
| 51 | | Forward action | | | Communication |
| 60 | | Reverse action | Communication ^{*2} | Communication ^{*2} | _ |
| 61 | | Forward action | Communication | Communication | |
| 70 | | Reverse action | | | PLC function |
| 71 | | Forward action | — | — | (with frequency applied) ^{*3} |
| 80 | Invalid | Reverse action | PLC function | PLC function | |
| 81 | | Forward action | (with frequency applied) ^{*3} | (with frequency applied) ^{*3} | — |
| 90 | | Reverse action | | | PLC function |
| 91 | | Forward action | _ | — | (without frequency applied) ^{*3} |
| 100 | 1 | Reverse action | PLC function | PLC function | |
| 101 | | Forward action | (without frequency applied) ^{*3} | (without frequency applied) ^{*3} | — |
| 1000 | | Reverse action | According to Pr.609 . ^{*1} | According to Pr.610. | |
| 1001 | | Forward action | According to Pr.609. | | _ |
| 1010 | | Reverse action | | | According to Pr.609. |
| 1011 | | Forward action | | | |
| 2000 | Enabled | Reverse action (without frequency reflected) | | According to Dr 640 | |
| 2001 | LIUDIOU | Forward action (without frequency reflected) | According to Pr.609 . ^{*1} | According to Pr.610 . | _ |
| 2010 | | Reverse action (without frequency reflected) | | | |
| 2011 | | Forward action (without frequency reflected) | | _ | According to Pr.609 . |

*1 When $Pr.133 \neq$ "9999", the Pr.133 setting is valid.

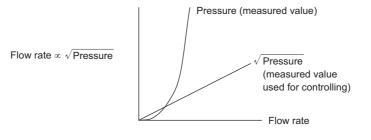
*2 BACnet MS/TP, CC-Link, CC-Link IE Field Network, or LONWORKS communication is available. For the details on BACnet MS/TP protocol, refer to page 533. For details of other types of communication, refer to the Instruction Manual on each option.

*3 For the details on the PLC function, refer to the PLC Function Programming Manual.

 The set point/deviation input method can also be flexibly selected by Pr.609 PID set point/deviation input selection and the measured value input method can be selected by Pr.610 PID measured value input selection. Selection by Pr.609 and Pr.610 is enabled when Pr.128 = "1000 to 2011".

| Setting value | | Command source | Input method | |
|---------------|--------|-----------------------------|-------------------|--|
| Pr.609 | Pr.610 | Command Source | input metriou | |
| 1 | 1 | Terminal 1 ^{*4} | | |
| 2 | 2 | Terminal 2 ^{*4} | | |
| 3 | 3 | Terminal 4 ^{*4} | Direct input | |
| 4 | 4 | Communication ^{*5} | | |
| 5 | 5 | PLC function | | |
| — | 101 | Terminal 1 ^{*4} | | |
| — | 102 | Terminal 2 ^{*4} | | |
| — | 103 | Terminal 4 ^{*4} | Square root input | |
| — | 104 | Communication ^{*5} | | |
| — | 105 | PLC | | |

- *4 When the same command source has been selected for the set point and measured value at **Pr.609** and **Pr.610**, set point input is invalid. (Inverter runs at set point 0%)
- *5 BACnet MS/TP, CC-Link, CC-Link IE Field Network, or LONWORKS communication is available. For the details on BACnet MS/TP protocol, refer to page 533. For details on other types of communication, refer to the Instruction Manual of each option.
- When **Pr.610 PID measured value input selection** = "101 to 105", the square root of the input value is used as the measured value. The setting is used when pressure is measured for controlling the flow rate and the following relationship exists.





• When terminals 2 and 4 are selected for deviation input, perform bias calibration using C3 and C6 to prevent a minus voltage from being entered as the deviation input signal. Input of a minus voltage might damage devices and the inverter.

• The following shows the relationship between the input values of the analog input terminals and set point, measured value and deviation. (Calibration parameter initial values)

| | Input | Re | Collibration noramator | | |
|----------------|-----------------------------|----------------------------------|----------------------------------|--|---|
| Input terminal | specification ^{*6} | Set point | Result | Deviation | Calibration parameter |
| | 0 to 5 V | 0 V = 0% 5 V = 100% | 0 V = 0% 5 V = 100% | 0 V = 0% 5 V = 100% | |
| Terminal 2 | 0 to 10 V | 0 V = 0% 10 V = 100% | 0 V = 0% 10 V = 100% | 0 V = 0% 10 V = 100% | Pr.125, C2 to C4 |
| | 0 to 20 mA | 0 mA = 0% 20 mA = 100% | 0 mA = 0% 20 mA = 100% | 0 mA = 0% 20 mA = 100% | |
| Terminal 1 | 0 to ±5 V | -5 to 0 V = 0% +5 V = +100% | -5 to 0 V = 0% +5 V = +100% | -5 V = -100% 0 V = 0% +5 V = +100% | When Pr.128 = "10": Pr.125 , C2 to C4 . |
| | 0 to ±10 V | -10 to 0 V = 0% +10 V = +100% | -10 to 0 V = 0% +10 V = +100% | -10 V = -100% 0 V = 0% +10 V = +100% | When Pr.128 ≥ "1000": C12 to C15. |
| Terminal 4 | 0 to 5 V | 0 to 1 V = 0% 5 V = 100% | 0 to 1 V = 0% 5 V = 100% | 0 V = -20% 1 V = 0% 5 V = 100% | |
| | 0 to 10 V | 0 to 2 V = 0% 10 V = 100% | 0 to 2 V = 0% 10 V = 100% | 0 V = -20% 2 V = 0% 10 V = 100% | Pr.126, C5 to C7 |
| | 0 to 20 mA | 0 to 4 mA = 0% 20 mA = 100% | 0 to 4 mA = 0% 20 mA = 100% | 0 mA = -20% 4 mA = 0% 20 mA = 100% | |

*6 Can be changed by **Pr.73 Analog input selection**, **Pr.267 Terminal 4 input selection** and the voltage/current input switch. (Refer to page 349.)

NOTE

Always calibrate the input after changing the voltage/current input specification with Pr.73 and Pr.267, and the voltage/current input selection switch.

Multistage set point input (Pr.1460 to Pr.1466)

- The set point can be selected by combining the ON/OFF status of the PDI1 to PDI3 signals. Up to eight set points can be selected. Use Pr.1460 PID multistage set point 1 to Pr.1466 PID multistage set point 7 to set the target values for selection.
- When "9999" is set in the selected multistage set point parameter, PID control is performed according to the **Pr.128**, **Pr.609**, and **Pr.133** settings.

| Selected set point | PDI1 ^{*1} | PDI2 ^{*1} | PDI3 ^{*1} | Parameter for setting |
|------------------------|--------------------|--------------------|--------------------|---|
| | OFF | OFF | OFF | As set in the Pr.128 and Pr.609 PID settings. |
| _ | OFF | OFF | OFF | As set in Pr.133 when Pr.133 ≠ "9999". |
| Multistage set point 1 | ON | OFF | OFF | Pr.1460 |
| Multistage set point 2 | OFF | ON | OFF | Pr.1461 |
| Multistage set point 3 | ON | ON | OFF | Pr.1462 |
| Multistage set point 4 | OFF | OFF | ON | Pr.1463 |
| Multistage set point 5 | ON | OFF | ON | Pr.1464 |
| Multistage set point 6 | OFF | ON | ON | Pr.1465 |
| Multistage set point 7 | ON | ON | ON | Pr.1466 |

*1 When functions are not assigned to the input terminals, the signals are treated as OFF.

• NOTE

- · The multistage set point input is not available for the second PID.
- The priority of the set point input is as follows: Pr.1460 to Pr.1466> Pr.133> Pr.128.

Input/output signals

- Assigning the PID control valid (X14) signal to the input terminal by Pr.178 to Pr.189 (Input terminal function selection) enables PID control to be performed only when the X14 signal is turned ON. When the X14 signal is OFF, regular inverter running is performed without PID action. (When the X14 signal is not assigned, PID control is enabled only by setting Pr.128 ≠ "0".)
- Input signal

| Signal | Function | Pr.178 to Pr.189 setting | Description |
|--------|---|--------------------------------|---|
| X14 | PID control valid | 14 | When this signal is assigned to the input terminal, PID control is enabled |
| X80 | Second PID control valid | 80 | when this signal is ON. |
| PDI1 | PID multistage set point setting 1 | 38 | The extension of in De 4400 to De 4400 conclusion to the second base of the |
| PDI2 | PID multistage set point setting 2 | 39 | The set point set in Pr.1460 to Pr.1466 can be selected by combining the ON/OFF status of the signals. |
| PDI3 | PID multistage set point setting 3 | 40 | |
| X64 | PID forward/reverse action switchover | 64 | PID control is switched between forward and reverse action without |
| X79 | Second PID forward/reverse action switchover | 79 | changing parameters by turning ON this signal. |
| X72 | PID P control switchover | 72 | Integral and differential values can be reset by turning ON this signal. |
| X73 | Second PID P control switchover | 73 | integral and unterential values can be leset by turning ON this signal. |

· Output signal

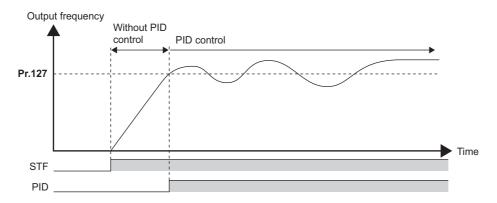
| Signal Function | | Pr.190 to Pr.196 setting | | Description | |
|-----------------|---|-----------------------------|-------------------|---|--|
| Signal | Function | Positive logic | Negative logic | Description | |
| FUP | PID upper limit | 15 | 115 | Output when the measured value signal exceeds Pr.131 PID upper limit | |
| FUP2 | Second PID upper limit | 201 | 301 | (Pr.1143 Second PID upper limit). | |
| FDN | Lower limit output | 14 | 114 | Output when the measured value signal falls below Pr.132 PID lower limit | |
| FDN2 | Second PID lower limit | 200 | 300 | (Pr.1144 Second PID lower limit). | |
| RL | PID forward/reverse rotation output | 16 | 116 | "Hi" is output when the output display of the parameter unit is forward rotation | |
| RL2 | Second PID forward/ reverse rotation output | 202 | 302 | (FWD) and "Low" is output when the display is reverse rotation (REV) and stop (STOP). | |
| PID | During PID control activated | 47 | 147 | Turns ON during PID control. When the PID calculation result is reflected to the output frequency (Pr.128 < | |
| PID2 | During second PID control activated | 203 | 303 | "2000"), the PID signal turns OFF at turn OFF of the start signal. When the PID calculation result is not reflected to the output frequency (Pr.128 ≥ "2000"), the PID signal turns ON during PID calculation regardless of the start signal status. | |
| Y48 | PID deviation limit | 48 | 148 | Output when the absolute deviation value exceeds the limit value set in Pr.553 | |
| Y205 | Second PID deviation limit | 205 | 305 | PID deviation limit (Pr.1145 Second PID deviation limit). | |
| SLEEP | PID output interruption | 70 | 170 | Set Pr.575 Output interruption detection time (Pr.1147 Second output interruption detection time) ≠ "9999". This signal turns ON when the PID | |
| SLEEP2 | During second PID output shutoff | 204 | 304 | output suspension function is activated. | |

- NOTE

• Changing the terminal functions with **Pr.178 to Pr.189** and **Pr.190 to Pr.196** may affect other functions. Set parameters after confirming the function of each terminal.

◆ PID automatic switchover control (Pr.127)

- The system can be started up more quickly by starting up without PID control activated.
- When **Pr.127 PID control automatic switchover frequency** is set, the startup is made without PID control until the output frequency reaches the **Pr.127** setting. Once the PID control starts, the PID control is continued even if the output frequency drops to **Pr.127** setting or lower.



Operation selection and sleep function stop selection when a value error is detected (FUP signal, FDN signal, Y48 signal, Pr.554)

- Using **Pr.554 PID signal operation selection**, set the action when the measured value input exceeds the upper limit (**Pr.131 PID upper limit**) or lower limit (**Pr.132 PID lower limit**), or when the deviation input exceeds the permissible value (**Pr.553 PID deviation limit**).
- Set the time from when the measured value input exceeds the **Pr.131** or **Pr.132** setting until the FUP or FDN signal is output in **Pr.1370 Detection time for PID limiting operation**. To set the detection time for upper and lower limits separately, set **Pr.1346 PID lower limit operation detection time**.
- Set the parameter to select the operation when the FUP/FDN or Y48 signal is output, and the operation when the sleep function is activated.

| Pr.554 setting | Inverter operation | | | | | | |
|-------------------|---|--|--------------------------|--|--|--|--|
| P1.554 Setting | At FUP/FDN signal output ^{*1} | At Y48 signal output ^{*1} | At sleep operation start | | | | |
| 0 (initial value) | Signal output only | Signal output only | | | | | |
| 1 | Signal output + output shutoff (E.PID) ^{*2} | Signal output + output shutoff (E.PID) ^{*2} | | | | | |
| 2 | Signal output only | | | | | | |
| 3 | Signal output + output shutoff $(E.PID)^{*2}$ | Signal output + output shutoff (E.PID)*2 | | | | | |
| 4 | Signal output + deceleration stop (E.PID) ^{*3} | Signal output only | Coasts to stop | | | | |
| 5 | Signal output + deceleration stop (restart) ^{*4} | | | | | | |
| 6 | Signal output + deceleration stop (E.PID) ^{*3} | | | | | | |
| 7 | Signal output + deceleration stop (restart) ^{*4} | Signal output + output shutoff (E.PID) ^{*2} | | | | | |
| 10 | Signal output only | Signal output only | Deceleration stop | | | | |
| 11 | Signal output + output shutoff (E.PID) ^{*2} | | | | | | |
| 12 | Signal output only | o: | | | | | |
| 13 | Signal output + output shutoff $(E.PID)^{*2}$ | Signal output + output shutoff (E.PID) ^{*2} | | | | | |
| 14 | Signal output + deceleration stop (E.PID) ^{*3} | Signal output only | | | | | |
| 15 | Signal output + deceleration stop (restart) ^{*4} | | | | | | |
| 16 | Signal output + deceleration stop (E.PID) ^{*3} | Signal output Loutput abutoff (E.DID)*2 | | | | | |
| 17 | Signal output + deceleration stop $(restart)^{*4}$ | Signal output + output shutoff (E.PID) ^{*2} | | | | | |

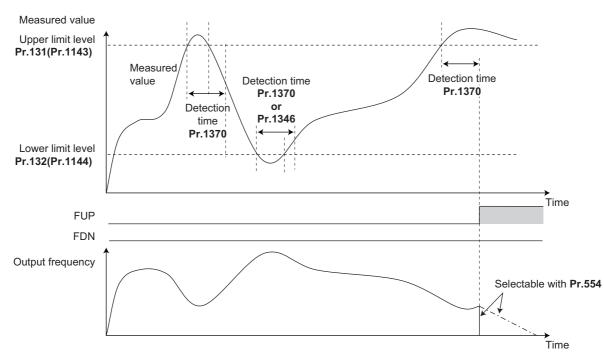
*1 When each of **Pr.131**, **Pr.132** and **Pr.553** settings corresponding to each of the FUP, FDN and Y48 signals is "9999" (no function), signal output and protective function are not available.

*2 At the same time with the signal output, the protective function (E.PID) is activated.

*3 At the same time with the signal output, deceleration is performed using the normal deceleration time. After the deceleration stop, the protective function (E.PID) is activated.

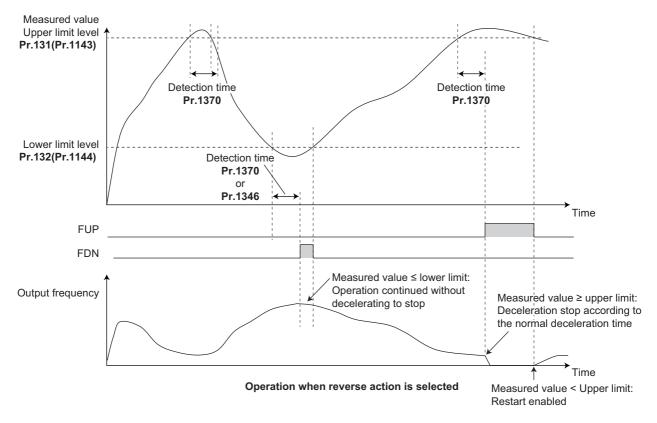
*4 At the same time with the signal output, deceleration is performed using the normal deceleration time. When the measured value returns to normal, operation can be restarted.

• The following is the operation example of the FUP and FDN signals.



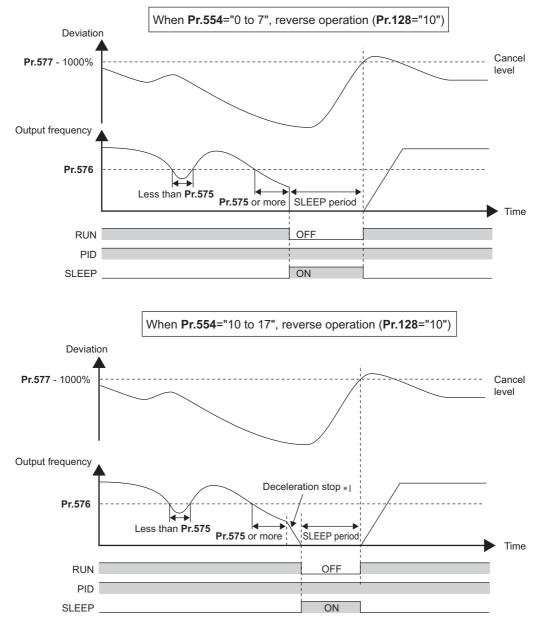
When deceleration stop (restart) is selected (Pr.554 = "5, 7, 15, or 17"), deceleration starts at the same time the signal is output and operation is decelerated to stop using the normal deceleration time. If the measured value falls within the range between the upper and lower limits, restarting is enabled and operation will be restarted in the PID control mode. When reverse action is selected for PID action, deceleration stop is not performed although the FDN signal is output when the measured value falls below the lower limit. (When forward action is selected, deceleration stop is not performed although the FUP signal is output when the measured value exceeds the upper limit.)

When the sleep function is used at the same time, the sleep function is prioritized during sleep operation.



PID output suspension function (sleep function) (SLEEP signal, Pr.575 to Pr.577)

- When a status where the output frequency after PID calculation is less than Pr.576 Output interruption detection level
 has continued for the time set in Pr.575 Output interruption detection time or longer, inverter running is suspended. This
 allows the amount of energy consumed in the inefficient low-speed range to be reduced.
- When the deviation (set point measured value) reaches the PID output shutoff release level (Pr.577 setting value -1000%) while the PID output suspension function is activated, the PID output suspension function is released, and PID control operation is automatically restarted.
- Whether to allow motor to coast to a stop or perform a deceleration stop when sleep operation is started can be selected using **Pr.554**.
- While the PID output suspension function is activated, the PID output interruption (SLEEP) signal is output. During this time, the Inverter running (RUN) signal turns OFF and the During PID control activated (PID) signal turns ON.
- For the terminal used for the SLEEP signal, set "70 (positive logic)" or "170 (negative logic)" in any parameter from **Pr.190** to **Pr.196 (Output terminal function selection)**.



*1 When the PID output shutoff release level is reached during a deceleration stop, output shutoff is released, operation is re-accelerated and PID control is continued. During deceleration, **Pr.576 Output interruption detection level** is invalid.



- The stirring function during the PID sleep prevents clogging of the pump while the sleep function is activated. (Refer to page 459.)
- The PID sleep boost function maintains the sleep state for a long period of time. (Refer to page 459.)

Integral stop selection when the frequency is limited (Pr.1015)

- The operation for the integral term can be selected when the frequency or the manipulated amount is limited during PID control. The operation during output suspension can be selected for the integral term using the PID output suspension (sleep) function.
- The manipulation range can be selected.

| Pr.1015 setting | Operation at limited frequency | Range of manipulation | Operation during output interruption |
|-------------------|-----------------------------------|-----------------------|---|
| 0 (initial value) | Integral stop | -100% to +100% | |
| 1 | Integral continuation | -100% 10 +100% | Integral clear |
| 2 | Integral stop | 0% to 100% | |
| 10 | Integral stop | -100% to +100% | Integral stop |
| 11 | Integral continuation | -100% 10 +100% | |
| 12 | Integral stop | 0% to 100% | |

- NOTE

• While the integral stop is selected, the integral stop is enabled when any of the following conditions is met.

Integral stop conditions

- The frequency reaches the upper or lower limit.
- The manipulated amount reaches plus or minus 100% (**Pr.1015** = "0 or 10").
- The manipulated amount reaches 0% or 100% (**Pr.1015** = "2 or 12").

• When a frequency set in **Pr.576 Output interruption detection level** is lower than the minimum frequency, the frequency command value falls down to the level set in **Pr.576** after PID calculation (while the PID output suspension function is enabled).

PID monitor function

- This function displays the PID control set point, measured value and deviation on the operation panel, and can output these from the terminals FM/CA and AM.
- An integral value indicating a negative % can be displayed on the deviation monitor. 0% is displayed as 1000. (These values cannot be output on the deviation monitor from terminals FM and CA.)
- Set the following values to Pr.52 Operation panel main monitor selection, Pr.774 to Pr.776 (Operation panel monitor selection), Pr.992 Operation panel setting dial push monitor selection, Pr.54 FM/CA terminal function selection and Pr.158 AM terminal function selection for each monitor.

| Parameter | Monitor | Minimum | M | onitor rang | e | | |
|-----------|--|-----------|--------------------------|----------------------------------|---|--|--|
| Setting | description | increment | Terminal FM/ CA | Terminal AM | Operation panel | Remarks | |
| 52 | PID set point | | | | | | |
| 92 | Second PID set point/deviation input selection | 0.1% | 0% to 100% ^{*1} | | | "0" is displayed at all times when PID control | |
| 53 | PID measured value | 0.1% | 0% to 100% ^{*1} | | | is based in deviation input. | |
| 93 | Second PID measured value | 0.170 | 0% 10 100% | | | | |
| 67 | PID measured value 2 | | | | | Displays PID measured value even if the PID control operating conditions are not satisfied | |
| 95 | Second PID measured value 2 | 0.1% | 0% to 100% ^{*1} | | | while the PID control is enabled. "0" is displayed at all times when PID control is based in deviation input. | |
| 54 | PID deviation | | | | 900% to | | |
| 94 | Second PID deviation | 0.1% | Setting not available | -100% to 100% ^{*1*2} | 1100% or -100% to 100% ^{*1} | Using Pr.290 Monitor negative output selection , negative values can be output to the terminal AM and displayed with a minus sign on the operation panel (FR-DU08). | |
| 91 | PID manipulated amount | | Setting not | -100% to | 900% to 1100% | When signed indication is invalid, the indicated values are from "900%" to "1100%" | |
| 96 | Second PID manipulated amount | 0.1% | available | 100%*2 | or -100% to 100% | on the operation panel. (0% is offset and displayed as "1000%".) | |

*1 When C42 (Pr.934) and C44 (Pr.935) are set, the minimum increment changes from unit % to no unit, and the monitor range can be changed. (Refer to page 442.)

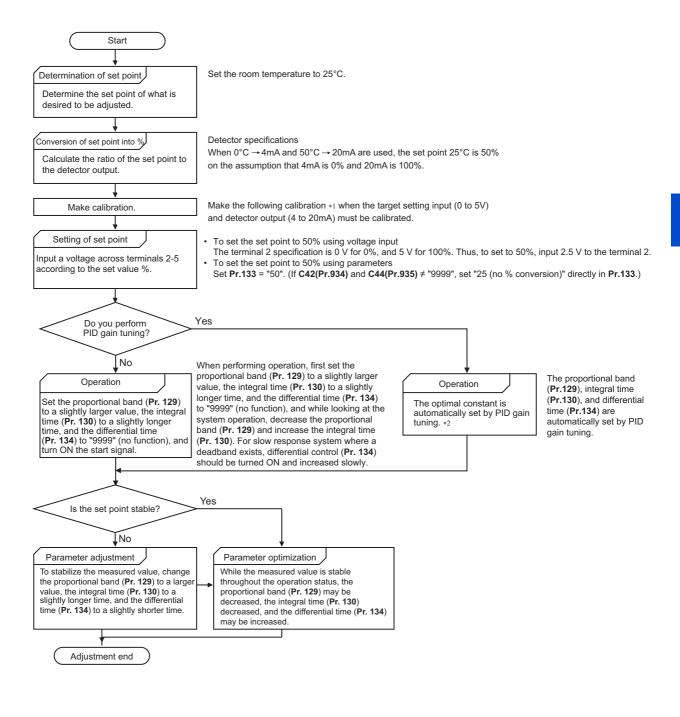
*2 When the minus value display is set disabled using **Pr.290**, the terminal AM output becomes "0".

Adjustment procedure

| | When Pr.128 \neq "0", PID control is enabled. |
|------------------------|---|
| Enable PID control | Set the set point, measured value and deviation input methods at Pr.128, Pr.609 and Pr.610 . |
| | |
| Setting the parameter | Adjust the PID control parameters of Pr.127 , Pr.129 to Pr.134 , Pr.553 , Pr.554 , Pr.575 to Pr.577 . |
| | |
| PID gain tuning | Pr.129, Pr.130 and Pr.134 are adjusted automatically by PID gain tuning. (Refer to page 437.) |
| | |
| Terminal setting | Set the I/O terminals for PID control. (Pr.178 to Pr.189 (Input terminal function selection) , Pr.190 to Pr.196 (Output terminal function selection)) |
| | |
| Turn the X14 signal ON | When the X14 signal is assigned to the input terminal, PID control is enabled by the X14 signal turning ON. |
| | |
| Operation | |
| | |

Calibration example

(Adjust room temperature to 25°C by PID control using a detector that outputs 4 mA at 0°C and 20 mA at 50°C.)



*1 When calibration is required

Calibrate detector output and set point input by Pr.125, C2 (Pr.902) to C4 (Pr.903) (terminal 2) or Pr.126, C5 (Pr.904) to C7 (Pr.905) (terminal 4). (Refer to page 357.)

When both C42 (Pr.934) and C44 (Pr.935) are other than "9999", calibrate the detector output and set point input by Pr.934 and Pr.935. (Refer to page 442.)

Make calibration in the PU operation mode during an inverter stop.

*2 For details about PID gain tuning, refer to page 437.

· Calibrating set point input

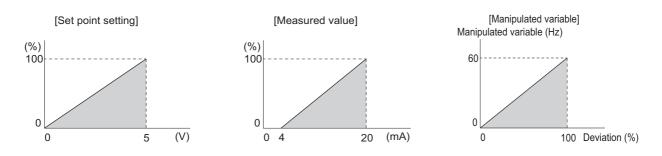
(Example: To enter the set point on terminal 2)

- **1.** Apply the input (for example, 0 V) of set point setting 0% across terminals 2 and 5.
- 2. Using C2 (Pr.902), enter the frequency (for example, 0 Hz) to be output by the inverter when the deviation is 0%.
- **3.** Using C3 (Pr.902), set the voltage value at 0%.
- **4.** Apply the input (for example, 5 V) of set point setting 100% across terminals 2 and 5.
- **5.** Using **Pr.125**, enter the frequency (for example, 60 Hz) to be output by the inverter when the deviation is 100%.
- **6.** Using C4 (Pr.903), set the voltage value at 100%.

- NOTE

- When the set point is set at **Pr.133**, the setting frequency of **C2 (Pr.902)** is equivalent to 0% and the setting frequency of **Pr.125** (**Pr.903**) is equivalent to 100%.
- · Measured value input calibration
 - **1.** Apply the input (for example, 4 mA) of measured value 0% across terminals 4 and 5.
 - 2. Perform calibration by C6 (Pr.904).
 - **3.** Apply the input (for example, 20 mA) of measured value 100% across terminals 4 and 5.
 - **4.** Perform calibration by **C7 (Pr.905)**.

- Set the frequencies set at C5 (Pr.904) and Pr.126 to each of the same values set at C2 (Pr.902) and Pr.125.
- The display unit for analog input can be changed from "%" to "V" or "mA". (Refer to page 359.)
- The following figure shows the results of having performed the calibration above.



♦ Setting multiple PID functions

• When the second PID function is set, two sets of PID functions can be switched for use. The PID setting is selected as shown in the following table.

| Pr.128 setting (First PID setting) | Pr.753 setting (Second PID setting) | Pr.155 setting ^{*1} | RT signal | PID setting applied to the output frequency |
|--|--|---------------------------------|-----------|--|
| "0" or not applied to the frequency | "0" or not applied to the frequency | — | — | Control other than PID control |
| "0" or not applied to the frequency | Applied to the frequency | — | — | Second PID setting |
| Applied to the frequency | "0" or not applied to the frequency | — | _ | First PID setting |
| | | 0 | OFF | First PID setting |
| Applied to the frequency | Applied to the frequency | 0 | ON | Second PID setting |
| | | 10 | — | First PID setting |

*1 While **Pr.155** = "0", the second function is enabled immediately after the RT signal turns ON. While **Pr.155** = "10", the second function is enabled only during constant speed operation when the RT signal turns ON. (For the details, refer to page 377.)

• The parameters and signals for the second PID function are in the same way as the following parameters and signals of the first PID function. Refer to the first PID function when setting the second PID functions.

| Classification | First F | PID function parameters | Seco | ond PID function parameters |
|----------------|---------|---|------|--|
| Classification | Pr. | Name | Pr. | Name |
| | 127 | PID control automatic switchover frequency | 754 | Second PID control automatic switchover frequency |
| | 128 | PID action selection | 753 | Second PID action selection |
| | 129 | PID proportional band | 756 | Second PID proportional band |
| | 130 | PID integral time | 757 | Second PID integral time |
| | 131 | PID upper limit | 1143 | Second PID upper limit |
| | 132 | PID lower limit | 1144 | Second PID lower limit |
| | 133 | PID action set point | 755 | Second PID action set point |
| | 134 | PID differential time | 758 | Second PID differential time |
| Parameter | 553 | PID deviation limit | 1145 | Second PID deviation limit |
| | 554 | PID signal operation selection | 1146 | Second PID signal operation selection |
| | 575 | Output interruption detection time | 1147 | Second output interruption detection time |
| | 576 | Output interruption detection level | 1148 | Second output interruption detection level |
| | 577 | Output interruption cancel level | 1149 | Second output interruption cancel level |
| | 609 | PID set point/deviation input selection | 1140 | Second PID set point/deviation input selection |
| | 610 | PID measured value input selection | 1141 | Second PID measured value input selection |

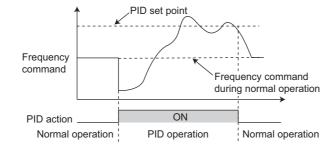
| Classification | First F | PID function parameters | Sec | ond PID function parameters | |
|----------------|---------|--|--------|---|--|
| Classification | Signal | Name | Signal | Name | |
| | X14 | PID control valid | X80 | Second PID control valid | |
| Input signal | X64 | PID forward/reverse action switchover | X79 | Second PID forward/reverse action switchover | |
| | X72 | PID P control switchover | X73 | Second PID P control switchover | |
| | FUP | PID upper limit | FUP2 | Second PID upper limit | |
| | FDN | PID lower limit | FDN2 | Second PID lower limit | |
| Output signal | RL | PID forward/reverse rotation output | RL2 | Second PID forward/reverse rotation output | |
| | PID | During PID control activated | PID2 | During second PID control activated | |
| | SLEEP | PID output interruption | SLEEP2 | During second PID output shutoff | |
| | Y48 | PID deviation limit | Y205 | Second PID deviation limit | |



- Even if the X14 signal is ON, PID control is stopped and multi-speed or JOG operation is performed when the multi-speed operation (RH, RM, RL, or REX) signal or JOG signal (JOG operation) is input.
- · PID control is invalid under the following settings.
- Pr.79 Operation mode selection = "6" (Switchover mode)
- Note that input to the terminal 1 is added to the terminals 2 and 4 inputs. For example when Pr.128 = "20 or 21", the terminal 1 input is considered as a set point and added to the set point of the terminal 2.
- To use terminal 4 and 1 inputs in PID control, set "0" (initial value) to Pr.858 Terminal 4 function assignment and Pr.868 Terminal 1 function assignment. When a value other than "0", PID control is invalid.
- · Changing the terminal functions with Pr.178 to Pr.189 and Pr.190 to Pr.196 may affect other functions. Set parameters after confirming the function of each terminal.
- When PID control is selected, the minimum frequency becomes the frequency of Pr.902 and the maximum frequency becomes the frequency of Pr.903.

(The Pr.1 Maximum frequency and Pr.2 Minimum frequency settings also are valid.)

- · During PID operation, the remote operation function is invalid.
- · When control is switched to PID control during normal operation, the frequency during that operation is not carried over, and the value resulting from PID calculation referenced to 0 Hz becomes the command frequency.



Operation when control is switched to PID control during normal operation

A Parameters referred to

- Pr.59 Remote function selection 🖙 page 234
- Pr.73 Analog input selection IP page 349 Pr.79 Operation mode selection IP page 240
- Pr.178 to Pr.189 (Input terminal function selection) Figure 373 Pr.190 to Pr.196 (Output terminal function selection) page 330
- Pr.290 Monitor negative output selection 314
- C2 (Pr.902) to C7 (Pr.905) Frequency setting voltage (current) bias/gain 357

5.11.7 PID gain tuning

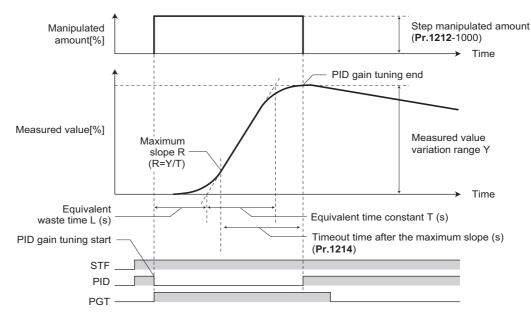
Changing the PID control manipulated amount and measuring the PID control response enable automatic setting of the constant optimal for PID control.

For tuning, use the step response method or the limit cycle method.

| Pr. | Name | Initial value | Setting range | Description |
|--------------|--------------------------------------|------------------|---|--|
| 1211 A690 | PID gain tuning timeout time | 100 s | 1 to 9999 s | Set the time after the PID gain tuning starts until a timeout error occurs. |
| 1212 A691 | Step manipulated amount | 1000% | 900% to 1100% | Set the step manipulated amount when using the step response method to perform the PID gain tuning. |
| 1213 A692 | Step response sampling cycle | 1 s | 0.01 to 600 s | Set the cycle for sampling of measurement values when using the step response method to perform the PID gain tuning. |
| 1214 A693 | Timeout time after the maximum slope | 10 s | 1 to 9999 s | Set the time after the measurement of the maximum slope until the completion of the tuning when using the step response method to perform the PID gain tuning. |
| 1215 A694 | Limit cycle output upper limit | 1100% | 900% to 1100% | Set the upper limit value of the two-position output when using the limit cycle method to perform the PID gain tuning. |
| 1216 A695 | Limit cycle output lower limit | 1000% | 900% to 1100% | Set the lower limit value of the two-position output when using the limit cycle method to perform the PID gain tuning. |
| 1217 A696 | Limit cycle hysteresis | 1% | 0.1% to 10% | Set the hysteresis of the set point when using the limit cycle method to perform the PID gain tuning. |
| 1218 A697 | PID gain tuning setting | 0 | 0, 100 to 102, 111, 112, 121, 122, 200 to 202, 211, 212, 221, 222 | Select the target loop, method, and control adjustment method for the PID gain tuning. |
| | | | 0 | PID gain tuning function disabled |
| 1219 | | | 1 | PID gain tuning start |
| A698 | PID gain tuning start/status | 0 | 2 | During PID gain tuning (read only) |
| | | | 8 | PID gain tuning forced end |
| | | | 9, 90 to 96 | Tuning error (read only) |

Step response method

• In the step response method, the manipulated amount is changed step by step for the real system. From the change in the measured values, the maximum slope (R) and the equivalent waste time (L) are calculated to determine each constant.

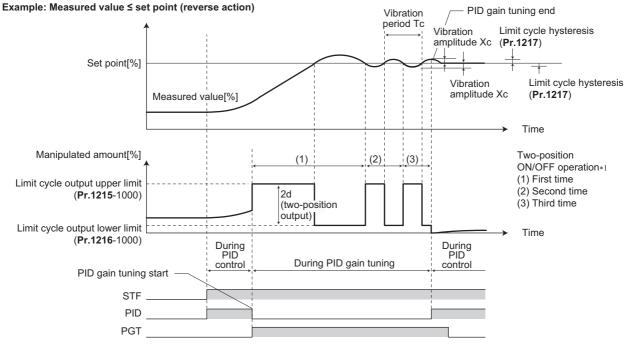


• The step manipulated amount (Pr.1212 - 1000) is added to the present manipulated amount.

- The measured value is taken for every sampling cycle (**Pr.1213**). From the variation between the measured values (Y) and the time (t), the maximum slope (R) is calculated.
- The measurement ends when the timeout time (Pr.1214) elapsed after the maximum slope is obtained.
- After the integral term is cleared, PID control is performed with the constant to which the change has been applied (the constant used before PID gain tuning when a fault occurs).

Limit cycle method

- In the limit cycle method, the two-position ON/OFF operation is performed three times for output of the manipulated amount for the real system. From the vibration waveform data of the measured values, the vibration amplitude (Xc) and the vibration cycle (Tc) are measured. Based on the measured values, each constant is determined.
- In the limit cycle method, less influence of the noise of the measured values is given as compared in the step response method, and a stable tuning result can be obtained.



*1 Details of the two-position ON/OFF operation

| PID control operation | Initial output of the manipulated amount | Two-position ON/OFF operation |
|-----------------------|--|--|
| Reverse action | When measured value ≤ set point Manipulated amount = Upper limit of the output (Pr.1215 - 1000) When measured value > set point Manipulated amount = Lower limit of the output (Pr.1216 - 1000) | Using measured value ≥ set point + hysteresis (Pr.1217) Manipulated amount = Lower limit of the output (Pr.1216 - 1000) Using measured value ≤ set point - hysteresis (Pr.1217) Manipulated amount = Upper limit of the output (Pr.1215 - 1000) |
| Forward action | When measured value ≤ set point Manipulated amount = Lower limit of the output (Pr.1216 - 1000) When measured value > set point Manipulated amount = Upper limit of the output (Pr.1215 - 1000) | Using measured value ≥ set point + hysteresis (Pr.1217) Manipulated amount = Upper limit of the output (Pr.1215 - 1000) Using measured value ≤ set point - hysteresis (Pr.1217) Manipulated amount = Lower limit of the output (Pr.1216 - 1000) |

The manipulated amount is output at the limit cycle output upper limit (Pr.1215 - 1000). (When the measured value is higher than the set point, the manipulated amount is once output at the limit cycle lower limit (Pr.1216 - 1000), and then after the set point exceeds the measured value, the manipulated amount is output at the limit cycle output upper limit (Pr.1215 - 1000).)

- The two-position ON/OFF operation is repeated three times. From the waveform data of the values measured for output of the second and third two-position operation, the vibration amplitude (Xc) and the vibration cycle (Tc) are measured.
- From the vibration amplitude (Xc) and the vibration cycle (Tc), the threshold sensitivity (Ku) and the threshold cycle (Tu) are calculated.
- Each constant is calculated using a formula depending on the Pr.1218 setting, and PID gain tuning is finished.

• After the integral term is cleared, PID control is performed with the constant to which the change has been applied (the constant used before PID gain tuning when a fault occurs).

- Confirm that the measured values are stable when performing PID gain tuning with the step response method. When the measured values are unstable, the tuning result may not be accurate.
- Accurate measurement of the maximum slope may not be achieved if the Pr.1213 setting is small in the step response method.

PID gain tuning operation setting (Pr.1218)

• Set the PID gain tuning operation in this parameter. The digit in the hundreds place represents the PID loop. The digit in the tens place represents the tuning method. The digit in the ones place represents the control adjustment method.

| Pr.1218 setting | PID loop | Tuning method | Control adjustment method | |
|-------------------|-----------------------------------|-------------------------------|---------------------------|--|
| 0 (initial value) | PID gain tuning function disabled | | | |
| 100 | | | P control adjustment | |
| 101 |] | Step response method | PI control adjustment | |
| 102 |] | | PID control adjustment | |
| 111 | First PID | Limit cycle method (set-point | PI control adjustment | |
| 112 |] | control) | PID control adjustment | |
| 121 |] | Limit cycle method (follow-up | PI control adjustment | |
| 122 |] | control) | PID control adjustment | |
| 200 | | | P control adjustment | |
| 201 |] | Step response method | PI control adjustment | |
| 202 | 1 | | PID control adjustment | |
| 211 | Second PID | Limit cycle method (set-point | PI control adjustment | |
| 212 | 1 | control) | PID control adjustment | |
| 221 | 1 | Limit cycle method (follow-up | PI control adjustment | |
| 222 | 1 | control) | PID control adjustment | |

Parameter setting for each PID gain tuning method

• Set the following parameters according to the selected tuning method (step response method / limit cycle method).

| | Tunin | g method | | |
|-----------|-------------------------|--------------------|--------------------------------------|---|
| Pr. | Step response method | Limit cycle method | Item | Description |
| 128 (753) | 0 | 0 | PID action selection | Select the PID action. |
| 1218 | 0 | 0 | PID gain tuning setting | Select the PID gain tuning operation. |
| 1211 | 0 | 0 | PID gain tuning timeout time | Set the timeout time for PID gain tuning. A timeout error occurs when the elapsed time exceeds the setting. |
| 1212 | 0 | _ | Step manipulated amount | Set the step manipulated amount for PID gain tuning. |
| 1213 | 0 | — | Step response sampling cycle | Set the cycle for sampling of measurement values for PID gain tuning. |
| 1214 | 0 | _ | Timeout time after the maximum slope | Set the timeout time after the maximum slope measurement for PID gain tuning. The measurement for tuning is completed when the elapsed time exceeds the setting. |
| 1215 | — | 0 | Limit cycle output upper limit | Set the upper limit value of the two-position output for PID gain tuning. |
| 1216 | — | 0 | Limit cycle output lower limit | Set the lower limit value of the two-position output for PID gain tuning. (When the setting is the Pr.1215 setting or higher, a tuning error occurs.) |
| 1217 | — | 0 | Limit cycle hysteresis | Set the hysteresis of the set point for PID gain tuning. |

o: Parameter to set

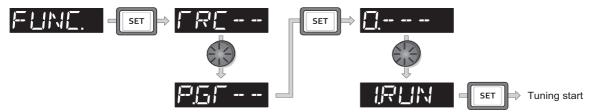
Execution of PID gain tuning (Pr.1219, PGT signal)

• While the PID gain tuning function is enabled (**Pr.1218** ≠ "0"), PID gain tuning is started when any of the following operations is performed during PID control.

Turn ON the PID gain tuning start/forced end (PGT) signal.

Set Pr.1219 PID gain tuning start/status = "1".

Selecting the PID gain tuning start (1.RUN) in the function menu on the operation panel (FR-DU08).



- To use the PGT signal, set "81" in any parameter from Pr.178 to Pr.189 (Input terminal function selection) to assign the function to an input terminal.
- The PID gain tuning status can be checked with the read value of **Pr.1219** or the PID gain tuning status monitor. The PID gain tuning status monitor is displayed instead of the output voltage monitor.

| Status monitor | PID gain tuning status |
|----------------|------------------------|
| 2 | Tuning in progress |
| 3 | Tuning completed |
| 8 | Tuning forced end |

• When PID gain tuning is completed, the following parameters are automatically set.

| Pr. | Pr. Name | | response me | Limit cycle method | | |
|-----------|-----------------------|-----------|-------------|--------------------|------------|-------------|
| F1. | Name | P control | PI control | PID control | PI control | PID control |
| 129 (756) | PID proportional band | 0 | 0 | 0 | 0 | 0 |
| 130 (757) | PID integral time | — | 0 | 0 | 0 | 0 |
| 134 (758) | PID differential time | — | — | 0 | — | 0 |

o: The calculation result is applied. —: "9999" is set.

 To forcibly terminate the tuning during PID gain tuning, perform any of the following operations. Turn OFF the PID gain tuning start/forced end (PGT) signal.

Set Pr.1219 PID gain tuning start/status = "8".

Select the PID gain tuning forced end (8.END) in the function menu on the operation panel (FR-DU08). Turn OFF the power supply, reset the inverter, or turn OFF the start command.



- By PID gain tuning, the settings of the PID constant parameters (**Pr.129**, **Pr.130**, **Pr.134**, **Pr.756** to **Pr.758**) are automatically changed. Before performing PID gain tuning, record the PID constant parameter settings before tuning as required.
- PID gain tuning also requires setting of the PID upper limit (Pr.131 or Pr.1143), PID lower limit (Pr.132 or Pr.1144), PID deviation limit (Pr.553 or Pr.1145).
- Changing the terminal assignment with **Pr.178 to Pr.189** may affect other functions. Set parameters after confirming the function of each terminal.
- By PID gain tuning, the amount of operation is changed considerably. In some applications such as a winding machine, materials may be affected.

PID gain tuning error

• When the read value of **Pr.1219** or the PID gain tuning status monitor display is "9, 90 to 96", tuning has not been properly completed due to a tuning error. Remove the cause of the tuning error, and perform tuning again.

| Monitor value | Error description | Cause of tuning error | Corrective action for error |
|---------------|--|---|--|
| 9 | Termination of tuning due to activation of an inverter protective function | An inverter protective function is activated. | Remedy the cause. (Refer to page 594.) |
| 90 | Input upper limit error | The measured value is higher than the PID upper limit (Pr.131 or Pr.1143). | Change the Pr.131 or Pr.1143 setting as appropriate. |
| 91 | Input lower limit error | The measured value is lower than the PID lower limit (Pr.132 or Pr.1144). | Change the Pr.132 or Pr.1144 setting as appropriate. |
| 92 | Deviation limit error | The deviation exceeded the PID deviation limit (Pr.553 or Pr.1145). | Change the Pr.553 or Pr.1145 setting as appropriate. |
| 93 | Timeout error | Tuning is not terminated within the time set in Pr.1211 after the start of PID gain tuning. | Change the Pr.1211 setting as appropriate. |
| 94 | Calculation error | The tuning calculation is inconsistent. | In the step response method, change the Pr.1212 and Pr.1213 settings as appropriate. In the limit cycle method, change the Pr.1217 setting as appropriate. |
| 95 | Setting error | PID control is disabled during tuning. The PID control setting has been changed during tuning. In the limit cycle method, the Pr.1215 setting is equal to or lower than the Pr.1216 setting. | Enable PID control. Change the Pr.1215 and Pr.1216 settings as appropriate. |
| 96 | PID mode error | PID gain tuning has been started during automatic switchover or pre-charge operation. A stall prevention or regeneration avoidance operation occurred during PID gain tuning. A condition for output shutoff by the sleep function was satisfied during PID gain tuning. Frequency fluctuation occurred because of the frequency jump, maximum frequency, or minimum frequency during PID gain tuning. | Change the setting of each function as appropriate. |

Fine adjustment after PID gain tuning

 If fine adjustment is required after completion of PID gain tuning, adjust the proportional band (Pr.129 or Pr.756), integral time (Pr.130 or Pr.757), and differential time (Pr.134 or Pr.758).

| Status of measurement values | Adjustment method |
|--|--|
| The response is fast, but vibrations are observed. Measured value[%] Set point[%] Time | Increase the proportional band (Pr.129 or Pr.756). (Smaller proportional effect) Increase the integral time (Pr.130 or Pr.757). (Smaller integral effect) |
| Optimal Measured value[%] Set point[%] Time | _ |
| Response is slow. Measured value[%] Set point[%] Time | Decrease the proportional band (Pr.129 or Pr.756). (Larger proportional effect) Decrease the integral time (Pr.130 or Pr.757). (Larger integral effect) |
| NOTE | |

• When the differential operation is used, adjust the differential time (**Pr.134** or **Pr.758**) while checking the stability and the response. (Increasing the differential time makes the differential effect larger, and decreasing the differential time makes the differential effect smaller.)

5.11.8 Changing the display increment of numerical values used in PID control

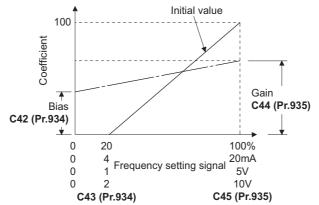
When the LCD operation panel (FR-LU08) or the parameter unit (FR-PU07) is used, the display unit of parameters and monitor items related to PID control can be changed to various units.

| Pr. | Name | Initial value | Setting range | Description | | |
|---------------------------------|---|---------------|--|---|------------------------------|--|
| 759 A600 PID unit selection | | 0 | 0 to 43 | Change the unit of the PID control-related values that is displayed on the LCD operation panel (FR-LU08) or the parameter unit (FR-PU07). | | |
| | | | 9999 | Without display unit switching | | |
| C42 (934) A630 ^{*1} | PID display bias coefficient | 9999 | 0 to 500 | Set the coefficient of the bias side input. | (minimum) of measured value | |
| A630 | | | 9999 | Displayed in %. | | |
| C43 (934) A631 ^{*1} | PID display bias analog value | 20% | 0% to 300% | Set the converted % of the bias si of measured value input. | de (minimum) current/voltage | |
| C44 (935) A632 ^{*1} | PID display gain coatticiant | | 0 to 500 Set the coefficient of the gain side (maximu input. | | (maximum) of measured value | |
| A632 | | | 9999 | Displayed in %. | | |
| C45 (935) A633 ^{*1} | PID display gain analog value | 100% | 0% to 300% | Set the converted % of the gain si of measured value input. | de (maximum) current/voltage | |
| 1136 | Second PID display bias | 9999 | 0 to 500 | Defer to CA2 (024) | | |
| A670 | coefficient | 9999 | 9999 | Refer to C42 (934) . | | |
| 1137 A671 | Second PID display bias analog value | 20% | 0% to 300% | Refer to C43 (934). | | |
| 1138 | | | 0 to 500 | Refer to C44 (935) . | Second PID control | |
| A672 | | | 9999 | Nelei lu C44 (333) . | | |
| 1139 A673 | Second PID display gain analog value | 100% | 0% to 300% | 6 Refer to C45 (935) . | | |
| 1142 A640 | Second PID unit selection | 9999 | 0 to 43, 9999 | Refer to Pr.759 . | | |

*1 The parameter number in parentheses is the one for use with the LCD operation panel and the parameter unit.

Calibration of PID display bias and gain (C42 (Pr.934) to C45 (Pr.935))

- When both C42 (Pr.934) and C44 (Pr.935) ≠ "9999", the bias and gain values for the set point, measured value and deviation in PID control can be calibrated.
- "Bias"/"gain" function can adjust the relation between PID displayed coefficient and measured value input signal that is externally input. Examples of these measured value input signals are 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mADC. (The terminals used for measured value input can be selected at **Pr.128**, **Pr.609**, **Pr.610**.)
- Set the value that is displayed when the PID measured value (control amount) is 0% to C42 (Pr.934) and the value that is displayed when the PID measured value (control amount) is 100% to C44 (Pr.935).
- When both of C42 (Pr.934) and C44 (Pr.935) ≠"9999" and Pr.133 is set as the set point, the setting of C42 (Pr.934) is treated as 0%, and C44 (Pr.935) as 100%.



• There are three methods to adjust the PID display bias/gain.

Method to adjust any point by application of a current (voltage) to the measured value input terminal Method to adjust any point without application of a current (voltage) to the measured value input terminal Method to adjust only the display coefficient without adjustment of current (voltage)

(Refer to page 357 for details, and make the necessary adjustments by considering C7 (Pr.905) as C45 (Pr.935) and Pr.126 as C44 (Pr.935).)

NOTE

- Always calibrate the input after changing the voltage/current input specification with Pr.73 and Pr.267, and the voltage/current input selection switch.
- Take caution when the following condition is satisfied because the inverter recognizes the deviation value as a negative (positive) value even though a positive (negative) deviation is given: Pr.934 (PID bias coefficient) > Pr.935 (PID gain coefficient).

To perform a reverse action, set **Pr.128 PID action selection** to forward action. Alternatively, to perform a forward action, set **Pr.128** to reverse action. In this case, the PID output shutoff release level is (1000 - **Pr.577**).

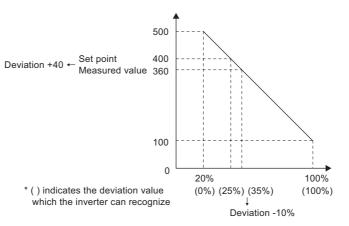
| Pr.934 < Pr.935 | (normal setting) | Pr.934 ≥ Pr.935 | | |
|----------------------------------|----------------------------------|----------------------------------|----------------------------------|--|
| Reverse action | Reverse action setting to Pr.128 | Reverse action | Forward action setting to Pr.128 | |
| Forward action | Forward action setting to Pr.128 | Forward action | Reverse action setting to Pr.128 | |
| PID output shutoff release level | Pr.577 - 1000 | PID output shutoff release level | 1000 - Pr.577 | |

(Example) Set the following: Pr.934 = "500" or 20% (4 mA is applied), Pr.935 = "100" or 100% (20 mA is applied).

When the set point = 400 and the measured value = 360, the deviation is +40 (>0), but the inverter recognizes the deviation as -10% (<0). Because of this, operation amount does not increase in the reverse operation setting.

The operation amount increases when the forward operation is set.

To perform PID output shutoff release at deviation of +40 or higher, set **Pr.577** = "960".



The display of the following parameters is changed according to the C42 (Pr.934), C44 (Pr.935), Pr.1136, and Pr.1138 settings.

| Pr. | Name | | | | |
|-----|----------------------------------|--|--|--|--|
| 131 | PID upper limit | | | | |
| 132 | PID lower limit | | | | |
| 133 | PID action set point | | | | |
| 553 | PID deviation limit | | | | |
| 577 | Output interruption cancel level | | | | |
| 761 | Pre-charge ending level | | | | |
| 763 | Pre-charge upper detection level | | | | |

| Pr. | Name | | | | | |
|------|---|--|--|--|--|--|
| 1143 | Second PID upper limit | | | | | |
| 1144 | Second PID lower limit | | | | | |
| 755 | Second PID action set point | | | | | |
| 1145 | Second PID deviation limit | | | | | |
| 1149 | Second output interruption cancel level | | | | | |
| 766 | Second pre-charge ending level | | | | | |
| 768 | Second pre-charge upper detection level | | | | | |

Changing the PID display coefficient of the LCD operation panel (FR-LU08) or the parameter unit (FR-PU07) (Pr.759)

• Use **Pr.759 PID unit selection** to change the unit of the displayed value on the FR-LU08 or the FR-PU07. For the coefficient set in **C42 (Pr.934) to C44 (Pr.935)**, the units can be changed as follows.

| Pr.759 setting | Unit indication | Unit name |
|----------------|--------------------|-----------------------------|
| 9999 | % | % |
| 0 | — | (No indication) |
| 1 | К | Kelvin |
| 2 | С | Degree Celsius |
| 3 | F | Degree Fahrenheit |
| 4 | PSI | Pound-force per Square Inch |
| 5 | MPa | Mega Pascal |
| 6 | kPa | Kilo Pascal |
| 7 | Pa | Pascal |
| 8 | bar | Bar |
| 9 | mbr | Millibar |
| 10 | GPH | Gallon per Hour |
| 11 | GPM | Gallon per Minute |
| 12 | GPS | Gallon per Second |
| 13 | L/H | Liter per Hour |
| 14 | L/M | Liter per Minute |
| 15 | L/S | Liter per Second |
| 16 | CFH | Cubic Feet per Hour |
| 17 | CFM | Cubic Feet per Minute |
| 18 | CFS | Cubic Feet per Second |
| 19 | СМН | Cubic Meter per Hour |
| 20 | СММ | Cubic Meter per Minute |

| Pr.759 setting | Unit indication | Unit name |
|----------------|--------------------|------------------------|
| 21 | CMS | Cubic Meter per Second |
| 22 | ftM | Feet per Minute |
| 23 | ftS | Feet per Second |
| 24 | m/M | Meter per Minute |
| 25 | m/S | Meter per Second |
| 26 | lbH | Pound per Hour |
| 27 | lbM | Pound per Minute |
| 28 | lbS | Pound per Second |
| 29 | iWC | Inch Water Column |
| 30 | iWG | Inch Water Gauge |
| 31 | fWG | Feet of Water Gauge |
| 32 | mWG | Meter of Water Gauge |
| 33 | iHg | Inches of Mercury |
| 34 | mHg | Millimeters of Mercury |
| 35 | kgH | Kilogram per Hour |
| 36 | kgM | Kilogram per Minute |
| 37 | kgS | Kilogram per Second |
| 38 | ppm | Pulse per Minute |
| 39 | pps | Pulse per Second |
| 40 | kW | Kilowatt |
| 41 | hp | Horse Power |
| 42 | Hz | Hertz |
| 43 | rpm | Revolution per Minute |

5.11.9 PID Pre-charge function

This function drives the motor at a certain speed before starting PID control. This function is useful for a pump with a long hose, since PID control would start before the pump is filled with water, and proper control would not be performed without this function,

| Pr. | Name | Initial value | Setting range | Description | | |
|--------------|--|------------------|----------------------|--|---|--|
| 760 A616 | Pre-charge fault selection | 0 | 0 | Fault indication with output shutoff immediately after pre-charge fault occurs. | | |
| ACIO | | | 1 | Fault indication with deceleratio | n stop after pre-charge fault occurs. | |
| 761 | Pre-charge ending level | 9999 | 0% to 100% | Set the measured amount to en | d the pre-charge operation. | |
| A617 | Tre-charge ending level | 0000 | 9999 | Without pre-charge ending leve | I | |
| 762 | Pre-charge ending time | 9999 | 0 to 3600 s | Set the time to end the pre-char | ge operation. | |
| A618 | Tre-charge ending time | 0000 | 9999 | Without pre-charge ending time | | |
| 763 A619 | Pre-charge upper detection level | 9999 | 0% to 100% | Set the upper limit for the pre-charged amount. A pre-charge fault occurs when the measured value exceeds the setting during pre-charging. | | |
| | | | 9999 | Without Pre-charge upper detect | ction level | |
| 764 A620 | Pre-charge time limit | | 0 to 3600 s | Set the time limit for the pre-charged amount. A pre-charge fault of when the pre-charge time exceeds the setting. | | |
| A020 | | | 9999 | Without Pre-charge time limit | | |
| 1132 | Pre-charge change increment | 9999 | 0% to 100% | Set the change increment amount per second after the automatic switchover frequency is reached (for vertical pumps). | | |
| A626 | amount | 9999 | 9999 | Constant-speed operation after the automatic switchover frequency is reached (for horizontal pumps). | | |
| 765 A656 | Second pre-charge fault selection | 0 | 0, 1 | Refer to Pr.760 . | | |
| 766 A657 | Second pre-charge ending level | 9999 | 0% to 100%, 9999 | Refer to Pr.761 . | | |
| 767 A658 | Second pre-charge ending time | 9999 | 0 to 3600 s, 9999 | Refer to Pr.762 . | Set the second pre-charge function. The second pre-charge function is valid when the RT signal is ON. | |
| 768 A659 | Second pre-charge upper detection level | 9999 | 0% to 100%, 9999 | Refer to Pr.763 . | | |
| 769 A660 | Second pre-charge time limit | 9999 | 0 to 3600 s, 9999 | Refer to Pr.764 . | | |
| 1133 A666 | Second pre-charge change increment amount | 9999 | 0% to 100%, 9999 | Refer to Pr.1132 . | | |

Operation selection for the pre-charge function

- To enable the pre-charge function when PID control is enabled, set the pre-charge end conditions at Pr.761 Pre-charge ending level and at Pr.762 Pre-charge ending time, or set "77" to Pr.178 to Pr.189 (Input terminal function selection). When operation is started, the inverter runs at the frequency set to Pr.127 PID control automatic switchover frequency to enter the pre-charge state.
- Pre-charge ends and PID control starts after a pre-charge ending condition is satisfied.
- The pre-charge function is also activated at a start after release of a PID output suspension (sleep) state or MRS (output shutoff). The PID output suspension (sleep) function is not activated until the started pre-charge operation ends.
- During pre-charge operation, the During pre-charge operation (Y49) signal is output. For the terminal used for the Y49 signal output, set "49 (positive logic)" or "149 (negative logic)" in any parameter from **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function.

• The pre-charge function valid/invalid settings and pre-charge ending conditions are as follows:

| Pr.127 setting | Pre-charge ending condition setting | | | Pre-charge | Valid pre-charge ending condition ^{*1} | | |
|----------------|-------------------------------------|-----------------|--------------|------------|---|------|-----|
| FI.127 Setting | Pr.761 setting Pr.762 setting | | X77 signal | function | valid pre-charge ending condition | | |
| 9999 | — | — | — | Disabled | ed — | | |
| | | 9999 | Not assigned | Disabled | | | |
| | 9999 | 9999 | Assigned | | — | — | X77 |
| | 9999 | Other than 9999 | Not assigned | | — | Time | — |
| Other than | | | Assigned | Enabled | — | Time | X77 |
| 9999 | | 9999 | Not assigned | | Result | — | — |
| | Other than 9999 | | Assigned | | Result | — | X77 |
| | | Other than 9999 | Not assigned | | Result | Time | — |
| | | | Assigned | | Result | Time | X77 |

*1 When two or more ends conditions are satisfied, the pre-charge operation ends by the first-satisfied condition.

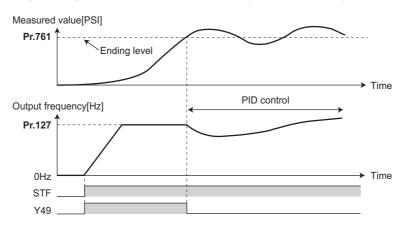
NOTE

- During the pre-charge operation, it is regarded as integrated value = estimated value. The motor speed may drop shortly from the automatic switchover frequency depending on the parameter settings.
- Parameter changes and switchover to the second PID control are applied immediately. If PID control has not started when the settings were changed, PID control starts with changed settings. (If PID control has already started, these settings do not apply. If the changed settings already satisfies a condition to start PID control, the PID control starts as soon as these are changed.)
- The pre-charge also ends when PID control is set to invalid, the start command has been turned OFF, and output has been shut off.

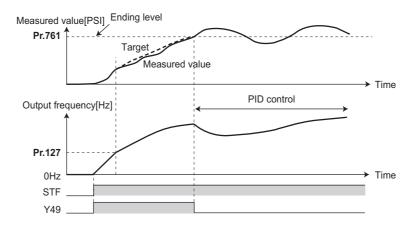
Example of the pre-charge operation

When the measured amount reaches the pre-charge ending level (Pr.761 Pre-charge ending level ≠ "9999")
 The pre-charge operation ends when the measured value reaches the Pr.761 setting or higher, then the PID control is performed.

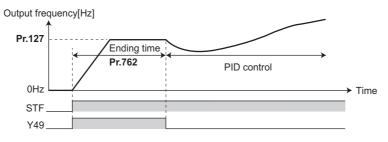
When Pr.1132 Pre-charge change increment amount = "9999" (horizontal pumps)



When **Pr.1132 Pre-charge change increment amount** \neq "9999" (vertical pumps), PID control is performed so that the change increment amount of the set point equals the **Pr.1132** setting after the automatic switchover frequency is reached until the pre-charge ending condition is satisfied. (Although PID control is performed after the automatic switchover frequency is reached until the pre-charge ends, the status is regarded as the one during pre-charge.)

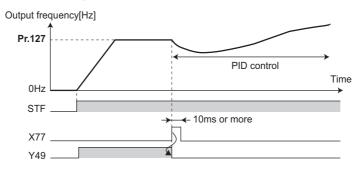


When the elapsed time reaches the pre-charge ending time (Pr.762 Pre-charge ending time ≠ "9999")
 The pre-charge operation ends when the pre-charge time reaches the Pr.762 setting or higher, then the PID control is performed.



When the signal is input to end the pre-charge operation

When the X77 signal turns ON, the pre-charge operation ends, and the PID control starts. (If a start command is given while the X77 signal is ON, the pre-charge operation is not performed, and PID control starts.)



- NOTE

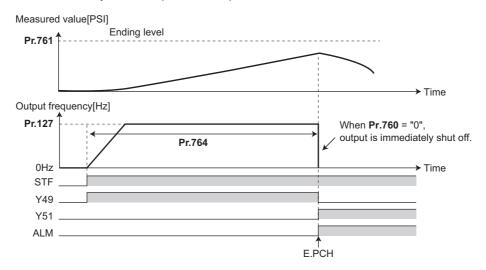
- When the PID output suspension (sleep) function is in use, and the X77 signal is set to valid after this function is released, set the X77 signal to OFF after checking that the during the During pre-charge operation (Y49) signal is OFF.
- When the PID output suspension (sleep) function is in use, and PID control is to be performed immediately after this function is released, leave the X77 signal ON until PID control ends.
- When the pre-charge operation is valid, the pre-charge operation is performed at the output shutoff cancellation (MRS signal, etc.). (The pre-charge operation is also performed in the case of instantaneous power failure when the automatic restart after instantaneous power failure is valid.)
- When the control method is changed to PID control from a control with higher priority in frequency command (multi-speed setting, JOG operation, etc.), the motor is accelerated/decelerated until its speed reaches the automatic switchover frequency (**Pr.127**), and the pre-charge is performed.

Operation setting at pre-charge fault

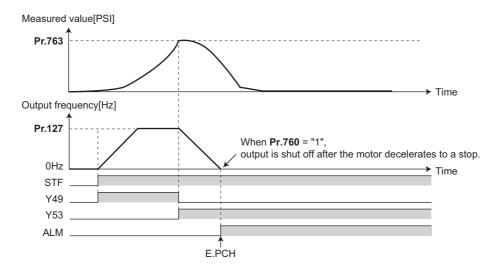
- The protective function can be activated when limit values are exceeded if the time limit is set at **Pr.764 Pre-charge time limit** and the measured value limit level is set at **Pr.763 Pre-charge upper detection level**.
- Whether to shut off output immediately after the protective function is activated or after a deceleration stop can be selected by Pr.760 Pre-charge fault selection. (Pre-charge protective function is effective regardless of the setting of pre-charge ending conditions.)
- When the time limit is exceeded, the Pre-charge time over (Y51) signal is output. When the measured value limit level is exceeded, the Pre-charge level over (Y53) signal is output. For the Y51 signal, set "51 (positive logic)" or "151 (negative logic)" to Pr.190 to Pr.196 (Output terminal function selection), and for the Y53 signal, set "53 (positive logic)" or "153 (negative logic)" in Pr.190 to Pr.196 (Output terminal function selection) to assign the functions to terminals.

- For Pr.764 Pre-charge time limit, set a value greater than Pr.762 Pre-charge ending time.
- For Pr.763 Pre-charge upper detection level, set a value greater than Pr.761 Pre-charge ending level.

• Example of protective function by time limit (**Pr.760** = "0")



• Example of protective function measured value limit (Pr.760 = "1")



Setting multiple PID pre-charge functions

- When the second pre-charge function is set, two sets of pre-charge functions can be switched for use. The second precharge function is enabled by the turning ON RT signal.
- The second pre-charge function parameters and signals function in the same way as the following parameters and signals of the first pre-charge function. Refer to the first pre-charge function when setting the second pre-charge functions.

| Classification | Firs | st pre-charge function parameters | Second pre-charge function parameters | | |
|----------------|------|--|---------------------------------------|---|--|
| Classification | Pr. | Name | Pr. | Name | |
| | 760 | Pre-charge fault selection | 765 | Second pre-charge fault selection | |
| 761 762 | 761 | Pre-charge ending level | 766 | Second pre-charge ending level | |
| | 762 | Pre-charge ending time | 767 | Second pre-charge ending time | |
| Parameter 763 | | Pre-charge upper detection level | 768 | Second pre-charge upper detection level | |
| | 764 | Pre-charge time limit | 769 | Second pre-charge time limit | |
| | 1122 | 132 Pre-charge change increment amount | | Second pre-charge change increment | |
| | 1152 | | | amount | |

| Classification | Firs | t pre-charge function parameters | Second pre-charge function parameters | | |
|----------------|----------------------------|----------------------------------|---------------------------------------|------------------------------------|--|
| Classification | Signal | Name | Signal | Name | |
| Input signal | X77 Pre-charge end command | | X78 | Second pre-charge end command | |
| | Y49 | During pre-charge operation | Y50 | During second pre-charge operation | |
| Output signal | Y51 | Pre-charge time over | Y52 | Second pre-charge time over | |
| | Y53 | Pre-charge level over | Y54 | Second pre-charge level over | |



- The second PID pre-charge function is valid also when the first pre-charge function is set to invalid and the second pre-charge function is set.
- When "10" (second function enabled only during constant-speed operation) is set to **Pr.155**, the second PID function is not selected even if the RT signal turns ON.

5.11.10 Multi-pump function (Advanced PID function)

PID control function can adjust the volume of water, etc. by controlling pumps. When the motor output is insufficient, auxiliary motors can be driven by the commercial power supply. Up to three auxiliary motors can be connected.

| Pr. | Name | Initial value | | Setting range | Description | | |
|---|---|---------------|-------|---------------|---|------------|--|
| F 1. | Name | FM CA | | Setting range | Description | | |
| 578 | Auxiliary motor operation | 0 | | 0 | No auxiliary motor operation | | |
| A400 | selection | 0 | | 1 to 3 | Set the number of auxiliary motors to be run. | | |
| | | | | 0 | Basic system | | |
| 579 | Motor connection function | 0 | | 1 | Alternative system | | |
| A401 | selection | 0 | | 2 | Direct system | | |
| | | | | 3 | Alternative direct system | | |
| 580 A402 | MC switchover interlock time | 1 s | | 0 to 100 s | Set the MC switchover interlock time. | | |
| 581 A403 | Start waiting time | 1 s | | 0 to 100 s | Set the time from when the MC is switched until it starts. Set this time a little longer than the MC switching time. | | |
| 582 Auxiliary motor connection-time A404 deceleration time | | 1 s | | 0 to 3600 s | Used to decrease the output frequency of the inverter when a motor connection occurs. Set the deceleration time for decreasing the output frequency. | | |
| | | | | 9999 | The output frequency is not decreased when a motor connection occurs. | | |
| 583 Auxiliary motor disconnection- A405 time acceleration time | | 1 s | | 0 to 3600 s | Used to increase the output frequency of the invert when a motor connection occurs. Set the acceleration time for increasing the output frequency. | | |
| | | | | 9999 | The output frequency is not increased when a mo connection occurs. | | |
| 584 A406 | Auxiliary motor 1 starting frequency | 60 Hz | 50 Hz | 0 to 590 Hz | | | |
| 585 A407 | Auxiliary motor 2 starting frequency | 60 Hz | 50 Hz | 0 to 590 Hz | Set the frequency to start the auxiliary motor. | | |
| 586 A408 | Auxiliary motor 3 starting frequency | 60 Hz | 50 Hz | 0 to 590 Hz | | | |
| 587 A409 | Auxiliary motor 1 stopping frequency | 0 Hz | · | 0 to 590 Hz | | | |
| 588 A410 | Auxiliary motor 2 stopping frequency | 0 Hz | | 0 to 590 Hz | Set the frequency to stop the auxiliary motor. | | |
| 589 A411 | Auxiliary motor 3 stopping frequency | 0 Hz | | 0 to 590 Hz | | | |
| 590 A412 | Auxiliary motor start detection time | 5 s | | 0 to 3600 s | Set the delay time until the auxiliary motor is started. | | |
| 591 A413 | Auxiliary motor stop detection time | 5 s | | 0 to 3600 s | Set the delay time until the auxiliary motor is stopped. | | |
| 1370 A442 | Detection time for PID limiting operation | 0 s | | 0 to 900 s | Set the time until the auxiliary motor is stopped when the PID overpressure control function is used. | | |
| 1376 A414 | Auxiliary motor stopping level | 9999 | | 9999 | | 0% to 100% | Set the level for stopping the auxiliary motor by the PID overpressure control function. |
| ~+1+ | | | | 9999 | The PID overpressure control function is disabled. | | |



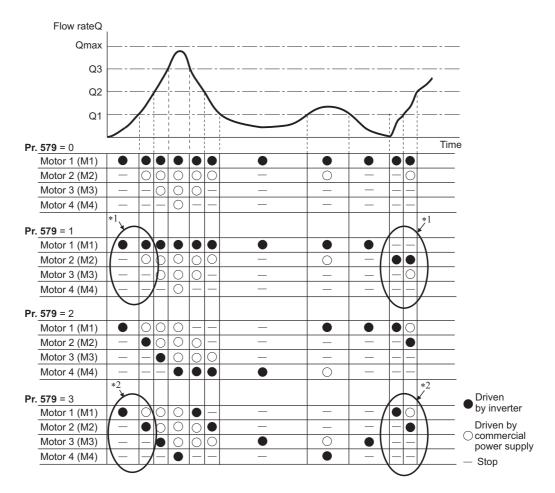
• Refer to page 419 to set PID control.

• When using the sleep function, refer to page 430 to set the function.

Multi-pump function control method

• Use **Pr.579 Motor connection function selection** to select the control method for the multi-pump function. Use **Pr.578 Auxiliary motor operation selection** to set the number of auxiliary motors.

| Pr.579 setting | Control method | Description |
|----------------|------------------------------|---|
| 0 | Basic system | The motor driven by the inverter is always fixed. Commercial power supply operation of auxiliary motors is available by turning ON and OFF the MC between the power supply and the motor depending on the output frequency of the inverter. |
| 1 | Alternative system | The motor driven by the inverter is fixed during operation. Commercial power supply operation of auxiliary motors is available by turning ON and OFF the MC between the power supply and the motor depending on the output frequency of the inverter. When output is shut off by the sleep function, the MC between the inverter and the motor is switched to switch the motor to be driven by the inverter. |
| 2 | Direct system | When the start signal is turned ON, the motor is started by the inverter. When the conditions to start the next motor are established, MCs between the inverter and the motor and the power supply and the motor are switched to change the operation of the motor driven by the inverter to commercial power supply operation, and the next motor is started by the inverter. When conditions to stop motors are established while auxiliary motors are running, the motor started first (currently driven by the commercial power supply) is stopped first, and then the other motors are stopped. |
| 3 | Alternative direct system | When the start signal is turned ON, the motor is started by the inverter. When the conditions to start the next motor are established, MCs between the inverter and the motor and the power supply and the motor are switched to change the operation of the motor driven by the inverter to commercial power supply operation, and the next motor is started by the inverter. When conditions to stop motors are established while auxiliary motors are running, the motor driven by the inverter is decelerated to stop, and operation of a motor currently driven by the commercial power supply is switched to the inverter-driven operation after frequency search. To perform frequency search when the motor operation is switched from commercial power supply operation, set Pr.57 Restart coasting time <i>≠</i> "9999". |



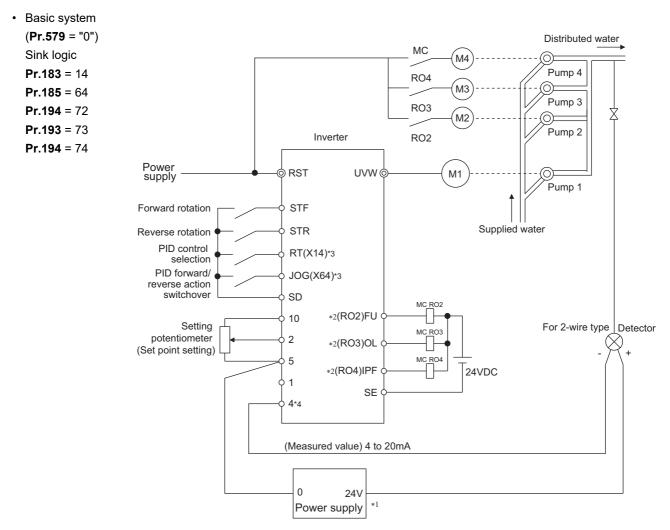
*1 The starting order of motors is M2-M3-M1 if the previous order was M1-M2-M3.

*2 The motor starts in the order of elapsed time after completion of the previous inverter-driven operation, from the longest to the shortest. (The motor that has not been driven by the inverter for the longest time starts first.)



- The motor 1 (M1) starts first when power is turned ON for the first time or after inverter reset.
- When the **Pr.578** or **Pr.579** setting has been changed, The motor 1 (M1) starts first.

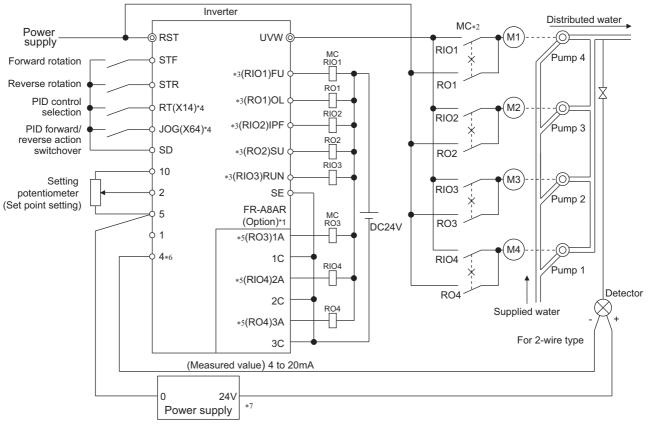
Connection diagram



- *1 Prepare a power supply matched to the power supply specifications of the detector.
- *2 The applied output signal terminals differ by the settings of Pr.190 to Pr.196 (Output terminal function selection).
- *3 The applied input signal terminals differ by the settings of Pr.178 to Pr.189 (Input terminal function selection).
- *4 The AU signal need not be input.

Alternative system (Pr.579 = "1"), direct system (Pr.579 = "2"), alternative direct system (Pr.579 = "3")
 Sink logic

Pr.183 = 14, **Pr.185** = 64, **Pr.194** = 75, **Pr.193** = 71, **Pr.192** = 76, **Pr.191** = 72, **Pr.190** = 77 **Pr.320** = 73, **Pr.321** = 78, **Pr.322** = 74



- *1 When driving three or more motors, use the plug-in option (FR-A8AR).
- *2 Always provide mechanical interlocks for the MC.
- *3 The applied output signal terminals differ by the settings of Pr.190 to Pr.196 (Output terminal function selection).
- *4 The applied input signal terminals differ by the settings of Pr.178 to Pr.189 (Input terminal function selection).
- *5 The applied output terminals differ by the settings of Pr.320 to Pr.322 (RA output selection).
- *6 The AU signal need not be input.
- *7 Prepare a power supply matched to the power supply specifications of the detector.

Input/output signals

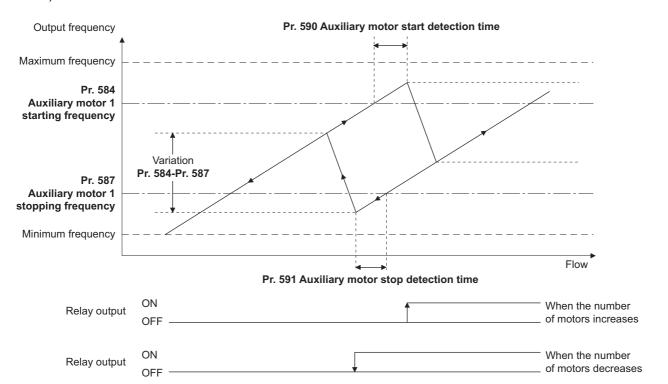
- When the PID control valid (X14) signal is assigned to the input terminal by setting **Pr.178 to Pr.189 (Input terminal function selection)**, the multi-pump function is enabled only at turn-ON of the X14 signal.
- Use **Pr.190 to Pr.196 (Output terminal function selection)** or relay output option (FR-A8AR) to assign functions of motor control signal to **Pr.320 to Pr.322 (RA output selection)**. (Only positive logic is available.)

| Output signal | Pr.190 to Pr.196 and Pr.320 to Pr.322 settings | | Function | |
|---------------|--|-------------------|---|--|
| Output signal | Positive logic | Negative logic | T unction | |
| SLEEP | 70 | 170 ^{*1} | PID output interruption | |
| RO1 | 71 | *2 | Commercial power supply side motor 1 connection RO1 | |
| RO2 | 72 | *2 | Commercial power supply side motor 2 connection RO2 | |
| RO3 | 73 | *2 | Commercial power supply side motor 3 connection RO3 | |
| RO4 | 74 | *2 | Commercial power supply side motor 4 connection RO4 | |
| RIO1 | 75 | *2 | Inverter side motor 1 connection RIO1 | |
| RIO2 | 76 | *2 | Inverter side motor 2 connection RIO2 | |
| RIO3 | 77 | *2 | Inverter side motor 3 connection RIO3 | |
| RIO4 | 78 | _* ² | Inverter side motor 4 connection RIO4 | |

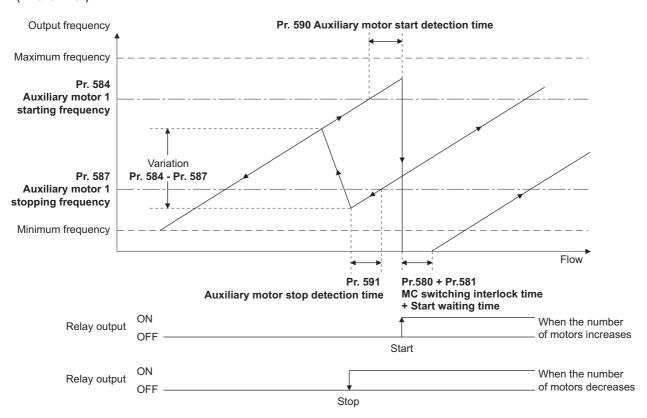
- *1 The value cannot be set in **Pr.320 to Pr.322**.
- *2 Negative logic cannot be set.

Motor switchover timing

Switchover timing at a start (stop) of an auxiliary motor 1 in the basic system (Pr.579 = "0") and alternative system (Pr.579 = "1")



• Switchover timing at a start (stop) of an auxiliary motor 1 in the direct system (**Pr.579** = "2") and alternative direct system (**Pr.579** = "3")

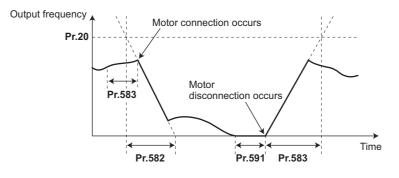


Waiting time setting at MC switchover (Pr.580, Pr.581)

- Set a waiting time for switchover of MC for the direct system (Pr.579 = "2") or alternative direct system (Pr.579 = "3").
- Set the MC switching time (for example, the time after RIO1 turns OFF until RO1 turns ON) in Pr.580 MC switchover interlock time (multi-pump).
- Set the time after the MC switchover until the motor starts (for example, the time after RIO1 turns OFF and RIO2 turns ON until the inverter output starts) in Pr.581 Start waiting time (multi-pump). Set this time a little longer than the MC switching time.

Acceleration/deceleration time when an auxiliary motor is connected and disconnected (Pr.582, Pr.583)

- Use Pr.582 Auxiliary motor connection-time deceleration time to set the deceleration time for forcibly decreasing the output frequency of the inverter when an auxiliary motor connection occurs. Set the deceleration time in Pr.582 from Pr.20
 Acceleration/deceleration reference frequency to stop. The output frequency is not forcibly changed when Pr.582 = "9999".
- Use Pr.583 Auxiliary motor disconnection-time acceleration time to set the acceleration time for forcibly increasing the output frequency of the inverter when an auxiliary motor disconnection occurs. Set the acceleration time in Pr.583 from stop to Pr.20 Acceleration/deceleration reference frequency. The output frequency is not forcibly changed when Pr.583 = "9999".



Starting auxiliary motors (Pr.584 to Pr.586, Pr.590)

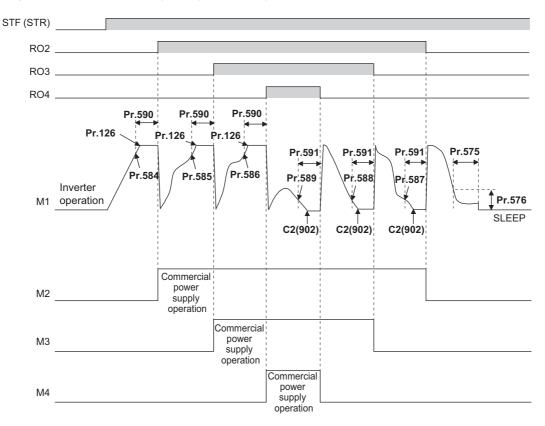
- Use Pr.584 to Pr.586 to set the output frequency of the inverter at which the commercial power supply operation motors are started. When the output frequency is equal to or higher than the setting for the time set in Pr.590 Auxiliary motor start detection time or longer, auxiliary motors driven by the commercial power supply are started.
- To set the starting frequency, use Pr.584 Auxiliary motor 1 starting frequency for the first auxiliary motor, and use Pr.585 Auxiliary motor 2 starting frequency for the second motor, and use Pr.586 Auxiliary motor 3 starting frequency for the third motor.
- The starting sequence depends on the Pr.579 Motor connection function selection setting.

Stopping auxiliary motors (Pr.587 to Pr.589, Pr.591)

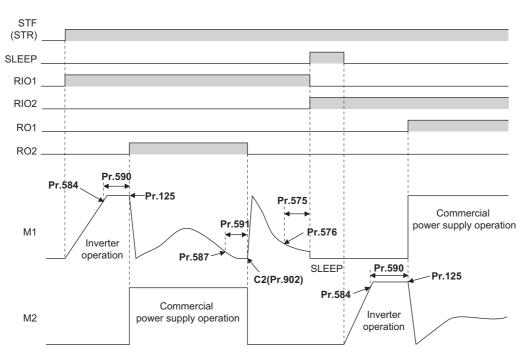
- Use Pr.587 to Pr.589 to set the output frequency of the inverter at which the commercial power supply operation motors are stopped. When the output frequency is equal to or lower than the setting for the time set in Pr.591 Auxiliary motor stop detection time or longer, auxiliary motors driven by the commercial power supply are stopped.
- To set the stopping frequency, use Pr.587 Auxiliary motor 1 stopping frequency for the first auxiliary motor, and use
 Pr.588 Auxiliary motor 2 stopping frequency for the second motor, and use Pr.589 Auxiliary motor 3 stopping frequency for the third motor.
- The stopping sequence depends on the Pr.579 Motor connection function selection setting.

Timing diagram

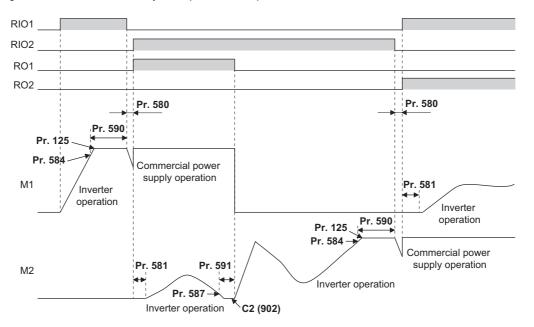
• When using four motors in the basic system (Pr.579 = "0")



• When using two motors in the alternative system (Pr.579 = "1")



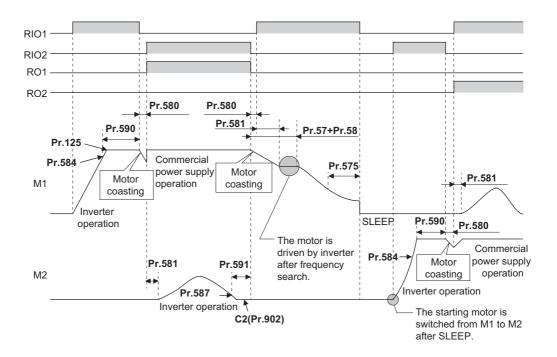
• When using two motors in the direct system (Pr.579 = "2")



NOTE

- When a start signal is turned OFF while running, MC (RO1 to RO4) turns OFF and the motor decelerates.
- When a protective function is activated while running, MC (RO1 to RO4) turns OFF and the inverter output is shut off.

• When using two motors in the alternative direct system (Pr.579 = "3")





- When the start signal is turned OFF during operation, the inverter-driven motor is decelerated to stop. The motors under commercial power supply operation are switched over to inverter-driven operation one at a time and decelerated to stop after frequency search in order from the longest operation time.
- · When a protective function is activated while running, MC (RO1 to RO4) turns OFF and the inverter output is shut off.
- When the MRS signal is turned ON during operation, the inverter output is shut off and the running motors coast to a stop. Although the motor with the longest operating time of the commercial power supply operation is switched to the inverter operation after the time period set in Pr.591 Auxiliary motor stop detection time elapsed, the output shutoff status remains. When the MRS signal is turned OFF, the inverter-driven operation starts after frequency search.
- If the starting signal is turned ON during deceleration regardless of the Pr.579 setting, the multi-pump operation is performed again.

PID overpressure control (Pr.1370 and Pr.1376)

- · When the main valve is suddenly closed in the multi-pump function system, a sudden increase of the pipe pressure may occur, and the pipes may be broken. To prevent fracture of the pipes, all auxiliary motors are stopped when the feedback value exceeds the predetermined level.
- When the PID measured value reaches or exceeds the Pr.1376 Auxiliary motor stopping level and the elapsed time exceeds the Pr.1370 Detection time for PID limiting operation while the multi-pump function is activated, all operating auxiliary motors are disconnected and allowed to coast to a stop regardless of the Pr.579 Motor connection function selection setting. The motor driven by the inverter continues its operation.
- After the auxiliary motor is stopped, the motor operation does not start while the PID measured value is equal to or more than Pr.1376 setting even when the auxiliary motor starting condition is satisfied.



- The PID overpressure control function can be used when PID control is performed (reverse action only) by the set point and measured value input using the multi-pump function.
- Either the first or the second PID measured value is used according to the PID control selection. When the control switches between the first PID control and second PID control, the measured value to be used is also switched to continue the control operation.

≪ Parameters referred to 🚿

- Pr.20 Acceleration/deceleration reference frequency, Pr.21 Acceleration/deceleration time increments 5 page 228
- Pr.57 Restart coasting time, Pr.58 Restart cushion time 3 page 466
- Pr.178 to Pr.189 (Input terminal function selection) Page 373 Pr.190 to Pr.196 (Output terminal function selection) page 330

5.11.11 PID control enhanced functions

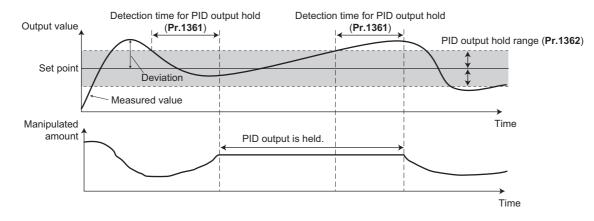
PID control enhanced functions can be used to perform PID control according to applications.

| Pr. | Name | lnitial value | Setting range | Description |
|--------------|---|------------------|------------------|---|
| 1361 A440 | Detection time for PID output hold | 5 s | 0 to 900 s | Set the time from when the deviation falls within the PID output hold range until the PID output is held. |
| 1362 | PID output hold range | 9999 | 0% to 50% | Set the range in which the PID output is held. |
| A441 | | 0000 | 9999 | The PID output holding is disabled. |
| 1363 A447 | PID priming time | 9999 | 0 to 360 s | Set the time from when the priming operation starts until the main pump starts. |
| 4004 | | | 9999 | The PID priming pump function is disabled. |
| 1364 A448 | Stirring time during sleep | 15 s | 0 to 3600 s | Set the stirring time. |
| 1365 A449 | Stirring interval time | 0 h | 0 to 1000 h | Set the interval time for the stirring operation. |
| 1366 A627 | Sleep boost level | 9999 | 0% to 100% | Increase the set point before the PID output suspension function is activated. |
| A02/ | | | 9999 | The PID sleep boost function is disabled. |
| 1367 A628 | Sleep boost waiting time | 0 s | 0 to 360 s | Set the waiting time for the sleep boost operation. |
| 1368 A629 | Output interruption cancel time | 0 s | 0 to 360 s | Set the time from when the deviation reaches the output interruption cancel level until the output is started. |
| 111 | Check valve deceleration time | 9999 | 0 to 3600 s | Set the deceleration time for the check valve deceleration function. |
| F031 | | 5555 | 9999 | The check valve deceleration function is disabled. |
| 1369 | Check valve closing completion | 9999 | 0 to 120 Hz | Set the frequency at which the check valve deceleration stops. |
| A446 | frequency | 0000 | 9999 | The check valve deceleration function is disabled. |
| 1346 A457 | PID lower limit operation detection time | 9999 | 0 to 900 s | Set the time from when the measured value reaches the lower limit pre-warning level (Pr.1371) until the set point change is started. |
| | | | 9999 | As set in Pr.1370 . |
| 1370 A442 | Detection time for PID limiting operation | 0 s 0 to 900 | | Set the time from when the measured value reaches the pre-warning level (P.1371) until the set point change is started. |
| 1371 A443 | PID upper/lower limit pre- warning level range | 9999 | 0% to 50% | Set the operation range for the PID upper/lower limit pre-warning function. |
| | | | 9999 | The PID upper/lower limit pre-warning function is disabled. |
| 1372 A444 | PID measured value control set point change amount | 5% | 0% to 50% | Set the set point change amount for the PID upper/lower limit pre- warning operation. |
| 1373 A445 | PID measured value control set point change rate | 0% | 0% to 100% | Set the set point change rate for the PID upper/lower limit pre- warning operation. |
| 1374 A450 | Auxiliary pressure pump operation starting level | 1000% | 900% to 1100% | Set the deviation level for operating the auxiliary pressure pump. |
| 1375 A451 | Auxiliary pressure pump operation stopping level | 1000% | 900% to 1100% | Set the deviation level for stopping the auxiliary pressure pump. |
| | | | 1 | Terminal 1 pressure input |
| 1377 | PID input pressure selection | 9999 | 2 | Terminal 2 pressure input |
| A452 | | 5555 | 3 | Terminal 4 pressure input |
| | | | 9999 | The PID input pressure control function is disabled. |
| 1378 A453 | PID input pressure warning level | 20% | 0% to 100% | Set the input pressure warning level. |
| 1379 | PID input pressure fault level | 9999 | 0% to 100% | Set the input pressure fault level. |
| A454 | • • | | 9999 | The input pressure fault detection is disabled. |
| 1380 A455 | PID input pressure warning set point change amount | 5% | 0% to 100% | Set the set point change amount when the pressure reaches the input pressure warning level. |
| 1381 | PID input pressure fault | 0 | 0 | The protective function (E.PID) for the input pressure fault is activated. |
| A456 | operation selection | 0 | 1 | A deceleration stop is performed when the input pressure fault occurs. |

◆ PID output hold (Pr.1361 and Pr.1362)

• The manipulated amount (PID output) can be fixed when the fluctuation of the deviation is small. This function eliminates unnecessary acceleration/deceleration, which is effective to reduce the power consumption.

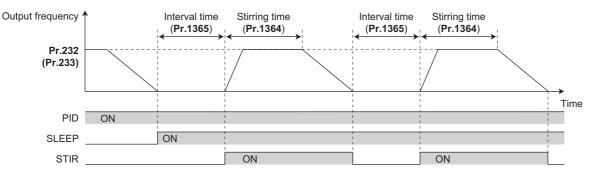
- When the deviation falls within the **Pr.1362 PID output hold range** and the elapsed time exceeds the **Pr.1361 Detection time for PID output hold**, the manipulated amount (PID output) is fixed at the output frequency at that time.
- Even if the deviation falls out of the PID output hold range, the manipulated amount (PID output) is maintained for the detection time for PID output hold.



- While the PID output is held, calculation is not performed for the P term, I term, and D term. For the P and I terms, the values at the start of the holding period are kept. The D term is set to "0".
- When the control switches between the first PID control and second PID control, the PID output holding state is canceled.
- The PID output holding function is disabled in the following cases:
- When **Pr.1362** = "9999", while the PID setting is not applied to the frequency, during the sleep function, at switching to the auxiliary motor in the multi-pump function, during PID gain tuning, during the sleep boost, during output shutoff, and while the analog current input is lost.

Stirring function during the PID sleep (Pr.1364 and Pr.1365)

- This function starts the pump periodically to prevent clogging of the pump while the PID output suspension function (sleep function) is activated.
- When the sleep function is activated and the elapsed time exceeds the Pr.1365 Stirring interval time, the pump is operated at the stirring frequency (Pr.232 or Pr.233). The pump decelerates to stop when the elapsed time exceeds the Pr.1364 Stirring time during sleep during the sleep. The interval time count for the second time onward starts after the previous deceleration stop is completed.



• The rotation direction depends on the Pr.232 and Pr.233 settings.

| Stirring f | requency | Rotation direction | Remarks | |
|----------------|----------------|-----------------------------------|---|--|
| Pr.232 setting | Pr.233 setting | Rotation direction | | |
| 9999 | 9999 | — | The stirring function during the PID sleep is disabled. | |
| 0 to 590 Hz | Any value | Command direction | Pr.232 frequency is used for stirring. | |
| 9999 | 0 to 590 Hz | Opposite to the command direction | Pr.233 frequency is used for stirring. | |

• The stirring signal (STIR) turns ON during the stirring operation. To use the STIR signal, set "218 (positive logic) or 318 (negative logic)" in any parameter from **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function.

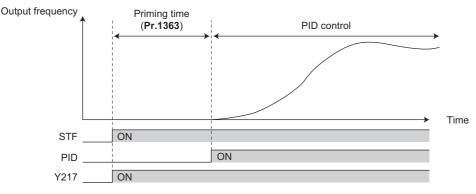
- When Pr.579 Motor connection function selection = "1 or 3" (multi-pump function), the starting order of the motors is changed when the sleep function is activated. The stirring operation during the sleep is applied to the motor to be started first next time. When the previous starting order was M1-M2-M3-M4, and the next starting order is M2-M3-M4-M1, stirring operation during the sleep will be applied to the M2 motor.
- When the auxiliary motor starting condition is satisfied by the stirring operation during the sleep while the multi-pump function is used, the stirring operation continues. The auxiliary motor does not start.

- NOTE

- When the control switches between the first PID control and second PID control during the sleep function, the interval time and the stirring time timer are carried over.
- When the sleep function cancellation condition is satisfied, the sleep function is cancelled, and the stirring function during the sleep is also cancelled.
- Changing the terminal assignment using **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

PID priming pump function (Pr.1363)

- This function starts the priming pump first before starting the main pump so that the main pump does not intake air at start.
- When the start command is turned ON after setting **Pr.1363 PID priming time** ≠ "9999", the Priming pump operation (Y217) signal turns ON to start the priming pump. When the elapsed time exceeds the **Pr.1363** setting, the main pump starts.
- The priming pump continues operation during operation of the main pump. When the STF signal is turned OFF to stop the main pump, the priming pump also stops.
- For the Y217 signal, set "217 (positive logic)" or "317 (negative logic)" in any parameter from **Pr.190 to Pr.196 (Output** terminal function selection) to assign the function.



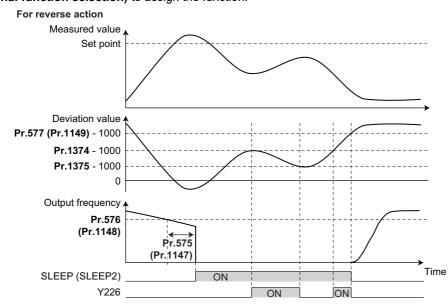
NOTE

- The priming operation is performed at every startup.
- When the operation is restarted after inverter reset by a protective function activation, the priming operation is performed.
- When the inverter is restarted by the retry operation at a fault occurrence, the priming pump operation is continued and after the restart, the PID control operation is performed without waiting for the priming time.
- When the control switches between the first PID control and second PID control during the priming time, the priming time is carried over.
- The PID priming pump function is enabled when the PID setting is applied to the frequency.
- Even when the inverter emergency stop operation (output shutoff by the MRS signal, etc.) is performed, the PID priming pump function operation continues while the power is supplied to the control circuit. For the emergency stop operation, configure another circuit to stop the priming pump.
- Changing the terminal assignment using Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

PID auxiliary pressure pump function (Pr.1374 and Pr.1375)

• This function enables signal output to activate an auxiliary pressure pump when the pump flow rate is low in the system which constantly requires a high pressure.

- When the deviation exceeds the auxiliary pressure pump operation starting level (Pr.1374 Auxiliary pressure pump operation starting level - 1000%) after the PID output suspension function (sleep function) is activated, the auxiliary pressure pump starts and the Auxiliary pressure pump operation (Y226) signal turns ON.
- When the deviation falls below the auxiliary pressure pump operation stopping level (**Pr.1375 Auxiliary pressure pump operation stopping level** 1000%) during the auxiliary pressure pump operation, the auxiliary pressure pump stops.
- For the Y226 signal, set "226 (positive logic)" or "326 (negative logic)" in any parameter from **Pr.190 to Pr.196 (Output** terminal function selection) to assign the function.



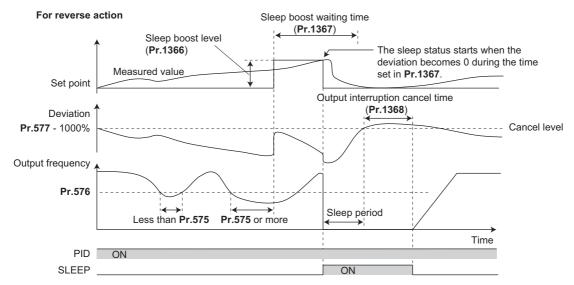
NOTE

The recommended settings of **Pr.577 (Pr.1149)**, **Pr.1374**, and **Pr.1375** are as follows. **Pr.577 (Pr.1149)**> **Pr.1374**> **Pr.1375**

- Even when the inverter emergency stop operation (output shutoff by the MRS signal, etc.) is performed, the PID auxiliary pressure pump function operation continues while the power is supplied to the control circuit. For the emergency stop operation, configure another circuit to stop the auxiliary pressure pump.
- Changing the terminal assignment using **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

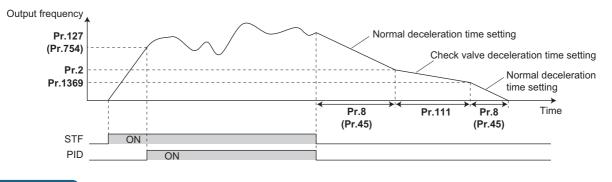
PID sleep boost (Pr.1366 to Pr.1368)

- The pump pressure can be increased before the PID output suspension function (sleep function) is activated. This function is useful to prevent frequent repetition of starting and stopping of the pump, and to maintain the sleep state for a long period of time.
- When the normal condition to activate the sleep function is satisfied (the output frequency is less than Pr.576 setting for the time set in Pr.575 or longer), the PID set point automatically increases by the amount set in Pr.1366 Sleep boost level.
- When the measured value reaches to the set point during **Pr.1367 Sleep boost waiting time**, the sleep function is activated. Then, the set point returns to its original value from the sleep boost set point. Then, the set point returns to its original value from the sleep boost set point.
- When the measured value does not reach to the sleep boost set point after the time set in **Pr.1367** passes, PID control continues without activating the sleep function.
- When the deviation remains at the Pr.577 setting or higher for the time set in Pr.1368 Output interruption cancel time, the inverter output restarts.



Check valve deceleration function (Pr.111 and Pr.1369)

- When the pump is stopped, slow deceleration can be applied to the predetermined section to prevent the water hammer sound caused by closing the valve.
- The Pr.111 Check valve deceleration time setting is applied to the section between Pr.2 Minimum frequency and Pr.1369 Check valve closing completion frequency.



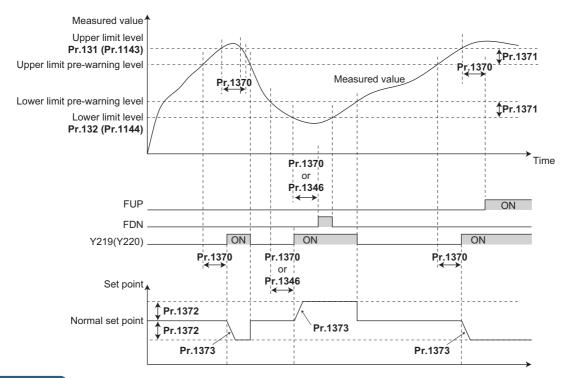
NOTE

- The check valve deceleration function is enabled when the PID setting is applied to the frequency.
- When the Pr.1369 setting is higher than the Pr.2 setting, the normal deceleration time (Pr.8 or Pr.45) setting is applied.

PID upper/lower limit pre-warning (Pr.1346, Pr.1370 to Pr.1373)

- The set point can be changed to suppress increases of the measured value before PID upper limit (FUP) or PID lower limit (FDN) is detected.
- When the measured value reaches and remains at the pre-warning level set in Pr.1371 PID upper/lower limit prewarning level range for the time set in Pr.1370 Detection time for PID limiting operation, the PID upper/lower limit prewarning (Y219) signal or the Second PID upper/lower limit pre-warning (Y220) signal is output. Also, the set point is changed by the amount set in Pr.1372 PID measured value control set point change amount.
- To set the detection time for upper and lower limits separately, set Pr.1346 PID lower limit operation detection time.
- Set the rate (%/s) in **Pr.1373 PID measured value control set point change rate** for changing the set point by the **Pr.1372** setting value. When the measured value falls within the normal range, the set point returns to its original value.
- For the Y219 and Y220 signals, assign the functions to output terminals using the **Pr.190 to Pr.196 (Output terminal function selection)**.

| Output signal | Pr.190 to Pr.196 setting | | | |
|---------------|--------------------------|----------------|--|--|
| Output signal | Positive logic | Negative logic | | |
| Y219 | 219 | 319 | | |
| Y220 | 220 | 320 | | |

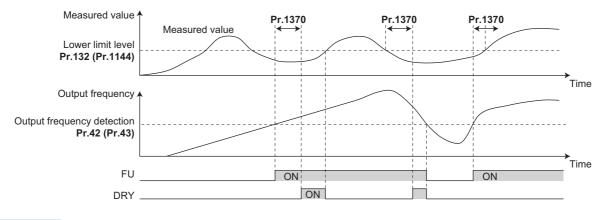


NOTE

- When **Pr.554** = "5, 7, 15, or 17" and a deceleration stop is performed by the FUP/FDN signal detection, the set point changed by the **Pr.1372** setting value remains effective.
- The set point change by the PID upper/lower limit pre-warning function is enabled when the PID setting is applied to the frequency.
- When the control switches between the first PID control and second PID control while the set point is changed by the **Pr.1372** setting value or while the Y219 (Y220) signal is output, the set point returns to its original value.
- When the upper limit or lower limit is disabled (**Pr.131** or **Pr.132** = "9999"), the upper/lower limit pre-warning function is not activated.
- The settings in Pr.1346 and Pr.1370 is used for the detection time for output of the FUP and FDN signals. (Refer to page 419.)

PID dry run monitoring function (Pr.1370)

- This function can prevent operation without water in the pipes by monitoring the flow rate (measured value) inside the pipes. When the flow rate decreases while the FU signal is ON, an output signal is sent for notification.
- The Dry run (DRY) signal is output during PID control when the measured value is lower than the lower limit (Pr.132 or Pr.1144) and the output frequency is higher than the setting in Pr.42 Output frequency detection or Pr.43 Output frequency detection for reverse rotation (FU signal ON) for the time set in Pr.1370 Detection time for PID limiting operation.
- To use the DRY signal, set "228 (positive logic) or 328 (negative logic)" in any parameter from **Pr.190 to Pr.196 (Output** terminal function selection) to assign the function.
- The PID dry run monitoring function is enabled for the reverse action.



• ΝΟΤΕ

The PID dry run monitoring function is enabled when the PID setting is applied to the frequency.

◆ PID input pressure control (Pr.1370, Pr.1373, and Pr.1377 to Pr.1381)

- In order to prevent air intake and cavitation inside the pump, this function controls the pump inlet pressure so that there is no water shortage.
- To enable the PID input pressure control function, set the terminal for the pressure input in Pr.1377 PID input pressure selection. (Select a terminal different from the one used for inputting the set point, measured value, or deviation.)

| Pr.1377 setting | Pressure input terminal | Remarks |
|----------------------|---|-----------------------------------|
| 1 | Terminal 1 | Set Pr.868 = "0 (initial value)". |
| 2 | Terminal 2 | — |
| 3 | Terminal 4 | Set Pr.858 = "0 (initial value)". |
| 9999 (initial value) | The PID input pressure control function is disabled. | _ |

- When the input pressure measured at the inlet remains lower than the Pr.1378 PID input pressure warning level for the time set in Pr.1370 Detection time for PID limiting operation, the PID input pressure warning (Y229) signal is output. Also, the set point is changed by the amount set in Pr.1380 PID input pressure warning set point change amount.
- Set the rate (%/s) in **Pr.1373 PID measured value control set point change rate** for changing the set point by the **Pr.1380** setting value. When the input pressure value falls within the normal range, the set point returns to its original value.
- When the input pressure measured at the inlet remains lower than the Pr.1379 PID input pressure fault level for the time set in Pr.1370 Detection time for PID limiting operation, the operation for the abnormal input pressure starts and the PID input pressure fault (Y230) signal is output.
- Select the operation for the abnormal input pressure in **Pr.1381**.

| Pr.1381 setting | Operation for the abnormal input pressure | Y230 signal |
|-------------------|---|---|
| 0 (initial value) | Output shutoff by the protective function (E.PID) activation | The signal is output at the same time with the protective function. |
| 1 | Deceleration stop (Operation can be restarted when the input pressure returns to normal.) | The signal is output after a deceleration stop. |

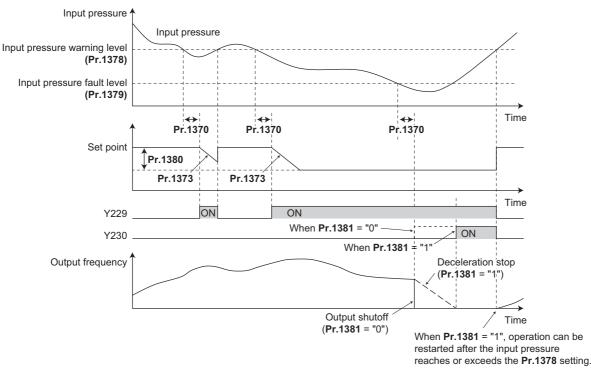
• For the Y229 and Y230 signals, assign the functions using Pr.190 to Pr.196 (Output terminal function selection).

| Output signal | Pr.190 to Pr.196 setting | | |
|---------------|--------------------------|----------------|--|
| Output signal | Positive logic | Negative logic | |
| Y229 | 229 | 329 | |
| Y230 | 230 | 330 | |

• To monitor the input pressure, set "69" in the monitor selection parameters. (0.1% increments)

| | Parameter Setting | | | Communication monitor code | |
|--------------------------|---|----------------------------------|--------------------------------|---|------------------------------------|
| Monitor item | Pr.52, Pr.774 to Pr.776, and Pr.992 (Operation panel indication) | Pr.54 (Terminal FM/CA output) | Pr.158 (Terminal AM output) | RS-485 communication dedicated monitor (hexadecimal) | MODBUS RTU real time monitor |
| PID input pressure value | 69 | 69 | 69 | H45 | 40269 |

For reverse action



- When the control switches between the first PID control and second PID control while the set point is changed by the **Pr.1380** setting value or while the Y229 (Y230) signal is output, the set point first returns to its original value, and is changed to the value after the switching.
- When the PID input pressure control function and the PID upper/lower limit pre-warning function are used simultaneously, each function may change the set point. When the set point change is attempted by both functions, the change by the PID input pressure control function has priority.
- When the PID input pressure control function and the PID sleep boost function are used simultaneously, each function may change the set point. When the set point change is attempted by both functions, the change by the PID input pressure control function has priority. (The sleep state is established without applying the set point change by the PID sleep boost function.)

5.11.12 Automatic restart after instantaneous power failure/flying start with an induction motor

Magnetic flux

The inverter can be restarted without stopping the motor operation in the following situations:

- · When switching from commercial power supply operation over to inverter running
- · When an instantaneous power failure occurs during inverter running
- When the motor is coasting at start

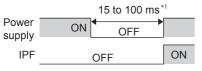
| Du | Nama | Initia | value | Setting | D ecombed by | |
|-------------|--|-------------------|------------|---|---|--|
| Pr. | r. Name | | M CA range | | Description | |
| | | antaneous power 0 | | 0 (2) ^{*1} , 1000 (1002) ^{*1} | Frequency search only performed at the first start | |
| | | | | 1, 1001 | Reduced voltage start only at the first start (no frequency search) | |
| 162 | Automatic restart after | | | 3, 1003 | Frequency search only performed at the first start (reduced impact restart) | |
| A700 | failure selection | | | 10 (12) ^{*1} , 1010 (1012) ^{*1} | Frequency search at every start | |
| | | | | 11, 1011 | Reduced voltage start at every start (no frequency search) | |
| | | | | 13, 1013 | Frequency search at every start (reduced impact restart) | |
| | | | | 0 | Rotation direction detection disabled | |
| | | | | 1 | Rotation direction detection enabled | |
| 299 A701 | Rotation direction detection selection at restarting | 9999 | | 9999 | When Pr.78 Reverse rotation prevention selection = "0", rotation direction detection enabled. | |
| | restarting | | | | When Pr.78 Reverse rotation prevention selection = "1 or 2", rotation direction detection disabled. | |
| | | - | | 0 | Coasting time differs according to the inverter capacity.*2 | |
| 57 A702 | Restart coasting time | | | 0.1 to 30 s | Set the waiting time for the inverter to perform a restart after restoring power due to an instantaneous power failure. | |
| | | | | 9999 | No restart | |
| 58 A703 | Restart cushion time | 1 s | | 0 to 60 s | Set the voltage cushion time for restart. | |
| 163 A704 | First cushion time for restart | 0 s | | 0 to 20 s | Set the voltage cushion time for restart. Consider this matched to the size of the load amount (moment of inertia/ | |
| 164 A705 | First cushion voltage for restart | 0% | | 0% to 100% | torque). | |
| 165 A710 | Stall prevention operation level for restart | 120% 110% | | 0% to 400% | Set the stall prevention level at restart operation on the assumption that the inverter rated current is 100%. | |
| 611 | Acceleration time at a | 9999 | | 0 to 3600 s | Set the acceleration time to reach Pr.20 Acceleration/deceleration reference frequency at restart. | |
| F003 | restart | | | 9999 | Standard acceleration time (for example, Pr.7) is applied as the acceleration time at restart. | |

*1 The same operation is performed for the both settings.

*2 The coasting time when Pr.57 = "0" is as shown below. (When Pr.162 and Pr.570 are set to the initial value.)

FR-F820-00077(1.5K) or lower and FR-F840-00038(1.5K) or lower: 0.5 s FR-F820-00105(2.2K) to FR-F820-00340(7.5K), FR-F840-00052(2.2K) to FR-F840-00170(7.5K): 1 s FR-F820-00490(11K) to FR-F820-02330(55K), FR-F840-00250(11K) to FR-F840-01160(55K): 3.0 s FR-F820-03160(75K) or higher, FR-F840-01800(75K) or higher: 5.0 s

Automatic restart after instantaneous power failure function

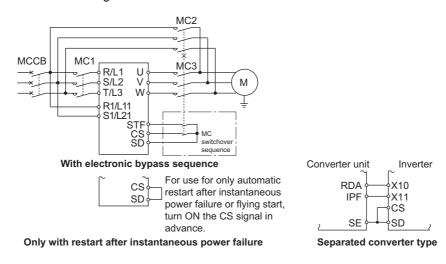


*1 10 to 100 ms for IP55 compatible models

- The inverter output is shut off at the activation of the Instantaneous power failure (E.IPF) or Undervoltage (E.UVT). (Refer to page 603 for E.IPF or E.UVT.)
- When E.IPF or E.UVT is activated, the Instantaneous power failure/undervoltage (IPF) signal is output.
- The IPF signal is assigned to terminal IPF in the initial status. By setting "2 (positive logic) or 102 (negative logic)" in any parameter from **Pr.190 to Pr.196 (Output terminal function selection)**, the IPF signal can be assigned to another terminal.
- When the automatic restart after instantaneous power failure function is selected, motor driving is resumed at the power restoration after an instantaneous power failure or undervoltage. (E.IPF and E.UVT are not activated.)

Connection (CS signal)

- When the Selection of automatic restart after instantaneous power failure / flying start (CS) signal is assigned to the input terminal by setting "6" in Pr.178 to Pr.189 (Input terminal function selection), restart operation is enabled at turn-ON of the CS signal.
- When the CS signal is assigned to an input terminal and **Pr.57 Restart coasting time** ≠ "9999" (with restart), the inverter cannot be operated while the CS signal remains OFF.



- Separated converter types detect the instantaneous power failure on the converter unit side. Perform wiring so that the IPF signal transmitted from the converter unit is input to the terminal to which the X11 signal is assigned.
 On the converter unit side, enable the restart operation. (For setting the converter unit, refer to the Instruction Manual of
- On the converter unit side, enable the restart operation. (For setting the converter unit, refer to the Instruction Manual of the converter unit.)
- For the terminal used for the X10 or X11 signal, set "10" (X10) or "11" (X11) in any parameter from **Pr.178 to Pr.189** and assign the function. (For separated converter types, the X10 signal is assigned to the terminal MRS in the initial setting.)
- For the X10 signal of separated converter types, NC contact input specification is selected in the initial setting. Set **Pr.599** = "0" to change the input specification to NO contact.

- NOTE

- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.
- If the CS signal is not assigned to any input terminal, solely setting Pr.57 enables the restart operation at all times.

Setting for the automatic restart after instantaneous power failure operation (Pr.162)

The restart operation is as shown in the following table according to the setting in **Pr.162 Automatic restart after instantaneous power failure selection**.

| Pr.162 setting | Restart timing | Automatic restart operation selection after instantaneous power failure | CS signal command source selection under Network operation mode | |
|-------------------|---------------------------------|--|--|--|
| 0, 2 | | Frequency search | | |
| 1 | Restart only at the first start | Reduced voltage start | | |
| 3 | | Frequency search (reduced impact restart) | Always External | |
| 10, 12 | | Frequency search | Always External | |
| 11 | Restart at every start | Reduced voltage start | | |
| 13 | | Frequency search (reduced impact restart) | | |
| 1000, 1002 | | Frequency search | | |
| 1001 | Restart only at the first start | Reduced voltage start | | |
| 1003 | | Frequency search (reduced impact restart) | Network (Pr.338 = "0") or External (Pr.338 | |
| 1010, 1012 | | Frequency search | = "1") | |
| 1011 | Restart at every start | Reduced voltage start | | |
| 1013 | | Frequency search (reduced impact restart) | | |

Restart operation with frequency search (Pr.162 = "0, 2, 3, 10, 12, 13, 1000, 1002, 1003, 1010, 1012, or 1013", Pr.299)

- When **Pr.162** = "0 (initial value), 2, 3, 10, 12, 13, 1000, 1002, 1003, 1010, 1012, or 1013", the motor speed is detected at a power restoration so that the motor can re-start smoothly.
- The encoder also detects the rotation direction so that the inverter can re-start smoothly even during the reverse rotation.
- Whether or not to detect the rotation direction can be selected by Pr.299 Rotation direction detection selection at restarting.
- If the motor capacity is different from the inverter capacity, set **Pr.299** = "0" (no rotation direction detection).
- When the rotation direction is detected, the following operation is performed according to **Pr.78 Reverse rotation prevention selection** setting.

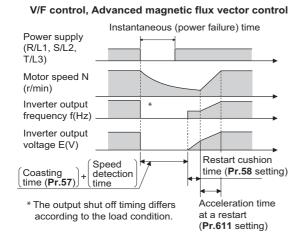
| Pr.299 setting | Pr.78 setting | | | |
|----------------------|---------------|---|---|--|
| FI.235 Setting | 0 | 1 | 2 | |
| 9999 (initial value) | 0 | × | × | |
| 0 | × | × | × | |
| 1 | 0 | 0 | 0 | |

 \circ : With rotation direction detection ×: Without rotation direction detection

5

• By setting "3, 13, 1003, or 1013" in **Pr.162**, the restart can be made smoother with even less impact than when "0, 2, 10, 12, 1000, 1002, 1010, or 1012" is set in **Pr.162**.

When the inverter is restarted with "3, 13, 1003, or 1013" set in **Pr.162**, offline auto tuning is required. (For details on offline auto tuning of Advanced magnetic flux vector control, refer to page 383, and for details on offline auto tuning of V/F control, refer to page 474.)



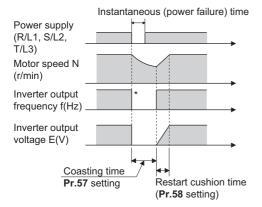
NOTE

- The rotation speed detection time (frequency search) changes according to the rotation speed of the motor. (maximum 1 second)
- When the inverter capacity is two ranks or greater than the motor capacity, the overcurrent protective function (E.OC[]) is sometimes activated and prevents the inverter from restarting.
- If two or more motors are connected to one inverter, this function operates abnormally. (The inverter does not restart successfully.)
- Because a DC injection brake is applied instantaneously at speed detection during a restart, the speed might drop if the moment of inertia (J) of the load is small.
- If reverse operation is detected when "1" (reverse rotation disabled) is set to Pr.78, operation decelerates by reverse rotation and then changes to forward rotation when the start command is forward rotation. The inverter does not restart when the start command is reverse rotation.
- When "3, 13, 1003, or 1013" is set to Pr.162, limit the wiring length to within 100 m.

Restart operation without frequency search (Pr.162 = "1, 11, 1001, or 1011")

When Pr.162 = "1 11, 1001, or 1011", reduced voltage start is used for the restart operation. In this method, the voltage is
raised gradually while keeping the output frequency level at the level before an instantaneous power failure, regardless of
the motor's coasting speed.

V/F control, Advanced magnetic flux vector control



* The output shut off timing differs according to the load condition.

- NOTE

• This restart method uses the output frequency that was active before the instantaneous power failure stored in memory. If the instantaneous power failure time is 0.2 second or more, the output frequency can no longer be stored and held in memory, so the restart is performed from **Pr.13 Starting frequency** (initial value: 0.5 Hz).

Restart at every start (Pr.162 = "10 to 13, or 1010 to 1013")

When "10 to 13, or 1010 to 1013" is set in Pr.162, a restart operation is performed at each start and automatic restart after instantaneous power failure (Pr.57 start after the reset time has elapsed). When "0 (initial value) to 3, or 1000 to 1003" is set in Pr.162, a restart operation is performed at the first start after a power-ON, and from the second power-ON onwards, a start from the starting frequency is performed.

Automatic restart operation of the MRS (X10) signal

The restart operation after restoration from output shutoff by the MRS (X10) signal is as shown in the following table according to the Pr.30 setting.

| Pr.30 setting | Operation after restoration from output shutoff by the MRS (X10) signal |
|--------------------------|---|
| 2, 10, 11, 102, 110, 111 | Restart operation (starting from the coasting speed) |
| Other than the above | Starting from Pr.13 Starting frequency. |

NOTE

When output is shut off using safety stop function (terminals S1 and S2), the inverter restarts in the same way as when output
is shut off by the MRS (X10) signal.

Adjustment of restart coasting time (Pr.57)

- · Coasting time is the time from the motor speed detection to the restart operation start.
- To enable restart operation, set "0" to **Pr.57 Restart coasting time**. If "0" is set to **Pr.57**, the coasting time is automatically set to the following value (unit: s). Generally, this setting does not interfere with inverter operation.

| | | 200 V class | : FR-F820-[] | | | | |
|--------------|---------------------------|----------------------------|--------------------------|----------------------|--|--|--|
| Pr.162 | 00046(0.75K), 00077(1.5K) | 00105(2.2K) to 00340(7.5K) | 00490(11K) to 02330(55K) | 03160(75K) or higher | | | |
| setting | | 400 V class: FR-F840-[] | | | | | |
| | 00023(0.75K), 00038(1.5K) | 00052(2.2K) to 00170(7.5K) | 00250(11K) to 01160(55K) | 01800(75K) or higher | | | |
| Other than | | | | | | | |
| 3, 13, 1003, | 0.5 | 1 | 3 | 5 | | | |
| 1013 | | | | | | | |
| 3, 13, 1003, | 1 | 2 | 3 | 5 | | | |
| 1013 | | _ | | Ť | | | |

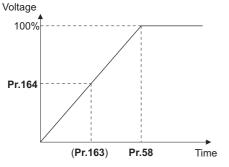
- Inverter operation is sometimes hindered by the size of the moment of inertia (J) of the load or running frequency. Adjust this coasting time within the range 0.1 s to 30 s to match the load specification.
- Set the waiting time when the sine wave filter is used (Pr.72 PWM frequency selection = "25") to 3 seconds or more.

Restart cushion time (Pr.58)

- The cushion time is the time taken to raise the voltage to the level required for the specified speed after the motor speed detection (output frequency before the instantaneous power failure when Pr.162 = "1, 11, 1001, or 1011").
- Normally, the motor runs at the initial value as it is. However, adjust to suit the moment of inertia (J) of the load or the size of the torque.

Adjustment of restart operation (Pr.163 to Pr.165, Pr.611)

• The voltage cushion time at a restart can be adjusted by Pr.163 and Pr.164 as shown in the figure on the left.



- The stall prevention operation level at a restart operation can be set in Pr.165.
- · Using Pr.611, the acceleration time to reach Pr.20 Acceleration/deceleration reference frequency after a restart operation can be set. This can be set individually from the normal acceleration time.

NOTE

- Changing the Pr.21 setting does not affect the Pr.611 setting increment.
- Changing the terminal assignment using Pr.178 to Pr.189 (Input terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.
- When the restart operation is selected, Undervoltage (E.UVT) and Instantaneous power failure (E.IPF) of the fault output signals become invalid.
- The SU and FU signals are not output during the restart. These signals are output after the restart cushion time passes.
- · Restart operation is also performed after the inverter reset is released or after the retry by the retry function occurs.

Operation command source selection for the CS signal during communication operation (Pr.162 = "1000 to 1003, 1010 to 1013")

• When "1000 to 1003, or 1010 to 1013" is set in Pr.162, the CS signal input via communication is enabled depending on the setting in Pr.338 Communication operation command source. (When Pr.162 = "0 to 3, or 10 to 13", the CS signal can be input via an external terminal only.)

▲ CAUTION

- Provide a mechanical interlock for MC1 and MC2. The inverter will be damaged if power supply is input to the inverter output section.
- · When the automatic restart after instantaneous power failure function is selected, the motor suddenly starts (after reset time passes) when an instantaneous power failure occurs. Stay away from the motor and machinery. Apply the supplied CAUTION stickers to easily visible places when automatic restart after instantaneous power failure has been selected.

[≪] Parameters referred to 🚿

Pr.7 Acceleration time, Pr.21 Acceleration/deceleration time increments 3 page 228

Pr.13 Starting frequency 🗊 page 238, page 239 Pr.65, Pr.67 to Pr.69 Retry function 🖙 page 276

Pr.78 Reverse rotation prevention selection 12 page 257

Pr.178 to Pr.189 (Input terminal function selection) age 373

5.11.13 Automatic restart after instantaneous power failure/flying start with a PM motor

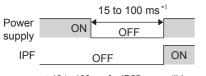
PM

When using the IPM motor MM-EFS or MM-THE4, the inverter operation can be restarted without stopping the motor operation. When the automatic restart after instantaneous power failure function is selected, the motor driving is resumed in the following situations:

- When power comes back ON during inverter driving after an instantaneous power failure
- · When the motor is coasting at start

| Pr. | Name | Initial value | Setting range | Description |
|---|-------------------------|---------------------------|---------------------------------|---|
| | Restart coasting time | | 0 | No waiting time |
| 57 A702 | | 9999 | 0.1 to 30 s | Set the waiting time for the inverter to perform a restart after restoring power due to an instantaneous power failure. |
| | | | 9999 | No restart |
| 162 | Automatic restart after | | 0 to 3, 1000 to 1003 | Frequency search only performed at the first start |
| A700 instantaneous power failure selection | ure selection 10 | 10 to 13, 1010 to 1013 | Frequency search at every start | |
| 611 | Acceleration time at a | cceleration time at a | 0 to 3600 s | Set the acceleration time to reach Pr.20 Acceleration/deceleration reference frequency at restart. |
| F003 I | restart | 9999 | aaaa | Standard acceleration time (for example, Pr.7) is applied as the acceleration time at restart. |

Automatic restart after instantaneous power failure function



*1 10 to 100 ms for IP55 compatible models

- The inverter output is shut off at the activation of the Instantaneous power failure (E.IPF) or Undervoltage (E.UVT). (Refer to page 594 for E.IPF or E.UVT.)
- When E.IPF or E.UVT is activated, the Instantaneous power failure/undervoltage (IPF) signal is output.
- The IPF signal is assigned to terminal IPF in the initial status. By setting "2 (positive logic) or 102 (negative logic)" in any parameter from **Pr.190 to Pr.196 (Output terminal function selection)**, the IPF signal can be assigned to another terminal.
- When the automatic restart after instantaneous power failure function is selected, motor driving is resumed at the power restoration after an instantaneous power failure or undervoltage. (E.IPF and E.UVT are not activated.)

Connection (CS signal)

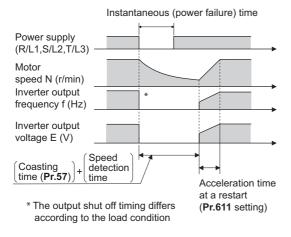
- When the Selection of automatic restart after instantaneous power failure / flying start (CS) signal is assigned to the input terminal by setting "6" in Pr.178 to Pr.189 (Input terminal function selection), restart operation is enabled at turn-ON of the CS signal.
- When the CS signal is assigned to an input terminal and **Pr.57 Restart coasting time** ≠ "9999" (with restart), the inverter cannot be operated while the CS signal remains OFF.

- NOTE

- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.
- If the CS signal is not assigned to any input terminal, solely setting Pr.57 enables the restart operation at all times.
- If the restart operation is selected, instantaneous power failure (E.IPF) is disabled while the fault output signal is output at an instantaneous power failure.
- The SU and FU signals are not output during the restart. These signals are output after the restart cushion time passes.
- Restart operation is also performed after the inverter reset is released or after the retry by the retry function occurs.

Selection of restart operation (Pr.162)

- At a power restoration, the encoder detects the motor speed by a frequency search so that the inverter can re-start smoothly.
- The encoder also detects the rotation direction so that the inverter can re-start smoothly even during the reverse rotation.
- When "10 to 13, or 1010 to 1013" is set in **Pr.162**, a restart operation is performed at each start and automatic restart after instantaneous power failure. When "0 to 2, or 1000 to 1002" is set in **Pr.162**, a restart operation is performed at the first start after a power-ON, and from the second power-ON onwards, a start from the starting frequency is performed.



- NOTE

- Because a DC injection brake is applied instantaneously at speed detection during a restart, the speed might drop if the moment of inertia (J) of the load is small.
- · Restart operation with reduced voltage is not available for PM motor control.

Restart coasting time (Pr.57)

- · Coasting time is the time from the motor speed detection to the restart operation start.
- To enable restart operation, set "0" (no coasting time) in Pr.57 Restart coasting time. Generally, this setting does not interfere with inverter operation.
- Inverter operation is sometimes hindered by the size of the moment of inertia (J) of the load or the output frequency. Adjust this coasting time within the range 0.1 s to 30 seconds to match the load specification.

Adjustment of restart operation (Pr.611)

• Using **Pr.611**, the acceleration time to reach **Pr.20 Acceleration/deceleration reference frequency** after a restart operation can be set. This can be set individually from the normal acceleration time.

- NOTE

- · Changing the Pr.21 Acceleration/deceleration time increments setting does not affect the Pr.611 setting increment.
- An IPM motor is a motor with interior permanent magnets. Regression voltage is generated when the motor coasts at an
 instantaneous power failure or at a flying start. The inverter's DC bus voltage rises if the motor coasts fast or makes a flying
 start in this condition.

When using the automatic restart after instantaneous power failure function (**Pr.57** \neq "9999"), it is recommended to also use the regenerative avoidance function (**Pr.882 Regeneration avoidance operation selection** = "1") to make startups stable. If the overvoltage protective function (E.OV[]) still occurs with the regeneration avoidance function, also use the retry function (**Pr.67**).

 During PM motor control, the function of the automatic restart after instantaneous power failure works only when an IPM motor MM-EFS or MM-THE4 is connected.

When a regeneration unit is used, the frequency search may not be available if the rotation speed is about 10% higher than the rated speed.

∕ € CAUTION

An IPM motor is a motor with interior permanent magnets. High voltage is generated at motor terminals while the motor is running.

Do not touch motor terminals and other parts until the motor stops to prevent an electric shock.

· When the automatic restart after instantaneous power failure function is selected, the motor suddenly starts (after reset time passes) when an instantaneous power failure occurs.

Stay away from the motor and machinery.

Apply the supplied CAUTION stickers to easily visible places when automatic restart after instantaneous power failure has been selected.

Parameters referred to

- Pr.13 Starting frequency Page 238, page 239
- Pr.65, Pr.67 to Pr.69 Retry function E[™] page 276 Pr.78 Reverse rotation prevention selection E[™] page 257

Pr.178 to Pr.189 (Input terminal function selection) ²² page 373 Pr.882 Regeneration avoidance operation selection ²² page 572

5.11.14 Offline auto tuning for a frequency search

Under V/F control or when driving the IPM motor MM-EFS or MM-THE4, the accuracy of the "frequency search", which is used to detect the motor speed for the automatic restart after instantaneous power failure and flying start, can be improved.

| Pr. | Name | Initial value | Setting range | Description |
|---------------------------|---|------------------|--|--|
| 162 A700 | Automatic restart after instantaneous power failure selection | 0 | 0 (2) ^{*1} , 1000 (1002) ^{*1} 1, 1001 3, 1003 10 (12) ^{*1} , 1010 (1012) ^{*1} 11, 1011 13, 1013 | Induction motor: Refer to page 466. PM motor: Refer to page 472. |
| 298 A711 ^{*2} | Frequency search gain | 9999 | 0 to 32767 | The offline auto tuning automatically sets the gain required for the frequency search. The constant value of Mitsubishi Electric motor (SF-PR, SF-JR, SF- |
| A/11 - | | | 9999 | HR, SF-JRCA, SF-HRCA, MM-EFS, or MM-THE4) is used. |
| 560 | Second frequency | | 0 to 32767 | The offline auto tuning automatically sets the gain required for the frequency search of the second motor. |
| A712 ^{*2} | | 9999 | 9999 | The constant value of Mitsubishi Electric motor (SF-PR, SF-JR, SF- HR, SF-JRCA, SF-HRCA, MM-EFS, or MM-THE4) is used for the second motor. |
| | J | | 0 | No offline auto tuning |
| 96 C110 | | 0 | 1, 101 | Offline auto tuning is performed under Advanced magnetic flux vector control. (Refer to page 383.) |
| 0110 | Status | | 11 | Offline auto tuning is performed without rotating the motor (V/F control, PM motor control (IPM motor MM-EFS/MM-THE4)). |
| | | | 0 to 50 Ω, 9999 ^{*3} | Tuning data |
| 90 C120 | Motor constant (R1) | 9999 | 0 to 400 mΩ, 9999 ^{*4} | (The value measured by offline auto tuning is automatically set.) 9999: The constant value of Mitsubishi Electric motor (SF-PR, SF-JR, SF-HR, SF-JRCA, SF-HRCA and so on) is used. |
| | | | 0 | No auto tuning for the second motor. |
| 463 C210 | Second motor auto tuning setting/status | 0 | 1, 101 | Offline auto tuning is performed for the second motor. (Refer to page 383.) |
| 0210 | | | 11 | Offline auto tuning is performed without rotating the second motor (V/ F control, PM motor control (IPM motor MM-EFS/MM-THE4)). |
| 458 | Second motor | 9999 | 0 to 50 Ω, 9999 ^{*3} | Tuning data of the second motor |
| C220 | 220 constant (R1) | | 0 to 400 mΩ, 9999 ^{*4} | (same as Pr.90) |

*1 The same operation is performed for the both settings.

*2 Tuning is not available under PM motor control.

*3 For the FR-F820-02330(55K) or lower and FR-F840-01160(55K) or lower.

*4 For the FR-F820-03160(75K) or higher and FR-F840-01800(75K) or higher.

Offline auto tuning for a frequency search (reduced impact restart)

- When an induction motor is used and the frequency search (reduced impact restart) is selected by setting **Pr.162 Automatic restart after instantaneous power failure selection** = "3, 13, 1003, or 1013", perform offline auto tuning.
- When the MM-EFS or MM-THE4 motor is used and the automatic restart after instantaneous power failure is selected, it is recommended that offline auto tuning is performed.

Before performing offline auto tuning

Check the following points before performing offline auto tuning:

- Check that V/F control or PM motor control (IPM motor MM-EFS or MM-THE4) is selected.
- Check that a motor is connected. (Check that the motor is not rotated by an external force during tuning.)
- Select a motor with the rated current equal to or less than the inverter rated current. (The motor capacity must be 0.4 kW or higher.)

If a motor with substantially low rated current compared with the inverter rated current is used, speed and torque accuracies may deteriorate due to torque ripples, etc. Set the rated motor current to about 40% or higher of the inverter rated current.

- The target motor is other than a high-slip motor, a high-speed motor, or a special motor.
- The motor may rotate slightly even if the offline auto tuning without motor rotation (Pr.96 Auto tuning setting/status = "11") is selected. Fix the motor securely with a mechanical brake, or before tuning, make sure that it is safe even if the motor rotates. (Caution is required especially in vertical lift applications.) Note that even if the motor runs slightly, tuning performance is unaffected.
- Offline auto tuning is not performed correctly when the surge voltage suppression filter (FR-ASF-H/FR-BMF-H) and sine
 wave filter (MT-BSL/BSC) are inserted between the inverter and motor. Be sure to remove them before performing tuning.

Setting

- 1. Set "11" in Pr.96 Auto tuning setting/status.
- 2. Set the rated motor current (initial value is the inverter rated current) in **Pr.9 Electronic thermal O/L relay**. (Refer to page 266.)
- **3.** Set **Pr.71 Applied motor** according to the motor to be used.

| N | lotor | Pr.71 setting |
|--|---|----------------|
| | SF-JR, SF-TH | 0 (3, 4) |
| Mitsubishi Electric standard motor | SF-JR 4P 1.5 kW or lower | 20 (23, 24) |
| Mitsubishi Electric high-efficiency motor | SF-HR | 40 (43, 44) |
| | Others | 0 (3, 4) |
| | SF-JRCA 4P, SF-TH (constant-torque) | 1 (13, 14) |
| Mitsubishi Electric constant-torque motor | SF-HRCA | 50 (53, 54) |
| | Others (SF-JRC, etc.) | 1 (13, 14) |
| Mitsubishi Electric high-performance energy- saving motor | SF-PR | 70 (73, 74) |
| Mitsubishi Electric IPM motor | MM-EFS (1500 r/min specification) / MM-THE4 | 210 (213, 214) |
| Mitsubishi Electric IPM motor | MM-EFS (3000 r/min specification) | 240 (243, 244) |
| Other manufacturer's standard motor | — | 0 (3, 4) |
| Other manufacturer's constant-torque motor | — | 1 (13, 14) |

Performing tuning

Point P

- Before performing tuning, check the monitor display of the operation panel or parameter unit if the inverter is in the state ready for tuning. The motor starts by turning ON the start command while tuning is unavailable.
- In the PU operation mode, press **FWD** / **REV** on the operation panel.
- For External operation, turn ON the start command (STF signal or STR signal). Tuning starts. (At this time, excitation noise occurs.)



- It takes about 10 seconds for tuning to complete. (The time depends on the inverter capacity and motor type.)
- Satisfy the required inverter start conditions to start offline auto tuning. For example, stop the input of the MRS signal.
- To force tuning to end, use the MRS or RES signal or RES signal or RES on the operation panel.
- (Turning OFF the start signal (STF signal or STR signal) also ends tuning.)
 During offline auto tuning, only the following I/O signals are valid (initial value). Input terminals <valid signals>: STP (STOP), OH, MRS, RT, RES, STF, STR, S1, and S2 Output terminals: RUN, OL, IPF, FM/CA, AM, A1B1C1, and So (SO)
- When the rotation speed and the output frequency are selected for terminals FM/CA and AM, the progress status of offline auto tuning is output in 15 steps from FM/CA and AM.
- Do not perform ON/OFF switching of the Second function selection (RT) signal during offline auto tuning. Auto tuning will not be performed properly.
- Since the RUN signal turns ON when tuning is started, pay close attention especially when a sequence which releases a mechanical brake by the RUN signal has been designed.
- When executing offline auto tuning, input the operation command after switching ON the main circuit power (R/L1, S/L2, T/L3) of the inverter.
- While **Pr.79 Operation mode selection** = "7", turn the PU operation external interlock (X12) signal ON to tune in the PU operation mode.
- During tuning, the monitor is displayed on the operation panel as follows.

| Status | Operation panel (FR-DU08) display | LCD operation panel (FR-LU08) display |
|--------------------|-----------------------------------|--|
| Setting | | AutoTune 12:34 TUNE 1 11 STOP PU PREV NEXT |
| Tuning in progress | | AutoTune 12:34 TUNE IIIIII 1 12 STF FWD PU PREV NEXT |
| Normal end | | AutoTune 12:34 TUNE Completed 13 STF STOP PU PREV NEXT |

- When offline auto tuning ends, press on the operation panel during PU operation. For External operation, turn OFF the start signal (STF signal or STR signal). This operation resets the offline auto tuning, and the PU's monitor display returns to the normal indication. (Without this operation, next operation cannot be started.)
- At tuning completion, the tuning results are set in the following parameters:

| Parameter | Name |
|-----------|----------------------------|
| 90 | Motor constant (R1) |
| 298 | Frequency search gain |
| 96 | Auto tuning setting/status |

NOTE

- The motor constants measured once during offline auto tuning are stored as parameters and their data are held until offline auto tuning is performed again. However, the tuning data is cleared when performing All parameter clear.
- · If offline auto tuning has ended in error, motor constants are not set.

Perform an inverter reset and perform tuning again.

| Error display | Error cause | Countermeasures |
|---------------|---|---|
| 8 | Forced end | Set "11" in Pr.96 and retry. |
| 9 | Inverter protective function operation | Make the setting again. |
| 91 | The current limit (stall prevention) function is activated. | Set the acceleration/deceleration time longer. Set Pr.156 Stall prevention operation selection = "1". |
| 92 | The converter output voltage fell to 75% of the rated voltage. | Check for the power supply voltage fluctuation. |
| 93 | Calculation error. The motor is not connected. | Check the motor wiring and make the setting again. |
| 94 | Rotation tuning frequency setting error. (The frequency command for the tuning was given to exceed the maximum frequency setting, or to be in the frequency jump range.) | Check the Pr.1 Maximum frequency and Pr.31 to Pr.36 Frequency jump settings. |

- When tuning is ended forcibly by pressing stop or turning OFF the start signal (STF or STR) during tuning, offline auto tuning does not end properly. (The motor constants have not been set.) Perform an inverter reset and perform tuning again.
- When the rated power supply of the motor is 200/220 V (400/440 V) 60 Hz, set the rated motor current multiplied by 1.1 in Pr.9 Electronic thermal O/L relay after tuning is complete.
- · For a motor with a PTC thermistor, thermal protector or other thermal detection, set "0" (motor overheat protection by inverter invalid) in Pr.9 to protect the motor from overheating.

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- · An instantaneous power failure occurring during tuning will result in a tuning error. After power is restored, the inverter starts normal operation. Therefore, when the STF (STR) signal is ON, the motor starts forward (reverse) rotation.
- · Any fault occurring during tuning is handled as in the normal operation. However, if the retry function is set, no retry is performed.
- The set frequency monitor displayed during the offline auto tuning is 0 Hz.

Tuning the second motor (Pr.463)

- · When one inverter switches the operation between two different motors, set the second motor in Pr.450 Second applied motor, set Pr.463 Second motor auto tuning setting/status = "11", and perform tuning of the second motor.
- Turning ON the RT signal enables the parameter settings for the second motor as shown in the following table.

| Function | RT signal-ON (second motor) | RT signal-OFF (first motor) |
|----------------------------|--------------------------------|--------------------------------|
| Motor constant (R1) | Pr.458 | Pr.90 |
| Frequency search gain | Pr.560 | Pr.298 |
| Auto tuning setting/status | Pr.463 | Pr.96 |

NOTE

- The RT signal is assigned to terminal RT in the initial status. Set "3" in one of Pr.178 to Pr.189 (Input terminal function selection) to assign the RT signal to another terminal.
- · Changing the terminal assignment using Pr.178 to Pr.189 (Input terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

- Note that the motor may start running suddenly.
- For the offline auto tuning in vertical lift applications, etc., caution is required to avoid falling due to insufficient torque.

Parameters referred to

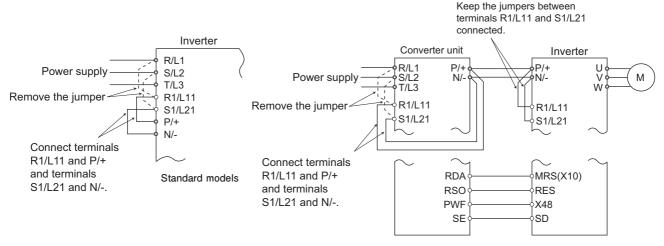
- Pr.9 Electronic thermal O/L relay 🖙 page 266 Pr.65, Pr.67 to Pr.69 Retry function 🖙 page 276
- Pr.71 Applied motor, Pr.450 Second applied motor 379
- Pr.79 Operation mode selection C r e 240
- Pr.156 Stall prevention operation selection F page 290 Pr.178 to Pr.189 (Input terminal function selection) T page 373

5.11.15 Power failure time deceleration-to-stop function

This is a function to decelerate the motor to a stop when an instantaneous power failure or undervoltage occurs.

| Pr. | Name | Initial value | | Setting | Description |
|-------------|--|---------------|-------|-------------------------|---|
| F1. | Name | FM | CA | range | Description |
| 261 | Power failure stop | | | 0 | Power failure time deceleration-to-stop function disabled |
| A730 | selection | 0 | | 1, 2, 11, 12, 21, 22 | Power failure time deceleration-to-stop function enabled. Select action at an undervoltage or when a power failure occurs. |
| 262 A731 | Subtracted frequency at deceleration start | 3 Hz | | 0 to 20 Hz | Normally, the motor runs at the initial value as it is. However, adjust to suit the size of the load specification (moment of inertia, torque). |
| 263 A732 | Subtraction starting frequency | 60 Hz | 50 Hz | 0 to 590 Hz | When output frequency ≥ Pr.263 : The motor decelerates if the output frequency decreases by the frequency set in Pr.262 . When output frequency < Pr.263 : The motor decelerates at frequencies of the output frequency. |
| | | | | 9999 | The motor decelerates from the output frequency - Pr.262. |
| 264 A733 | Power-failure deceleration time 1 | 5 s | | 0 to 3600 s | Set the slope applicable from the deceleration start to the Pr.266 set frequency. |
| 265 A734 | Power-failure deceleration time 2 | 9999 | | 0 to 3600 s | Set the slope applicable for the frequency range starting at Pr.266 and downward. |
| A734 | | | | 9999 | Same as Pr.264 . |
| 266 A735 | Power failure deceleration time switchover frequency | 60 Hz | 50 Hz | 0 to 590 Hz | Set the frequency at which the slope during deceleration switches from the Pr.264 setting to the Pr.265 setting. |
| 294 A785 | UV avoidance voltage gain | 100% | | 0% to 200% | Adjust the response at undervoltage avoidance operation. Setting a large value improves the response to changes in the bus voltage. |
| 668 A786 | Power failure stop frequency gain | 100% | | 0% to 200% | Adjust the response level for the operation where the deceleration time is automatically adjusted. |
| 606 | Power failure stop | | | 0 | Normally open input (NO contact input specification) |
| T722 | external signal input selection | 1 | | 1 | Normally closed input (NC contact input specification) |

Connection and parameter setting



Separated converter type

- For the standard model, remove the jumpers between terminals R/L1 and R1/L11 and terminals S/L2 and S1/L21, and connect terminals R1/L11 and P/+ and terminals S1/L21 and N/-.
- If an undervoltage, power failure or input phase loss occurs when **Pr.261 Power failure stop selection** ≠ "0", the motor decelerates to a stop.

• The power failure time deceleration-to-stop function operates as follows at an input phase loss.

| Pr.261 | Pr.872 | Operation when an input phase loss occurs |
|--------|--------|---|
| 0 | 0 | Operation continues |
| 0 | 1 | Input phase loss (E.ILF) |
| 1 2 | 0 | Operation continues |
| 1, 2 | 1 | Deceleration stop |
| 21, 22 | — | Deceleration stop |

- For the separated converter type, remove the jumpers between terminals R/L1 and R1/L11 and terminals S/L2 and S1/L21 of the converter unit, and connect terminals R1/L11 and P/+ and terminals S1/L21 and N/-. Do not remove the jumpers of terminal R1/L11 and terminal S1/L21 of the inverter. (In the initial status of the separated converter type, terminals P/+ and R1/L11 and terminals N/- and S1/L21 are connected.)
- For the separated converter type, connect the terminal to which the PWF signal of the converter unit is assigned and the terminal to which the X48 signal of the inverter is assigned. Also, set **Pr.261** of the converter unit in accordance with the inverter setting. (Refer to the Instruction Manual of the converter unit.)

♦ Outline of operation of deceleration stop at a power failure

- If an undervoltage or power failure occurs, the output frequency is turned OFF only for the frequency set to **Pr.262 Subtracted frequency at deceleration start**.
- The motor decelerates for the time set to **Pr.264 Power-failure deceleration time 1**. (The deceleration time setting is the time it takes for the motor to stop from **Pr.20 Acceleration/deceleration reference frequency**.)
- Change the deceleration time (slope) to stop using **Pr.265 Power-failure deceleration time 2** when the frequency is too low to obtain the regenerative energy or in other instances.

| Power supply | |] |
|--|---|---|
| Output frequency Power-failure deceleration time switchover frequency Pr.266 | Subtracted frequency at deceleration start Pr.262 | Pr.264 Power-failure deceleration time 1 Pr.265 Power-failure deceleration time 2 Time |

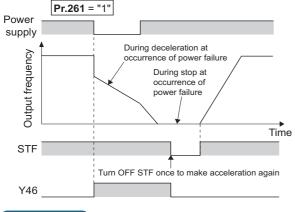
Action setting at undervoltage and power failure

· Set Pr.261 to select the action at an undervoltage and power failure.

| Pr.261 setting | Action at undervoltage and power failure | Power restoration during deceleration at occurrence of power failure | Deceleration stop time | Undervoltage avoidance function |
|-------------------|--|--|--------------------------------------|------------------------------------|
| 0 | Coasts to stop | Coasts to stop | coasts to stop - | |
| 1 | | Deceleration stop | According to Pr.262 to Pr.266 | Not available |
| 2 | | Re-acceleration | | Not available |
| 11 | Deceleration stan | Deceleration stop | setting | Available |
| 12 | Deceleration stop | Re-acceleration | | Available |
| 21 | | Deceleration stop | Automatic adjustment of | Not available |
| 22 | | Re-acceleration | deceleration time | Not available |

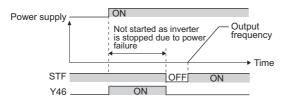
Power failure stop function (Pr.261 = "1, 11, or 21")

• Even if power is restored during deceleration triggered by a power failure, deceleration stop is continued after which the inverter stays stopped. To restart operation, turn the start signal OFF then ON again.



- NOTE

- If the automatic restart after instantaneous power failure is selected (Pr.57 Restart coasting time ≠ "9999") while the power failure time deceleration-to-stop function is set enabled (Pr.261 = "1, 11, or 21"), the power failure time deceleration stop function is disabled.
- When the power failure time deceleration-to-stop function is enabled (**Pr.261** = "1, 11 or 21"), the inverter does not start even if the power is turned ON or inverter reset is performed with the start signal (STF/STR) ON. Turn OFF the start signal once and then ON again to make a start.

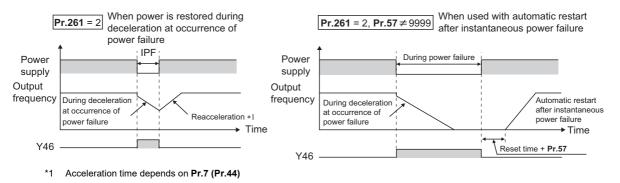


• During cyclic transmission or the like (in which start commands are periodically transmitted), operation is restarted if the power is restored during the deceleration even when the power failure time deceleration-to-stop function is enabled.

Continuous operation function at instantaneous power failure (Pr.261 = "2, 12, or 22")

- The motor re-accelerates to the set frequency when the power restores during the deceleration triggered by a power failure.
- Combining with the automatic restart after instantaneous power failure function enables a deceleration triggered by a
 power failure and re-acceleration at a power restoration.

If the power is restored after stoppage by a power failure, a restart operation is performed when automatic restart after instantaneous power failure (**Pr.57** \neq "9999") is selected.

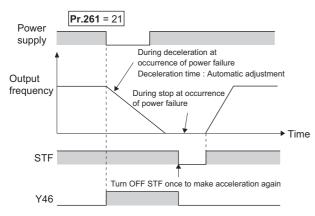


Undervoltage avoidance function (Pr.261 = "11 or 12", Pr.294)

- When "11 or 12" is set to **Pr.261**, the deceleration time is adjusted (shortened) to prevent an undervoltage from occurring during deceleration at occurrence of power failure.
- Adjust the downward frequency slope and the response level using **Pr.294 UV avoidance voltage gain**. Setting a large value improves the response to the bus voltage.

Automatic adjustment of deceleration time (Pr.261 = "21 or 22", Pr.294, Pr.668)

- When "21 or 22" is set to **Pr.261**, the deceleration time is automatically adjusted to keep (DC bus) voltage constant in the converter when the motor decelerates to a stop at a power failure. Setting of **Pr.262 to Pr.266** is not required.
- If a phenomenon such as motor vibration occurs during operation of the deceleration time automatic adjustment function, adjust the response level by setting the **Pr.668 Power failure stop frequency gain**. Increasing the setting improves the response to change in the bus voltage. However, the output frequency may become unstable.
- If setting Pr.294 UV avoidance voltage gain lower also does not suppress the vibration, set Pr.668 lower.



Deceleration stop by the Power failure stop external (X48) signal

- By turning OFF X48 signal, the power failure time deceleration-to-stop function is activated. This function is used, for example, when an external power failure detection circuit is installed.
- To use the power failure time deceleration-to-stop function for the separated converter type, use X48 signal. Connect the terminal to which the PWF signal of the converter unit is assigned and the terminal to which the X48 signal of the inverter is assigned.
- In the initial setting, the X48 signal is used with the normally closed (NC contact) input specification. Use **Pr.606 Power** failure stop external signal input selection to change the specification to the normally open (NO contact) input.
- To use the X48 signal, set "48" in any parameter from Pr.178 to Pr.189 (Input terminal function selection) to assign the function to an input terminal.

During deceleration at occurrence of power failure (Y46) signal

- After deceleration by a power failure, the inverter is not restarted even though the start command is input. Check the During deceleration at occurrence of power failure (Y46) signal at a power failure. (For example, when input phase loss protection (E.ILF) occurs.)
- The Y46 signal is turned ON during deceleration at occurrence of power failure and in a stop status after deceleration at occurrence of power failure.
- For the Y46 signal, set "46 (positive logic)" or "146 (negative logic)" in any parameter from **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function.

Power failed (Y67) signal

- Y67 signal turns ON when the output is shut off due to detection of power failure (power supply fault) or undervoltage, or the power failure time deceleration-to-stop function is activated.
- To use the Y67 signal, assign the function by setting "67 (positive logic)" or "167 (negative logic)" in any parameter from **Pr.190 to Pr.196 (output terminal function selection)**.



- When **Pr.30 Regenerative function selection** = "2" and the FR-HC2, FR-XC (in common bus regeneration mode), or FR-CV is used, the deceleration stop function is invalid at power failure.
- If the "output frequency Pr.262" at undervoltage or at power failure is a negative value, it is regarded as 0 Hz. (DC injection brake operation is performed without deceleration.)
- The power failure time deceleration stop function is disabled during a stop or when the breaker is tripped.
- The Y46 signal turns ON if an undervoltage occurs even if a deceleration at a power failure has not occurred. For this reason, the Y46 signal is sometimes output instantaneously when the power supply is turned OFF, but this is not a fault.
- When the power failure time deceleration-to-stop function is selected, undervoltage protection (E.UVT), instantaneous power failure protection (E.IPF) and input phase loss protection (E.ILF) are invalid.
- · When the load is high during PM motor control, an undervoltage sometimes causes the inverter to coast to a stop.
- Changing the terminal assignment using Pr.178 to Pr.189 (Input terminal function selection) and Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

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• Even if the power failure time deceleration-to-stop function is set, some loads might cause the inverter to trip and the motor to coast.

The motor coasts if sufficient regenerative power is not obtained from the motor.

Parameters referred to

- Pr.12 DC injection brake operation voltage is page 560
- Pr.20 Acceleration/deceleration reference frequency, Pr.21 Acceleration/deceleration time increments 🖙 page 228
- Pr.30 Regenerative function selection Page 566
- Pr.57 Restart coasting time page 466, page 472
- Pr.190 to Pr.196 (Output terminal function selection) 🖙 page 330 Pr.872 Input phase loss protection selection 🖙 page 276

5.11.16 PLC function

The inverter can be run in accordance with a sequence program.

In accordance with the machine specifications, a user can set various operation patterns: inverter movements at signal inputs, signal outputs at particular inverter status, and monitor outputs, etc.

| Pr. | Name | Initial value | Setting range | Description | | |
|------------------------------------|--|------------------------|------------------|---|---|-------------------|
| | | | 0 | PLC function disabled | | |
| 414 A800 | PLC function operation selection | operation ₀ | | PLC function enabled | The SQ signal is enabled by input from a command source (external input terminal/ communication). | |
| | | | 2, 12 | | The SQ signal is enabled by in external input terminal. | nput from an |
| 415 | Inverter operation lock | 0 | 0 | The inverter start command the sequence program. | d is enabled regardless of the op | erating status of |
| A801 | mode setting | 0 | 1 | running. | d is enabled only while the seque | ence program is |
| 416 A802 | Pre-scale function selection | 0 | 0 to 5 | Unit scale factor 0: No function 1: ×1 2: ×0.1 3: ×0.01 4: ×0.001 5: ×0.0001 | When the pulse train is input from terminal JOG, the number of sampling pulses can be converted. The result of conversion is stored to SD1236 Number of sampled pulses = Input pulse valu per count cycle × Pre-scale setting value (Pr.417) × Unit scale factor (Pr.416) | |
| 417 A803 | Pre-scale setting value | 1 | 0 to 32767 | Pre-scale setting value | | |
| | | | | 0: Clears the flash memory fault display (no operation after writing while the flash memory is in normal operation). | | Write |
| | | | | 9696: Clears the flash memory (no operation after writing while the flash memory is at a fault). | | |
| 498 | PLC function flash | 0 | 0, 9696 | Other than 0 and 9696: Outside the setting range | | |
| A804 | memory clear | Ŭ | (0 to 9999) | 0: Normal display | | |
| | | | | 1: The flash memory is not cleared because the PLC function is enabled. Read | | Read |
| | | | | 9696: During flash memory clearing operation or flash memory fault | | |
| 675 | User parameter auto | | 1 | Auto storage function enabled | | • |
| A805 | storage function selection | 9999 | 9999 | Auto storage function disabled | | |
| 1150 to 1199 A810 to A859 | User parameters 1 to User parameters 50 | 0 | 0 to 65535 | Desired values can be set. Because devices D206 to D255 used by the PLC function can be mutually accessed, the values set to Pr.1150 to Pr.1199 can be used by the sequence program. The result of performing calculation by a sequence program can also be monitored by Pr.1150 to Pr.1199 . | | |

Outline of PLC function

- To enable the PLC function, set a value other than "0" in Pr.414 PLC function operation selection. When "2 or 12" is set in Pr.414, the Sequence start (SQ) signal from the external input terminal is valid regardless of the setting of the Pr.338 Communication operation command source. (The Pr.414 setting change becomes valid after inverter reset.)
- Switch the execution key (RUN/STOP) of the sequence program by turning the SQ signal ON/OFF. The sequence program
 can be executed by turning the SQ signal ON. To input the SQ signal, set "50" in any parameter from Pr.178 to Pr.189
 (Input terminal function selection) to assign the function to a terminal.
- When "1" is set in Pr.415 Inverter operation lock mode setting, the inverter can be operated only when the sequence program is running. By changing the PLC program status from RUN to STOP during inverter operation, the motor decelerates to stop. To stop the inverter operation at the STOP status of the PLC program while performing auto operation using SD1148 (or SM1200 to 1211) of the PLC program, set Pr.415 = "1".
- For reading or writing sequence programs, use FR Configurator2 on the personal computer connected to the inverter via RS-485 communication or USB. (When **Pr.414** ≠ "0", sequence programs can be read from or written to FR Configurator2.)

· The following shows the required conditions to enable the SQ signal.

| | | SQ signal | | | |
|----------------|----------------|---|---|--|--|
| Pr.414 setting | Pr.338 setting | Input via an external (physical) terminal | Input via a communication virtual terminal | | |
| 1, 11 | 0 | ON | ON | | |
| 1, 11 | 1 | ON | — | | |
| 2, 12 | — | ON | — | | |

-: Not required to enable the SQ signal

User parameter (data register (D)) auto storage function selection

- Setting **Pr.675** = "1" enables the auto storage function for user parameters.
- The user parameter auto storage function is used to store the setting of Pr.1195 PLC function user parameters 46 (D251) to Pr.1199 PLC function user parameters 50 (D255) automatically in EEPROM at power OFF or inverter reset.
- The auto storage function is disabled while the inverter performs any of the following.
 Measurement of the main circuit capacitor's life, offline auto tuning, emergency drive function, measurement of load characteristics, or PID gain tuning

- NOTE

• The auto storage function may fail if the EEPROM is accessed by other functions at the same time at power OFF. To ensure the auto storage, provide a power source for the control circuit separately from that of the main circuit.

User parameter reading from EEPROM

 User parameters (Pr.1150 to Pr.1199) are read from RAM or EEPROM according to the settings in Pr.342 Communication EEPROM write selection and Pr.414 PLC function operation selection. When Pr.414 = "11 or 12", RAM data is read regardless of the Pr.342 setting.

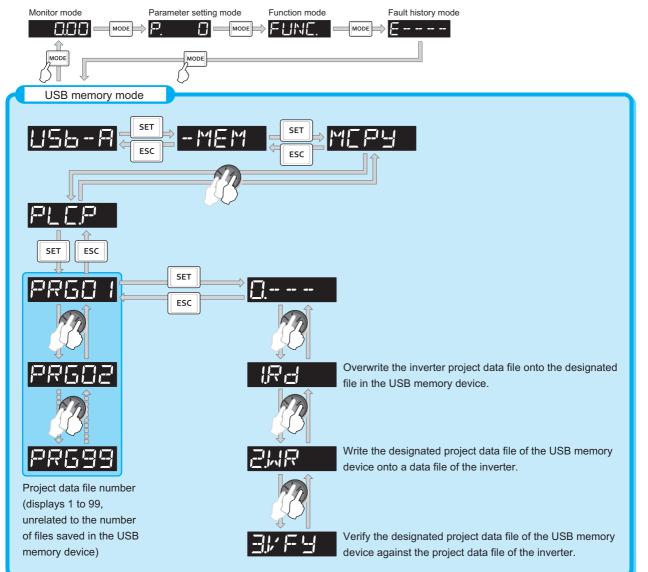
| Device | Pr.342 | Pr.414 | Read from | Written to | |
|-----------------------------------|--------|---------|---|------------|--|
| | 0 | 0, 1, 2 | EEPROM | EEPROM | |
| Inverter (via communication), | 0 | 11, 12 | RAM | | |
| FR Configurator2 | 1 | 0, 1, 2 | RAM | RAM | |
| | 1 | 11, 12 | RAM | | |
| | 0 | 0, 1, 2 | (Differs according to the option type.) | EEPROM | |
| Communication option | U | 11, 12 | RAM | | |
| Communication option | 1 | 0, 1, 2 | RAM | RAM | |
| | | 11, 12 | RAM | | |
| | 0 | 0, 1, 2 | EEPROM | EEPROM | |
| Parameter unit Operation panel | 0 | 11, 12 | RAM | | |
| | 1 | 0, 1, 2 | EEPROM | RAM | |
| | 1 | 11, 12 | RAM | | |



 For details on the PLC function, refer to the PLC Function Programming Manual and the Instruction Manual of FR Configurator2.

Copying the PLC function project data to USB memory

- This function copies the PLC function project data to a USB memory device. The PLC function project data copied in the USB memory device can be copied to other inverters. This function is useful in backing up the parameter setting and for allowing multiple inverters to operate by the same sequence programs.
- Refer to page 78 for an outline of the USB communication function.



• The following data can be copied by copying the project data via USB memory device.

| Extension | Extension File type | | Copy from USB memory device to inverter |
|-----------|---------------------------------------|-----------|--|
| .QPA | Parameter file | Supported | Supported |
| .QPG | Program file | Supported | Supported |
| .C32 | C32 Function block source information | | Supported |
| .QCD | Global text comment information | Supported | Supported |
| .DAT | Project management information | Supported | Not available |
| .TXT | Copy information | Supported | Not available |

- NOTE

• If the project data of the PLC function is locked with a password using FR Configurator2, copying to the USB memory device and verification are disabled. Also if set to write-disabled, writing to the inverter is disabled. (For details on the PLC function, refer to the PLC Function Programming Manual and the Instruction Manual of FR Configurator2.)

✓ Parameters referred to Pr.338 Communication operation command source ☞ page 251

5.11.17 Trace function

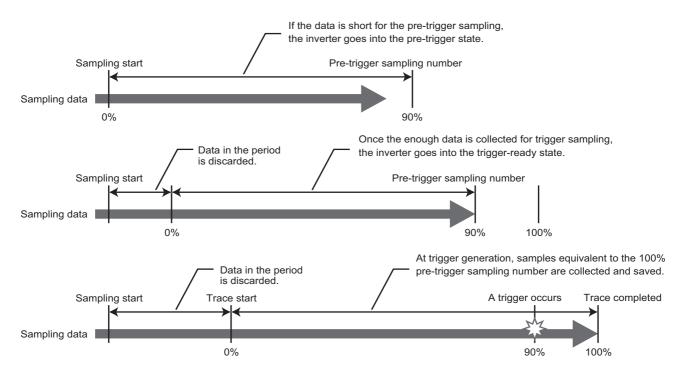
- The operating status of the inverter can be traced and saved on a USB memory device.
- Saved data can be monitored by FR Configurator2, and the status of the inverter can be analyzed.

| Pr. | Name | Initial value | Setting range | Description |
|--------------|-----------------------------------|---------------|---|--|
| | | | 0 | Without trace operation (The read value is always "0".) |
| 1020 | | | 1 | Sampling start |
| A900 | Trace operation selection | 0 | 2 | Forced trigger |
| | | | 3 | Sampling stop |
| | | | 4 | Transfer of data to USB memory device |
| 1021 | | | 0 | Memory mode |
| A901 | Trace mode selection | 0 | 1 | Memory mode (automatic transfer) |
| | | | 2 | Recorder mode |
| 1022 A902 | Sampling cycle | 2 | 0 to 9 | Set the sampling cycle. 0: approx. 0.125 ms, 1: approx. 0.25 ms, 2: 1 ms, 3: 2 ms, 4: 5 ms, 5: 10 ms, 6: 50 ms, 7: 100 ms, 8: 500 ms, 9: 1 s (For the setting values "0" and "1", the cycle varies according to the control mode.) |
| 1023 A903 | Number of analog channels | 4 | 1 to 8 | Select the number of analog channels for sampling. |
| 1024 | | | 0 | Manual sampling start |
| A904 | Sampling auto start | 0 | 1 | Sampling starts automatically when the power supply is turned ON or at a reset |
| | | | 0 | Fault trigger |
| 1025 | Trigger mode selection | | 1 | Analog trigger |
| A905 | | 0 | 2 | Digital trigger |
| | | | 3 | Analog or digital trigger (OR logic) |
| | | | 4 | Both analog and digital triggers (AND logic) |
| 1026 A906 | Number of sampling before trigger | 90% | 0% to 100% | Set the percentage of the pre-trigger sampling time with respect to the overall sampling time. |
| 1027 A910 | Analog source selection (1ch) | 201 | | |
| 1028 A911 | Analog source selection (2ch) | 202 | 1 to 3, 5 to | |
| 1029 A912 | Analog source selection (3ch) | 203 | 14, 17, 18, 20, 23, 24, | |
| 1030 A913 | Analog source selection (4ch) | 204 | 34, 40 to 42, 52 to 54, 61, 62, 64, 67 to | Select the analog data (monitor item) for sampling on each channel. |
| 1031 A914 | Analog source selection (5ch) | 205 | 69, 81 to 96, 98, 201 to | Select the analog data (monitor item) for sampling on each channel. |
| 1032 A915 | Analog source selection (6ch) | 206 | 213, 230 to 232, 237, | |
| 1033 A916 | Analog source selection (7ch) | 207 | 238 | |
| 1034 A917 | Analog source selection (8ch) | 208 | | |
| 1035 A918 | Analog trigger channel | 1 | 1 to 8 | Select the analog channel to be the trigger. |
| 1036 | Analog trigger operation | | 0 | Sampling starts when the value of the analog monitor exceeds the value set at the trigger level (Pr.1037) |
| A919 | selection | 0 | 1 | Sampling starts when the value of the analog monitor falls below the value set at the trigger level (Pr.1037) |
| 1037 A920 | Analog trigger level | 1000 | 600 to 1400 | Set the level at which the analog trigger turns ON. The trigger level is the value obtained by subtracting 1000 from the set value. |

| Pr. | Name | Initial value | Setting range | Description |
|--------------|--------------------------------|---------------|--|---|
| 1038 A930 | Digital source selection (1ch) | 1 | | |
| 1039 A931 | Digital source selection (2ch) | 2 | | |
| 1040 A932 | Digital source selection (3ch) | 3 | | |
| 1041 A933 | Digital source selection (4ch) | 4 | - 1 to 255 Select the digital data (I/O signal) for sampling on each o | Select the digital data (I/O signal) for sampling on each channel |
| 1042 A934 | Digital source selection (5ch) | 5 | | |
| 1043 A935 | Digital source selection (6ch) | 6 | | |
| 1044 A936 | Digital source selection (7ch) | 7 | | |
| 1045 A937 | Digital source selection (8ch) | 8 | | |
| 1046 A938 | Digital trigger channel | 1 | 1 to 8 | Select the digital channel to be the trigger. |
| 1047 | Digital trigger operation | 0 | 0 | Trace starts when the signal turns ON |
| A939 | selection | 0 | 1 | Trace starts when the signal turns OFF |

Operation outline

- This function samples the status (analog monitor and digital monitor) of the inverter, traces the sampling data when a trigger (trace start condition) is generated, and saves the resulting trace data.
- When the trace function is set enabled, samplings are collected and the inverter goes into the pre-trigger status.
- In the pre-trigger status, samples are collected, and the trigger standby status is entered when sufficient samples for the number of pre-trigger samples have been collected.
- When the trigger is generated in the trigger standby status, the trace is started and the trace data is saved.



Tracing procedure

1. Preparing a USB memory device

Select a USB memory device with ample capacity to store the necessary amount of trace data. When the trace function is used in the recorder mode, use a USB memory device with at least 1 GB of free space.

2. Prior setting for tracing

Set Pr.1021 to select a trace mode.

Set **Pr.1022 Sampling cycle** and **Pr.1023 Number of analog channels** according to the necessary sampling time. Use **Pr.1027 to Pr.1034** to set analog sources, and **Pr.1038 to Pr.1045** to set digital sources. Set a trigger type in **Pr.1025**.

3. Tracing

Set **Pr.1020 or Pr.1024** to start sampling or store trace data in the USB memory device. The trace status can be monitored. (Refer to page 493.)

4. Waveform check

By using FR Configurator2, trace data stored in a USB memory device can be displayed on a computer screen. For details, refer to the FR Configurator2 Instruction Manual.

Selection of trace mode (Pr.1021)

- · Select how to save the trace data which results from sampling the inverter status.
- · There are two trace data save methods, memory mode and recorder mode.

| Pr.1021 setting | Mode | Description | Storing trace data |
|--------------------|--|---|---|
| 0 | Memory mode | Trace data is stored sequentially to the internal RAM in the inverter. | To store trace data on a USB memory device, set Pr.1020 Trace operation selection = "4" after the sampling and tracing is completed. ^{*1} |
| 1 | Memory mode (automatic transfer) | Trace data is stored sequentially to the internal RAM in the inverter, and automatically transferred to the USB memory device. | Trace data is automatically stored on the USB memory device after tracing is completed. |
| 2 | Recorder mode | Trace data is stored directly on the USB memory device. Sampling data is fixed at 8 analog channels and 8 digital channels. The sampling cycle in this mode is longer than in the memory mode. (1 ms or longer) | To stop sampling and complete storing trace data after the sampling is started, set "2" (forced trigger) or "3" (sampling stop) in Pr.1020 Trace operation selection. ^{*1} |

*1 For details on **Pr.1020**, refer to page 492.

NOTE

• When the trace function is used in the recorder mode, use USB memory device having at least 1 GB of free space.

- Data transferred to USB is saved in the "TRC" folder under the "FR_INV" folder.
- Up to 99 sets of trace data can be stored in the USB memory device in the memory mode. When a data set is transferred to the USB memory that contains 99 sets of data, its "MEM001.tr1" file will be overwritten. REC001.tr1 is the only data file stored in the recorder mode.
- The data sampled in the recorder mode will be corrupted by resetting or turning OFF the inverter during sampling.
- By using FR Configurator2, the trace data of the internal RAM can be directly transmitted to the personal computer via the USB cable. For details, refer to the Instruction Manual of FR Configurator2.

Selection of sampling time (Pr.1022, Pr.1023)

- The sampling time is determined by the sampling cycle and the number of data acquisition points. The number of data acquisition points differs between the memory mode and the recorder mode.
- The sampling time in the memory mode varies depending on the settings in **Pr.1022 Sampling cycle** and **Pr.1023 Number** of analog channels.

| Pr.1023 | Memory mode | Number of data | |
|------------------------------|-------------------------|-------------------------|--------------------|
| Number of analog channels | Minimum (Pr.1022 = "0") | Maximum (Pr.1022 = "9") | acquisition points |
| 1 | 213 ms | 1704 s | 1704 |
| 2 | 160 ms | 1280 s | 1280 |
| 3 | 128 ms | 1024 s | 1024 |
| 4 | 106.5 ms | 852 s | 852 |
| 5 | 91 ms | 728 s | 728 |
| 6 | 80 ms | 640 s | 640 |
| 7 | 71 ms | 568 s | 568 |
| 8 | 64 ms | 512 s | 512 |

• The sampling time in the recorder mode varies depending on the setting in **Pr.1023 Number of analog channels**.

| Number of analog | Recorder mode | Number of data | |
|---|---------------------------------------|--------------------|----------|
| channels | Minimum (Pr.1022 = "2") ^{*1} | acquisition points | |
| Fixed to 8ch (analog source selection) | Approx. 14 hours | Approx. 621 days | 53687091 |

*1 Sampling is performed at a sampling cycle of 1 ms even if "0 or 1" is set to **Pr.1022 Sampling cycle**.

Analog source (monitor item) selection

• Select the analog sources (monitor items) to be set to Pr.1027 to Pr.1034 from the following table.

| Setting value | Monitor item ^{*1} | Minus (-) display ^{*2} | Trigger level criterion ^{*3} | Setting value | Monitor item ^{*1} | Minus (-) display ^{*2} | Trigger level criterion ^{*3} |
|------------------|--|------------------------------------|---|------------------|---|------------------------------------|---|
| 1 | Output frequency/speed | | *4 | 83 | BACnet valid APDU counter | | 65535 |
| 2 | Output current | | *4 | 84 | BACnet communication error counter | | 65535 |
| 3 | Output voltage | | *4 | 85 | BACnet Terminal FM/CA output level | | 100% |
| 5 | Frequency setting value/motor speed setting | | *4 | 86 | BACnet terminal AM output level | | 100% |
| 6 | Running speed | | *4 | 87 | Remote output value 1 | 0 | *4 |
| 7 | Motor torque | | *4 | 88 | Remote output value 2 | 0 | *4 |
| 8 | Converter output voltage | | *4 | 89 | Remote output value 3 | 0 | *4 |
| 9 ^{*5} | For manufacturer setting | | — | 90 | Remote output value 4 | 0 | *4 |
| 10 | Electronic thermal O/L relay load factor | | *4 | 91 | PID manipulated amount | 0 | *4 |
| 11 | Output current peak value | | *4 | 92 | Second PID set point/deviation input selection | | *4 |
| 12 | Converter output voltage peak value | | *4 | 93 | Second PID measured value | | *4 |
| 13 | Input power | | *4 | 94 | Second PID deviation | 0 | *4 |
| 14 | Output power | | *4 | 95 | Second PID measured value 2 | | *4 |
| 17 | Load meter | | *4 | 96 | Second PID manipulated amount | 0 | *4 |
| 18 | Motor excitation current | | *4 | 98 | Control circuit temperature | 0 | *4 |
| 20 | Cumulative energization time | | 65535 | 201 | *Output frequency | | Pr.84 |
| 23 | Actual operation time | | 65535 | 202 | *U-phase output current | 0 | *8 |
| 24 | Motor load factor | | *4 | 203 | *V-phase output current | 0 | *8 |
| 34 | Motor output | | *4 | 204 | *W-phase output current | 0 | *8 |
| 40 | PLC function user monitor 1 | 0 | *4 | 205 | Converter output voltage | | 400 V/800 V |
| 41 | PLC function user monitor 2 | 0 | *4 | 206 | *Output current (all three phases) | | *8 |
| 42 | PLC function user monitor 3 | 0 | *4 | 207 | *Excitation current (A) | | *8 |
| 52 | PID set point | | *4 | 208 | *Torque current (A) | | *8 |
| 53 | PID measured value | | *4 | 209 | Terminal 2 | | 100% |
| 54 | PID deviation | 0 | *4 | 210 | Terminal 4 | | 100% |
| 61 | Motor thermal load factor | | *4 | 211 | Terminal 1 | 0 | 100% |
| 62 | Inverter thermal load factor | | *4 | 212 | *Excitation current (%) | 0 | 100% |
| 64 | PTC thermistor resistance | | Pr.561 | 213 | *Torque current (%) | 0 | 100% |
| 67 | PID measured value 2 | | *4 | 230 | *Output frequency (signed) | 0 | Pr.84 |
| 68 ^{*6} | Emergency drive status | | 65535 | 231 | *Motor speed (with sign) | 0 | *7 |
| 69 | PID input pressure value | | *4 | 232 | *Speed command (with sign) | 0 | *7 |
| 81 | BACnet reception status | | 65535 | 237 | *Excitation current command | 0 | 100% |
| 82 | BACnet token pass counter | | 65535 | 238 | *Torque current command | 0 | 100% |

1 "" shows a monitor item with a high-speed sampling cycle.

*2 The monitor items with a circle (o) represents that its monitor value can be indicated with minus sign.

*3 Indicates a criterion at 100% when the analog trigger is set.

*4 Refer to the full-scale value of terminal FM/CA, or AM (page 314).

*5 The setting is available for the standard model.

 *6 The setting is available for the standard model and the IP55 compatible model.

*7 Rated motor frequency × 120 / number of motor poles

*8 The reference current for the trigger level is as follows.

| Model FR-F820-I1 | 00046 | 00077 | | | | | | 00630 | 00770 | 00930 | 01250 | 01540 | 01870 | 02330 | 03160 | 03800 | 04750 | |
|------------------|---------------------------------------|-------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| | | 0.75K | 1.5K | 2.2K | 3.7K | 5.5K | 7.5K | 11K | 15K | 18.5K | 22K | 30K | 37K | 45K | 55K | 75K | 90K | 110K |
| | Trigger level eference current (A) | 3 | 5 | 8 | 11 | 17.5 | 24 | 33 | 46 | 61 | 76 | 90 | 115 | 145 | 175 | 215 | 288 | 346 |

| Model FR-F840-[] | 00023 | 00038 | 00105 | 00083 | 00126 | 00170 | 00250 | 00310 | 00380 | 00470 | 00620 | 00770 | 00930 | 01160 | 01800 | 02160 | 02600 | 03250 | 03610 | 04320 | 04810 | 05470 | 06100 | 06830 |
|---------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 0.75K | 1.5K | 2.2K | 3.7K | 5.5K | 7.5K | 11K | 15K | 18.5K | 22K | 30K | 37K | 45K | 55K | 75K | 90K | 110K | 132K | 160K | 185K | 220K | 250K | 280K | 315K |
| Trigger level reference current (A |) 1.5 | 2.5 | 4 | 6 | 9 | 12 | 17 | 23 | 31 | 38 | 44 | 57 | 71 | 86 | 110 | 144 | 180 | 216 | 260 | 325 | 361 | 432 | 481 | 547 |

| | | 08660 | | | |
|--|------|-------|------|------|------|
| Model 1 K-1 042-0 | 355K | 400K | 450K | 500K | 560K |
| Trigger level reference current (A) | 610 | 683 | 770 | 866 | 962 |

◆ Digital source (monitor item) selection

• Select the digital sources (input/output signals) to be set to **Pr.1038 to Pr.1045** from the following table. When a value other than the ones in the following table is set, "0" (OFF) is applied for indication.

| Setting value | Signal name | Remarks | | | | | |
|------------------|-------------|--|--|--|--|--|--|
| 0 | — | | | | | | |
| 1 | STF | | | | | | |
| 2 | STR | | | | | | |
| 3 | AU | | | | | | |
| 4 | RT | | | | | | |
| 5 | RL | Foundatella en the signals referrés | | | | | |
| 6 | RM | For details on the signals, refer to page 373. | | | | | |
| 7 | RH | | | | | | |
| 8 | JOG | | | | | | |
| 9 | MRS | | | | | | |
| 10 | STP (STOP) | | | | | | |
| 11 | RES |] | | | | | |
| 12 | CS | | | | | | |
| 21 | X0 | | | | | | |
| 22 | X1 | | | | | | |
| 23 | X2 | | | | | | |
| 24 | X3 | | | | | | |
| 25 | X4 | | | | | | |
| 26 | X5 | | | | | | |
| 27 | X6 | | | | | | |
| 28 | X7 | For details on the signals, refer to | | | | | |
| 29 | X8 | the Instruction Manual of the FR- | | | | | |
| 30 | X9 | A8AX (option). | | | | | |
| 31 | X10 | | | | | | |
| 32 | X11 | | | | | | |
| 33 | X12 | | | | | | |
| 34 | X13 | | | | | | |
| 35 | X14 | | | | | | |
| 36 | X15 | | | | | | |
| 37 | DY | | | | | | |

| Setting value | Signal name | Remarks | | | | |
|------------------|-------------|--|--|--|--|--|
| 101 | RUN | | | | | |
| 102 | SU | | | | | |
| 103 | IPF | En dataile an tha airmala mitanta | | | | |
| 104 | OL | For details on the signals, refer to page 330. | | | | |
| 105 | FU | page 550. | | | | |
| 106 | ABC1 | | | | | |
| 107 | ABC2 | | | | | |
| 121 | DO0 | | | | | |
| 122 | DO1 | | | | | |
| 123 | DO2 | For details on the signals, refer to | | | | |
| 124 | DO3 | the Instruction Manual of the FR- | | | | |
| 125 | DO4 | A8AY (option). | | | | |
| 126 | DO5 | | | | | |
| 127 | DO6 | | | | | |
| 128 | RA1 | For details on the signals, refer to | | | | |
| 129 | RA2 | the Instruction Manual of the FR- | | | | |
| 130 | RA3 | A8AR (option). | | | | |

Trigger setting (Pr.1025, Pr.1035 to Pr.1037, Pr.1046, Pr.1047)

• Set the trigger generating conditions and the trigger target channels.

| Pr.1025 setting | Trigger generating conditions | Selection of trigger target channel |
|--------------------|---|--|
| 0 | Trace starts when inverter enters an fault status (protective function activated) | — |
| 1 | Trace starts when analog monitor satisfies trigger conditions | Pr.1035 |
| 2 | Trace starts when digital monitor satisfies trigger conditions | Pr.1046 |
| 3 | Tracing starts when either of analog or digital monitor satisfies trigger conditions (OR) | Pr.1035, Pr.1046 |
| 4 | Tracing starts when both of analog or digital monitor satisfies trigger conditions (AND) | Pr.1035, Pr.1046 |

• Set the trigger generation conditions for the analog monitor.

| Pr.1036 setting | Trigger generation conditions | Trigger level setting | |
|--------------------|--|--|--|
| 0 | at the trigger level | Set the trigger level from 600 to | |
| 1 | Sampling starts when the analog data targeted for the trigger falls below the value specified at the trigger level | 1400 (-400% to 400% ^{*1}) in Pr.1037 . | |

*1 In **Pr.1037**, set the number obtained by adding 1,000 to the trigger level.

• Set the trigger generation conditions for the digital monitor.

| Pr.1047 setting | Trigger generation conditions |
|--------------------|---|
| 0 | Trace starts when the digital data targeted for the trigger turns ON |
| 1 | Trace starts when the digital data targeted for the trigger turns OFF |

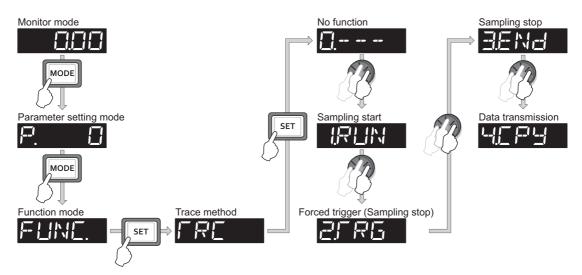
Start of sampling and copying of data (Pr.1020, Pr.1024)

- Set the trace operation. The trace operation is set by one of two ways, by setting **Pr.1020 Trace operation selection** and by setting in the trace mode on the operation panel.
- When "1" is set in **Pr.1020**, sampling starts.
- When "2" is set in **Pr.1020**, a trigger is regarded as generated (for instance: forced trigger), sampling stops and the trace starts.
- When "3" is set in Pr.1020, sampling stops.
- When "4" is set in **Pr.1020**, the trace data in internal RAM is transferred to USB memory device. (Trace data cannot be transferred during sampling.)
- To start sampling automatically when the power supply at power-ON or at a recovery after an inverter reset, set "1" in **Pr.1024 Sampling auto start**.

| Pr.1020 setting | Trace mode | Operation |
|-----------------|------------|--------------------------------|
| 0 | <u>[]</u> | Sampling standby |
| 1 | | Sampling start |
| 2 | 2F.RG | Forced trigger (sampling stop) |
| 3 | BENd | Sampling stop |
| 4 | чсру | Data transmission |

• The read value of Pr.1020 is always "0".

• Trace operation can also be set in the trace mode on the operation panel.



Selection of trace operation by input terminal (TRG signal, TRC signal)

- Trace operation can be selected by signal inputs.
- A forced trigger can be applied when the Trace trigger input (TRG) signal is ON.
- Sampling is started and stopped by the Trace sampling start/end (TRC) signal turning ON and OFF, respectively.
- To input the TRG signal, set "46" in any parameter from **Pr.178 to Pr.189 (Input terminal function selection)**, and to input the TRC signal, set "47" to assign the function to a terminal.

- NOTE

• Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Monitoring the trace status

• The trace status can be monitored on the operation panel by setting "38" in **Pr.52 Operation panel main monitor** selection, **Pr.774 to Pr.776 (Operation panel monitor selection)**, or **Pr.992 Operation panel setting dial push** monitor selection.

The content depends on the digits on the operation panel.



1000s place → Indicates internal RAM state. 100s place — Indicates USB memory access state.

1s place Indicates trace operation. 10s place Indicates trigger state.

| Monitor value | Trace status | | | | | | | | |
|-------------------------------|-------------------------------|------------------------------|----------------------|-----------------|--|--|--|--|--|
| | Fourth digit | Third digit | Second digit | First digit | | | | | |
| 0 or no display ^{*1} | No trace data in internal RAM | USB memory not accessed | Trigger not detected | Trace stopped | | | | | |
| 1 | Trace data in internal RAM | USB memory being accessed | Trigger detected | Trace operation | | | | | |
| 2 | — | USB memory transfer error | — | — | | | | | |
| 3 | — | USB buffer overrun | — | — | | | | | |

The value(s) "0" to the left of the leftmost non-zero value is(are) not shown in the monitor display. For example, if no trace data is in internal RAM, the USB memory is not accessed, no trigger is detected, and the trace operation is performed, "1" appears. (not "0001")

· When copying the traced data to a USB memory device, the operating status of the USB host can be checked with the inverter LED.

Refer to page 78 for an outline of the USB communication function.

| LED display status | Operating status | | | | | |
|--------------------|--|--|--|--|--|--|
| OFF | No USB connection. | | | | | |
| ON | The communication is established between the inverter and the USB device. | | | | | |
| Blinking rapidly | Traced data is being transmitted. (In the memory mode, transmission command is being issued. In the recorder mode, sampling is being performed.) | | | | | |
| Blinking slowly | Error in the USB connection. | | | | | |

• During trace operation, the Trace status (Y40) signal can be output.

To use the Y40 signal, set "40 (positive logic) or 140 (negative logic)" in one of Pr.190 to Pr.196 (Output terminal function selection) to assign function to an output terminal.

- NOTE

· Changing the terminal assignment using Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.52 Operation panel main monitor selection Page 305 Pr.178 to Pr.189 (Input terminal function selection) page 373 Pr.190 to Pr.196 (Output terminal function selection) page 330

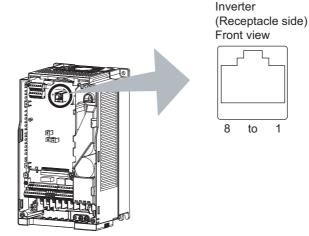
5.12 (N) Communication operation parameters

| Purpose | Parameter to set | | | |
|---|--|---|--|-----|
| To start operation via communication | Initial setting of operation via communication | P.N000, P.N001, P.N013, P.N014 | | |
| To communicate via PU connector | Initial setting of computer link communication (PU connector) | P.N020 to P.N028 | Pr.117 to Pr.124 | 505 |
| | Initial setting of computer link communication (RS-485 terminals) | P.N030 to P.N038 | Pr.331 to Pr.337, Pr.341 | 505 |
| To communicate via RS-485 terminals | MODBUS RTU communication specification | P.N002, P.N030, P.N031, P.N034, P.N080, | Pr.539, Pr.331, Pr.332, Pr.334, Pr.343, | 520 |
| | BACnet MS/TP protocol | P.N030, P.N031, P.N050 to P.N054 | Pr.331, Pr.332, Pr.390, Pr.726 to Pr.729 | 533 |
| To Communicate using USB (FR Configurator2) | USB communication | P.N040, P.N041 | Pr.547, Pr.548 | 547 |
| To connect a GOT | GOT automatic recognition | P.N020, P.N030 | Pr.117, Pr.331 | 548 |
| To back up the data of parameter settings and PLC function to the GOT | Backup/restore | P.N110, P.N111 | Pr.434, Pr.435 | 549 |

5.12.1 Wiring and configuration of PU connector

Using the PU connector as a computer network port enables communication operation from a personal computer, etc. When the PU connector is connected with a personal, FA, or other computer by a communication cable, a user program can run and monitor the inverter or read and write to parameters.

PU connector pin-outs



1

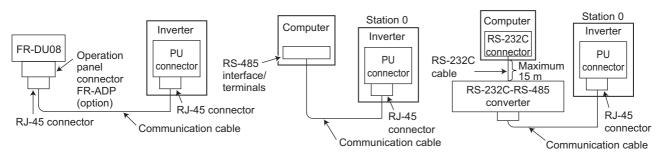
| Pin number | Name | Description |
|------------|------|--|
| 1 | SG | Earth (ground) (connected to terminal 5) |
| 2 | — | Operation panel power supply |
| 3 | RDA | Inverter receive+ |
| 4 | SDB | Inverter send- |
| 5 | SDA | Inverter send+ |
| 6 | RDB | Inverter receive- |
| 7 | SG | Earth (ground) (connected to terminal 5) |
| 8 | — | Operation panel power supply |



Pins No. 2 and 8 provide power to the operation panel or parameter unit. Do not use these pins for RS-485 communication.
Do not connect the PU connector to the computer's LAN board, FAX modem socket, or telephone modular connector. The product could be damaged due to differences in electrical specifications.

Wiring and configuration of PU connector communication system

· System configuration



• Wiring between a computer and an inverter for RS-485 communication

| | | | Inverter | |
|-------------------------|-----------------|---------------------------------------|--------------|--|
| Computer Side Terminals | | Cable connection and signal direction | PU connector | |
| Signal name Description | | Communication cable | | |
| RDA | Receive data | | SDA | |
| RDB | Receive data | • | SDB | |
| SDA | Send data | | RDA | |
| SDB | Send data | | RDB | |
| RSA | Request to send | | | |
| RSB | Request to send | | | |
| CSA | Clear to send | | | |
| CSB | Clear to send | 4 1 0.2 mm ² or more | | |
| SG | Signal ground | • 0.2 mm or more | SG | |
| FG | Frame ground | | | |

*1 Make connection in accordance with the Instruction Manual of the computer to be used with. Fully check the terminal numbers of the computer since they vary with the model.



- When performing RS-485 communication with multiple inverters, use the RS-485 terminals. (Refer to page 498.)
- Computer-inverter connection cable Refer to the following for the connection cable (RS-232C to RS-485 converter) between the computer with an RS-232C interface and an inverter. Commercially available products (as of October 2020)

| Model | Manufacturer |
|--|----------------|
| Interface embedded cable DAFXIH-CAB (D-SUB25P for personal computer) DAFXIH-CABV (D-SUB9P for personal computer) + Connector conversion cable DINV-485CAB (for inverter) ^{*2} | Diatrend Corp. |
| Interface embedded cable dedicated for inverter DINV-CABV ^{*2} | |

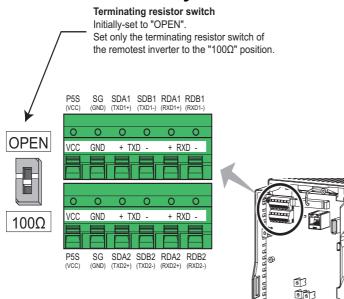
*2 The conversion cable cannot connect multiple inverters. (The computer and inverter are connected in a 1:1 pair.) This is an RS232C-to-RS485 converter-embedded conversion cable. No additional cable or connector is required. For the product details, contact the manufacturer.

• Use Ethernet cables compliant with the following standards when fabricating the cable.

| Ethernet cable | Connector | Standard | |
|--|-----------------|---|--|
| Category 5e or higher straight cable (double shielded / STP) ^{*3} | RJ-45 connector | The cables compliant with the following standards: • IEEE 802.3 (1000BASE-T) • ANSI/TIA/EIA-568-B (Category 5e) | |

5.12.2 Wiring and configuration of RS-485 terminals

RS-485 terminal layout



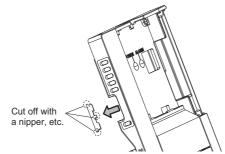
| Name | Description |
|--------------|---|
| RDA1 (RXD1+) | Inverter receive+ |
| RDB1 (RXD1-) | Inverter receive- |
| RDA2 (RXD2+) | Inverter receive + (for branch) |
| RDB2 (RXD2-) | Inverter receive - (for branch) |
| SDA1 (TXD1+) | Inverter send+ |
| SDB1 (TXD1-) | Inverter send- |
| SDA2 (TXD2+) | Inverter send + (for branch) |
| SDB2 (TXD2-) | Inverter send - (for branch) |
| P5S (VCC) | 5 V (permissible load current 100 mA) |
| SG (GND) | Earthing (grounding) (connected to terminal SD) |

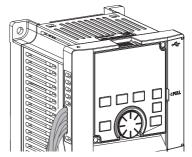
Wiring the RS-485 terminals

 The size of RS-485 terminal block is the same as that of the control circuit terminal block. Refer to page 66 for the wiring method.



- To avoid malfunction, keep the RS-485 terminal wires away from the control circuit board.
- When the FR-F820-01250(30K) or lower, or the FR-F840-00620(30K) or lower is used with a plug-in option, lead the wires through the hole on the side face of the front cover for wiring of the RS-485 terminals.

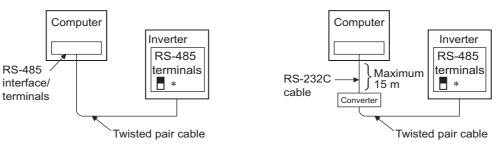




• When the FR-F820-01540(37K) of higher, or the FR-F840-00770(37K) or higher is used with a plug-in option, lead the wires on the left side of the plug-in option for wiring of the RS-485 terminals.

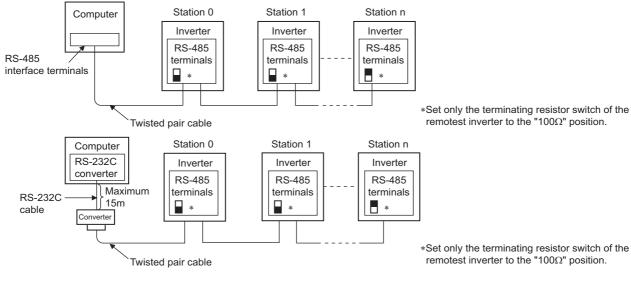
System configuration of RS-485 terminals

• Computer and inverter connection (1:1)



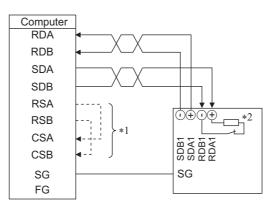
*Set the terminating resistor switch to the "100 Ω " position.

• Combination of a computer and multiple inverters (1:n)

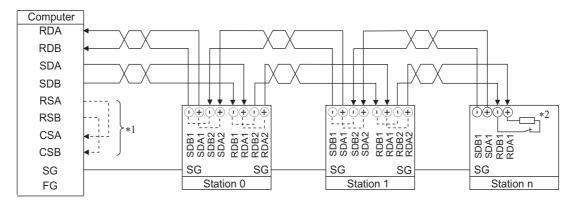


RS-485 terminal wiring method

· Wiring between a computer and an inverter for RS-485 communications

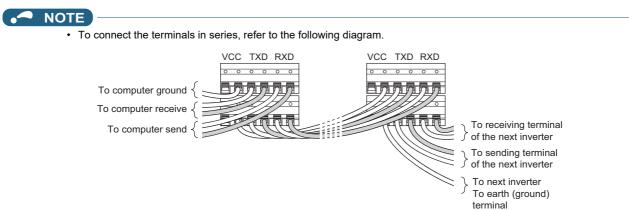


· Wiring between a computer and multiple inverters for RS-485 communication



*1 Make connection in accordance with the Instruction Manual of the computer to be used with. Fully check the terminal numbers of the computer since they vary with the model. *2

On the inverter most remotely connected with the computer, set the terminating resistor switch in the ON (100 Ω) position.

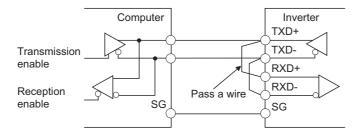


• To connect multiple inverters using RS-485 distributors, refer to the following. Commercially available products (as of October 2020)

| Product name | Model | Manufacturer |
|-----------------------|---|----------------------------|
| RS-485 distributor | BMJ-8-28N (Pins No. 2 and No. 8 are not connected internally.) (A plug with a terminating resistor is not used.) | HACHIKO ELECTRIC CO., LTD. |
| | DMDH-3PN (Pins No. 2 and No. 8 are not connected internally.) DMDH-10PN (Pins No. 2 and No. 8 are not connected internally.) | Diatrend Corp. |

Two-wire type connection

• If the computer is 2-wire type, a connection from the inverter can be changed to 2-wire type by passing wires across reception terminals and transmission terminals of the RS-485 terminals.



NOTE

· A program should be created so that transmission is disabled (receiving state) when the computer is not sending and reception is disabled (sending state) during sending to prevent the computer from receiving its own data.

5.12.3 Initial setting of operation via communication

Set the action when the inverter is performing operation via communication.

- · Set the RS-485 communication protocol. (Mitsubishi inverter protocol / MODBUS RTU protocol)
- Set the action at fault occurrence or at writing of parameters.

| Pr. | Name | Initial value | Setting range | Description | |
|-------------|---|---------------|------------------|--|--|
| F 40 | | 0 | 0 | Mitsubishi inverter protocol (computer link) | |
| 549 N000 | Protocol selection | | 1 | MODBUS RTU protocol | |
| | | | 2 | BACnet MS/TP protocol | |
| 342 N001 | Communication EEPROM write selection | 0 | 0 | Parameter values written by communication are written to the EEPROM and RAM. | |
| | | | 1 | Parameter values written by communication are written to the RAM. | |
| 502 N013 | Stop mode selection at communication error | 0 | 0 to 4 | Select the operation at a communication error occurrence. | |
| 779 | Operation frequency | | 0 to 590 Hz | Set the frequency for the operation when a communication error occurs. | |
| N014 | during communication 9999 error | 9999 | 9999 | Operation continues at the same frequency before the communication error. | |

Setting the communication protocol (Pr.549)

- Select the communication protocol.
- · The MODBUS RTU protocol can be used by communication from the RS-485 terminals.

| Pr.549 setting | Communication protocol |
|-------------------|--|
| 0 (initial value) | Mitsubishi inverter protocol (computer link) |
| 1 | MODBUS RTU protocol |
| 2 | BACnet MS/TP protocol |

Communication EEPROM write selection (Pr.342)

- When parameter write is performed via the inverter PU connector, RS-485 terminal, USB communication, or a communication option, the parameters storage device can be changed to RAM only from both EEPROM and RAM. Use this function if parameter settings are changed frequently.
- When changing the parameter values frequently, set "1" in **Pr.342 Communication EEPROM write selection** to write them to the RAM only. The life of the EEPROM will be shorter if parameter write is performed frequently with the setting unchanged from "0 (initial value)" (EEPROM write).

NOTE

- Turning OFF the inverter's power supply clears the modified parameter settings when **Pr.342** = "1 (write only to RAM)". Therefore, the parameter values at next power-ON are the values last stored in EEPROM.
- The parameter setting written in RAM cannot be checked on the operation panel. (The values displayed on the operation panel are the ones stored in EEPROM.)

Operation selection at a communication error (Pr.502, Pr.779)

- For communication using RS-485 terminals or a communication option, operation at a communication error can be selected. The operation is active under the Network operation mode.
- Select the stop operation at the retry count excess (**Pr.335**, enabled only when the Mitsubishi inverter protocol is selected) or at a signal loss detection (**Pr.336**, **Pr.539**).

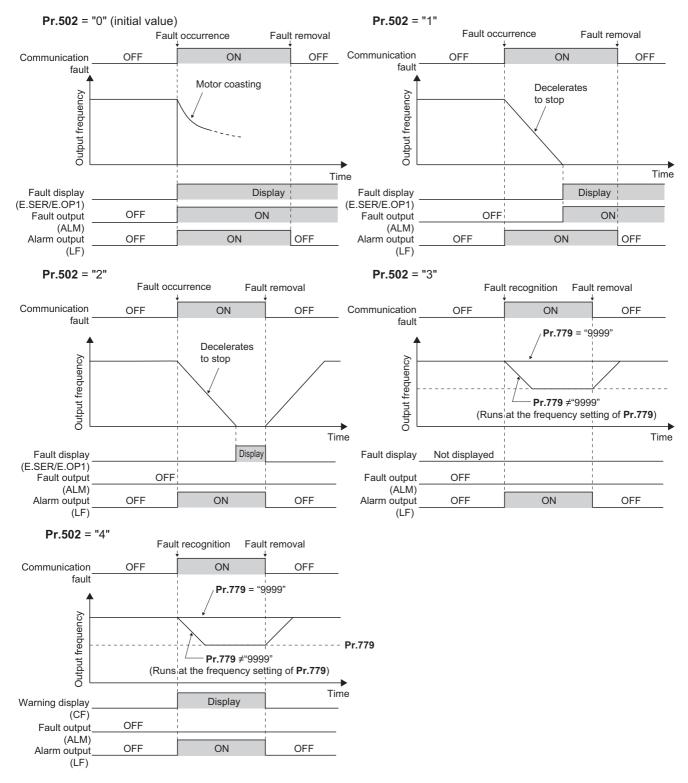
| | Pr.502 | At fault occurrence | | | At fault removal | | |
|----------------------------------|----------------------|---|-----------------------|-----------------------|---|-----------------------|-----------------------|
| Fault type | setting | Operation | Indication | Fault (ALM) signal | Operation | Indication | Fault (ALM) signal |
| | 0 (initial value) | Output shutoff | "E.SER" ^{*1} | ON | Output stop status continues. | "E.SER" ^{*1} | ON |
| | 1 | Output to decelerate | indication | ON after stop | conunues. | | |
| Communication line | 2 | and stan the motor | | OFF | Restart ^{*2} | Normal | OFF |
| | 3 | Operation continues | Normal | | | | |
| | 4 | at the frequency set in Pr.779 . | "CF" warning | OFF | Normal | Normal | OFF |
| | 0, 3 | Output shutoff | "E.1" | ON | Output stop status | | |
| Communication option (when a | 1, 2 | Output to decelerate and stop the motor. | "E.1" after stop | ON after stop | continues. | "E.1" | ON |
| communication option is used) | 4 | Operation continues at the frequency set in Pr.779 . | "CF" warning | OFF | Operation continues at the frequency set in Pr.779 . | "CF" warning | OFF |

*1 If in communication by the communication option, "E.OP1" is displayed.

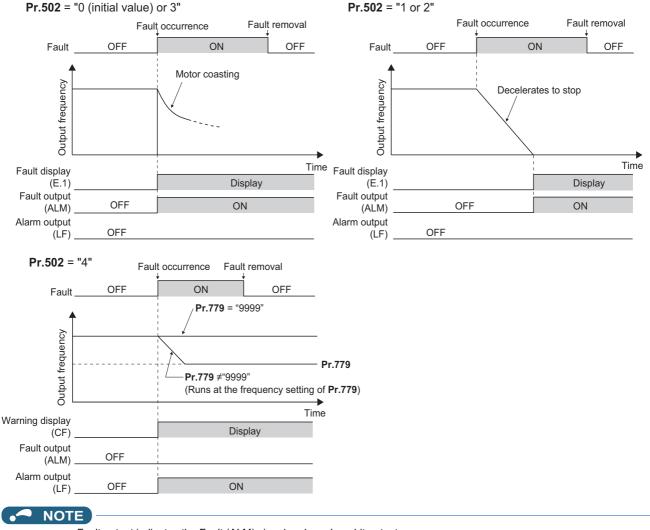
*2 When the communication error is removed during deceleration, the motor re-accelerates.

When a communication error is detected while communication with the RS-485 terminals is performed, the Alarm (LF) signal is output to an output terminal of the inverter. To use the LF signal, set "98 (positive logic) or 198 (negative logic)" in any parameter from Pr.190 to Pr.196 (Output terminal function selection) to assign the function to the output terminal. (To output the LF signal even if communication through RS-485 terminals is not performed for the time set in Pr.336 or longer, or during communication using a communication option, set "3 or 4" in Pr.502.)

· The following charts show operations when a communication line error occurs.



• The following charts show operations when a communication option fault occurs.



- Fault output indicates the Fault (ALM) signal and an alarm bit output.
- When the fault output is set enabled, fault records are stored in the fault history. (A fault record is written to the fault history at a fault output.)
- When the fault output is not enabled, fault record is overwritten to the fault history temporarily but not stored.
- After the fault is removed, the fault indication goes back to normal indication on the monitor, and the fault history goes back to the previous status.
- When Pr.502 ≠ "0", the normal deceleration time setting (settings like Pr.8, Pr.44, and Pr.45) is applied as the deceleration time. Normal acceleration time setting (settings like Pr.7 and Pr.44) is applied as the acceleration time for restart.
- When **Pr.502** = "2, 3, or 4", the inverter operates with the start command and the speed command, which were used before the fault.
- If a communication line error occurs, then the error is removed during deceleration while Pr.502 = "2", the motor re-accelerates from that point.
- The Pr.502 and Pr.779 settings are valid when communication is performed via the RS-485 terminals or a communication option.
- These parameters are valid under the Network operation mode. When performing communication through RS-485 terminals, set **Pr.551 PU mode operation command source selection** ≠ "1".
- Pr.502 is valid for the device that has the command source under the Network operation mode. If a communication option is
 installed while Pr.550 = "9999 (initial setting)", a communication error in RS-485 terminals occurs and Pr.502 becomes invalid.
- If the communication error setting is disabled with Pr.335 = "9999" or Pr.539 = "9999" while Pr.502 = "3 or 4", the inverter does
 not operate with the frequency set in Pr.779 when a communication error occurs.
- If a communication error occurs while continuous operation at Pr.779 is selected with Pr.502 = "3 or 4", the inverter operates at the frequency set in Pr.779 even though the speed command source is at the external terminals.
 Example) If a communication error occurs while Pr.339 = "2" and the RL signal is input through an external terminal, the operation is continued at the frequency set in Pr.779.

AUTION

• When Pr.502 = "3" and a communication line error occurs, or Pr.502 = "4" and a communication line error or a communication option fault occurs, the operation continues. When setting "3 or 4" in Pr.502, provide a safety stop countermeasure other than via communication. For example, input a signal through an external terminal (RES, MRS, etc.) or press the PU stop on the operation panel.

Parameters referred to

- Pr.7 Acceleration time, Pr.8 Deceleration time 3 page 228
- Pr.335 RS-485 communication retry count i page 505
- Pr.336 RS-485 communication check time interval 🖙 page 505
- Pr.539 MODBUS RTU communication check time interval 🖙 page 520 Pr.550 NET mode operation command source selection 🖙 page 251 Pr.551 PU mode operation command source selection 🖙 page 251

5.12.4 Initial settings and specifications of RS-485 communication

Use the following parameters to perform required settings for RS-485 communication between the inverter and a personal computer.

- Use the PU connector on the inverter or RS-485 terminals as communication interface.
- The Mitsubishi inverter protocol, MODBUS-RTU protocol, or BACnet protocol is used. Parameter setting, monitoring, etc. can be performed through communication.
- To make communication between the personal computer and inverter, setting of the communication specifications must be made to the inverter in advance.

Data communication cannot be made if the initial settings are not made or if there is any setting error.

Parameters related to PU connector communication

| Pr. | Name | Initial value | Setting range | Descr | iption | | | | |
|-------------|--|---------------|--|---|--|--|--|--|--|
| 117 N020 | PU communication station number | 0 | 0 to 31 | Use this parameter to specify the in Enter the inverter station numbers connected to one personal comput | when two or more inverters are | | | | |
| 118 N021 | PU communication speed | 192 | 48, 96, 192, 384, 576, 768, 1152 | Select the communication speed. The setting value × 100 equals the For example, enter 192 to set the c | communication speed. ommunication speed of 19200 bps. | | | | |
| N022 | PU communication data length | 0 | 0 | Data length 8 bits Data length 7 bits | | | | | |
| N023 | PU communication stop bit length | 1 | 0 | Stop bit length 1 bit Stop bit length 2 bits | | | | | |
| 119 | PU communication stop bit length / data | 1 | 0 1 10 | Stop bit length 1 bit Data length 8 bits Stop bit length 2 bits Stop bit length 1 bit | | | | | |
| | length | | 11 | Stop bit length 2 bits | Data length 7 bits | | | | |
| 120 N024 | PU communication parity check | 2 | 0 1 2 | Parity check disabled. Parity check (odd parity) enabled. Parity check (even parity) enabled. | | | | | |
| 121 N025 | PU communication retry count | 1 | 0 to 10 | Set the permissible number of retrie If the number of consecutive errors inverter output will be stopped. | exceeds the permissible value, the | | | | |
| 14020 | | | 9999 | The inverter output will not be shut error occurs. | off even when a communication | | | | |
| | | | 0 | PU connector communication is dis | sabled. | | | | |
| 122 N026 | PU communication check time interval | 9999 | 0.1 to 999.8 s | Set the interval of the communicati time. If a no-communication state persis time, the inverter output will be shu | ts for longer than the permissible | | | | |
| | | | 9999 | No communication check (Signal le | oss detection) | | | | |
| 123 | PU communication | 9999 | 0 to 150 ms | Set the time delay between data tra response. | ansmission to the converter and the | | | | |
| N027 | waiting time setting | 5555 | 9999 | The time delay is not set in this par Delay time: Number set in the data | | | | | |
| 124 | PU communication CR/ | | 0 | Without CR/LF | | | | | |
| 124 N028 | LF selection | 1 | · · · · · · · · · · · · · · · · · · · | With CR | | | | | |
| | | | 2 | With CR/LF | | | | | |

Parameters related to RS-485 terminal communication

| Pr. | Name | Initial value | Setting range | Description | | | | | |
|---------------------------|--|------------------|--|---|--|--|--|--|--|
| 331 N030 | RS-485 communication station number | 0 | 0 to 31 (0 to 247) ^{*1*2} | Enter the station number of the inverter. (Same specifications as Pr.117) | | | | | |
| 332 N031 | RS-485 communication speed | 96 | 3, 6, 12, 24, 48, 96, 192, 384, 576, 768, 1152 ^{*3} | Select the communication speed. (Same specifications as Pr.118) | | | | | |
| N032 | RS-485 communication data length | 0 | 0, 1 | Select the data length. (Same specifications as P.N022) ^{*4} | | | | | |
| N033 | RS-485 communication stop bit length | 1 | 0, 1 | Select the stop bit length. (Same specifications as $P.N023$) ^{*5} | | | | | |
| 333 | RS-485 communication stop bit length / data length | 1 | 0, 1, 10, 11 | Select the stop bit length and data bit length. (Same specifications as $\text{Pr.119})^{*4^{*}5}$ | | | | | |
| 334 N034 | RS-485 communication parity check selection | 2 | 0, 1, 2 | Select the parity check specifications. (Same specifications as Pr.120) | | | | | |
| 335 N035 ^{*6} | RS-485 communication retry count | 1 | 0 to 10, 9999 | Set the permissible number of retries for unsuccessful data reception. (Same specifications as Pr.121) | | | | | |
| | | | 0 | RS-485 communication is available, but the inverter trips in the NET operation mode. | | | | | |
| 336 N036 ^{*6} | RS-485 communication check time interval | 0 s | 0.1 to 999.8 s | Set the interval of the communication check (Signal loss detection) time. (Same specifications as Pr.122) | | | | | |
| | | | 9999 | No communication check (Signal loss detection) | | | | | |
| 337 N037 ^{*6} | RS_485 communication | | 0 to 150 ms, 9999 | Set the waiting time between data transmission to the inverter and the response. (Same specifications as Pr.123) | | | | | |
| 341 N038 ^{*6} | RS-485 communication CR/LF selection | 1 | 0, 1, 2 | Select the presence/absence of CR/LF. (Same specifications as Pr.124) | | | | | |

*1 When "1" (MODBUS RTU protocol) is set in **Pr.549**, the setting range within parentheses is applied.

*2 When a value outside the setting range is set, the inverter operates at the initial value.

*3 When **Pr.549** = "2" (BACnet MS/TP protocol), the setting range is "96 to 1152".

*4 In the MODBUS RTU protocol, the data length is fixed at 8 bits.

*5 In the MODBUS RTU protocol, **Pr.334** setting is applied as the stop bit length. (Refer to page 520.)

*6 In the MODBUS RTU protocol, this is invalid.

NOTE

- The monitor items and parameter settings can be read during communication with the Pr.336 RS-485 communication check time interval = "0 (initial value)" setting, but such operation will become faulty once the operation mode is changed to the NET operation mode. When the NET operation mode is selected as the start-up operation mode, communication is performed once, then a Communication fault (inverter) (E.SER) occurs. To perform operation or parameter writing via communication, set "9999" or a large setting value in Pr.336. (The setting value is determined by the computer program.) (Refer to page 513.)
- Always reset the inverter after making the initial settings of the parameters. After changing the communication-related parameters, communication cannot be made until the inverter is reset.

5.12.5 Mitsubishi inverter protocol (computer link communication)

Parameter setting and monitoring, etc. are possible by using the Mitsubishi inverter protocol (computer link communication) via inverter PU connector and the RS-485 terminals.

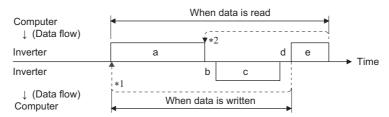
Communication specifications

• The communication specifications are shown in the following table.

| It | em | Description | Related parameter |
|-------------------|------------------|--|-------------------|
| Communication | protocol | Mitsubishi inverter protocol (computer link communication) | Pr.551 |
| Conforming stan | dard | EIA-485 (RS-485) | — |
| Number of conne | ectable units | 1: N (maximum 32 units), the setting range of station number is 0 to 31. | Pr.117 Pr.331 |
| Communication | PU connector | Selected among 4800/9600/19200/38400/57600/76800/115200 bps. | Pr.118 |
| speed | RS-485 terminals | Selected among 300/600/1200/2400/4800/9600/19200/38400/57600/76800/ 115200 bps. | Pr.332 |
| Control procedu | e | Asynchronous method | — |
| Communication | method | Half-duplex system | — |
| | Character system | ASCII (7 bits or 8 bits can be selected.) | Pr.119 Pr.333 |
| | Start bit | 1 bit | — |
| Communication | Stop bit length | 1 bit or 2 bits can be selected. | Pr.119 Pr.333 |
| specifications | Parity check | Check (at even or odd numbers) or no check can be selected. | Pr.120 Pr.334 |
| | Error check | Sum code check | — |
| | Terminator | CR/LF (whether or not to use it can be selected) | Pr.124 Pr.341 |
| Time delay settir | ng | Availability of the setting is selectable. | Pr.123 Pr.337 |

Communication procedure

- Data communication between the computer and inverter is made in the following procedure.
- (a) Request data is sent from the computer to the inverter. (The inverter will not send data unless requested.)
- (b) Communication waiting time
- (c) The inverter sends reply data to the computer in response to the computer request.
- (d) Inverter data processing time
- (e) An answer from the computer in response to reply data (c) of the inverter is transmitted. (Even if (e) is not sent, subsequent communication is made properly.)



- *1 If a data error is detected and a retry must be made, perform retry operation with the user program. The inverter output is shut off if the number of consecutive retries exceeds the parameter setting.
- *2 On receipt of a data error occurrence, the inverter returns reply data (c) to the computer again. The inverter output is shut off if the number of consecutive data errors reaches or exceeds the parameter setting.

Communication operation presence/absence and data format types

- Data communication between the computer and inverter is made in ASCII code (hexadecimal code).
- Communication operation presence/absence and data format types are as follows.

| Symbol | Operation | | Operation command | Operation frequency | Multi command | Parameter write | Inverter reset | Monitor | Parameter read |
|--------|--|---|-------------------|---------------------|------------------|--------------------|-------------------|------------------|-------------------|
| а | Communication request is inverter in accordance wit program in the computer. | h the user | A, A1 | А | A2 | A | A | В | В |
| b | Inverter data processing time | | With | With | With | With | Without | With | With |
| с | Reply data from the inverter (Data (a) is | No error ^{*1} (Request accepted) | С | С | C1 ^{*3} | С | C*2 | E, E1, E2, E3 | E |
| C | checked for an error.) | With error (Request rejected) | D | D | D | D | D*2 | D | D |
| d | Computer processing dela | ay time | 10 ms or more | | | | | | |
| | Reply from computer in response to reply data c | No error ^{*1} (No inverter processing) | Without | Without | Without (C) | Without | Without | Without (C) | Without (C) |
| е | e (Data c is checked for error.) | | Without | Without | F | Without | Without | F | F |

*1 In the communication request data from the computer to the inverter, the time of 10 ms or more is also required after an acknowledgment (ACK) signal showing "No data error detected" is sent. (Refer to page 511.)

*2 Reply from the inverter to the inverter reset request can be selected. (Refer to page 515.)

*3 At mode error, and data range error, C1 data contains an error code. (Refer to page 519.) Except for those errors, the error is returned with data format D.

Data writing format

a. Communication request data from the computer to the inverter

| Format | Number of characters | | | | | | | | | | | | | | | | | | |
|--------|----------------------|---------------------------|---|----------------|-------|----|----------------------|-------------------------|--------|-------|-----|-------|------|----|----|----|-------|------|----|
| Format | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 7 8 9 10 | | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| A | ENQ *1 | Invert station numb | n | Instru code | ction | *3 | Data | | | | Sum | check | *4 | | | | | | |
| A1 | ENQ *1 | Invert station numb | n | Instru code | ction | *3 | Data | | Sum o | check | *4 | | | | | | | | |
| A2 | ENQ *1 | Invert station numb | n | Instru code | ction | *3 | Send data type | Receive data type | Data ′ | 1 | | | Data | 2 | | | Sum c | heck | *4 |

c. Reply data from the inverter to the computer (No data error detected)

| Format | | | | | | | Nu | nber o | of cha | racte | rs | | | | | | | | |
|--------|-----------|-----------------------------|---------|----------------------|-------------------------|-----------------|-----------------|--------|--------|-------|----|------|----|----|----|-----------------------|--------------|----|----|
| Format | 1 | 2 | 3 | 4 | 5 | 5 6 7 | | | | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| С | ACK *1 | Inverte statior numbe | ו *0 | *4 | | | | | | | | | | | | | | | |
| C1 | STX *1 | Inverte statior numbe | 1 | Send data type | Receive data type | Error code 1 | Error code 2 | Data | 1 | | | Data | 2 | | | ETX [*] 1 | Sum check | | *4 |

c. Reply data from the inverter to the computer (Data error detected)

| Format | Number of characters | | | | | | | | | |
|--------|----------------------|-----------------|-------------------------|------------|----|--|--|--|--|--|
| Format | 1 | 2 | 3 | 4 | 5 | | | | | |
| D | NAK ^{*1} | Inverter static | on number ^{*2} | Error code | *4 | | | | | |

*1 A control code.

*3 Set the delay time. When **Pr.123 PU communication waiting time setting** or **Pr.337 RS-485 communication waiting time setting** is set to other than "9999", create the communication request data without "delay time" in the data format. (The number of characters decreases by 1.)

^{*2} The inverter station number is specified in hexadecimal in the range of H00 to H1F (stations No. 0 to 31).

*4 CR+LF code: When a computer transmits data to the inverter, some computers automatically provide either one or both of the codes CR (carriage return) and LF (line feed) at the end of a data group. In this case, the same setting is required for data sent from the inverter to the computer. Use **Pr.124** or **Pr.341** for the CR+LF code setting.

· Data reading format

a. Communication request data from the computer to the inverter

| Format | | Number of characters | | | | | | | | | | | |
|--------|-------------------|--|---|------------------|---|----|-----------|---|----|--|--|--|--|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | | | |
| В | ENQ ^{*1} | Inverter station number ^{*2} | | Instruction code | | *3 | Sum check | | *4 | | | | |

c. Reply data from the inverter to the computer (No data error detected)

| Format | | | Number of characters | | | | | | | | | | | |
|--------|-------------------|----------------------|----------------------|--|-----------|-------------------|----------|-------------------|--------|-------------------|--------|-----|----|--|
| Tornat | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | |
| E | STX ^{*1} | Inverter s | | Read da | ta | | | ETX ^{*1} | Sum ch | eck | *4 | | | |
| E1 | STX ^{*1} | Inverter s number | | Read da | ta | ETX ^{*1} | Sum che | eck | *4 | | | | | |
| E2 | STX ^{*1} | Inverter s | | Read da | Read data | | | | | ETX ^{*1} | Sum ch | eck | *4 | |
| Format | | | | | N | umber of | characte | ers | | | | | | |
| Format | 1 | 2 | 3 | | 4 to 23 | | | | 24 | 25 | 26 | 2 | 7 | |
| E3 | STX ^{*1} | Inverter s | | Read data (Inverter model information) | | | ר) | ETX ^{*1} | Sum c | heck | *4 | | | |

c. Reply data from the inverter to the computer (Data error detected)

| Format | Number of characters | | | | | | | | | |
|--------|----------------------|------------|---|---------------|----|--|--|--|--|--|
| Format | 1 | 2 | 3 | 4 | 5 | | | | | |
| D | NAK ^{*1} | Inverter s | | Error code | *4 | | | | | |

e. Transmission data from the computer to the inverter when reading data

| Format | Number of characters | | | | | | | | |
|----------------------------------|----------------------|------------|--|----|--|--|--|--|--|
| Format | 1 | 2 3 | | 4 | | | | | |
| C (No data error detected) | ACK ^{*1} | Inverter s | | *4 | | | | | |
| F (Data error detected) | NAK ^{*1} | Inverter s | | *4 | | | | | |

*1 A control code.

- *2 The inverter station number is specified in hexadecimal in the range of H00 to H1F (stations No. 0 to 31).
- *3 Set the delay time. When **Pr.123 PU communication waiting time setting** or **Pr.337 RS-485 communication waiting time setting** is set to other than "9999", create the communication request data without "delay time" in the data format. (The number of characters decreases by 1.)

*4 CR+LF code: When a computer transmits data to the inverter, some computers automatically provide either one or both of the codes CR (carriage return) and LF (line feed) at the end of a data group. In this case, the same setting is required for data sent from the inverter to the computer. Use **Pr.124** or Pr.341 for the CR+LF code setting.

Data definitions

Control code

| Signal name | ASCII code | Description | |
|-------------|------------|--|--|
| STX | H02 | Start Of Text (Start of data) | |
| ETX | H03 | End Of Text (End of data) | |
| ENQ | H05 | Enquiry (Communication request) | |
| ACK | H06 | Acknowledge (No data error detected) | |
| LF | H0A | Line Feed | |
| CR | H0D | Carriage Return | |
| NAK | H15 | Negative Acknowledge (Data error detected) | |

Inverter station number

Specify the station number of the inverter which communicates with the computer.

Instruction code

Specify the processing request, for example, operation or monitoring, given by the computer to the inverter. Therefore, the operation or monitoring an item is enabled by specifying the corresponding instruction code. (Refer to page 515.)

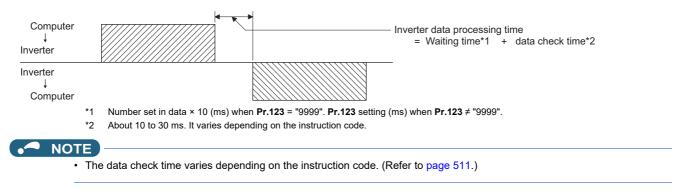
Data

Read/write data such as parameters transmitted from/to the inverter. The definitions and ranges of set data are determined in accordance with the instruction codes. (Refer to page 515.)

· Time delay

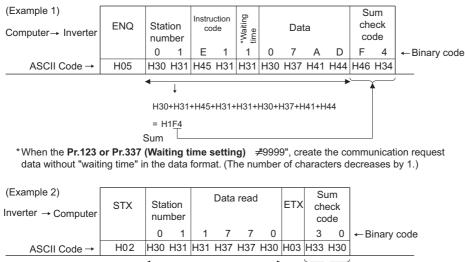
Specify the delay time (time period between the time when the inverter receives data from the computer and the time when the inverter starts transmission of reply data). Set the delay time in accordance with the response time of the computer in the range of 0 to 150 ms in 10 ms increments. (For example, "1" for 10 ms or "2" for 20 ms.)

When **Pr.123 PU communication waiting time setting** or **Pr.337 RS-485 communication waiting time setting** is set to other than "9999", create the communication request data without "delay time" in the data format. (The number of characters decreases by 1.)



· Sum check code

The sum check code is a 2-digit ASCII (hexadecimal) representing the lower 1 byte (8 bits) of the sum derived from the checked ASCII data.





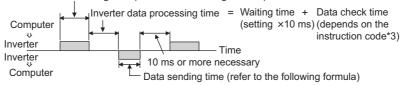
Error code

If any error is found in the data received by the inverter, its error definition is sent back to the computer together with the NAK code.

| Error code | Error item | Error description | Inverter operation | | |
|------------|------------------------|---|---|--|--|
| HO | Computer NAK error | The number of errors consecutively detected in communication request data from the computer is greater than the permissible number of retries. | | | |
| H1 | Parity error | The parity check result does not match the specified parity. | | | |
| H2 | Sum check error | The sum check code in the computer does not match that of the data received by the inverter. | The inverter output is shut off (E.PUE/E.SER) if error occurs | | |
| H3 | Protocol error | The data received by the inverter has a grammatical mistake. Or, data receive is not completed within the predetermined time. The CR or LF code specification is not the same as the setting of the parameter. | continuously more than the permissible number of retries. The LF signal is output. | | |
| H4 | Framing error | The stop bit length differs from the initial setting. | | | |
| H5 | Overrun error | New data has been sent by the computer before the inverter completes receiving the preceding data. | | | |
| H6 | — | — | — | | |
| H7 | Character error | The character received is invalid (other than 0 to 9, A to F, control code). | The inverter does not accept the received data. However, the inverter output is not shut off. | | |
| H8 | _ | — | — | | |
| H9 | _ | — | — | | |
| НА | Mode error | Parameter write was attempted when the inverter does not perform computer link communication, when the operation commands are not given through communication, or during inverter operation. | The inverter does not accept the received data. However, the | | |
| HB | Instruction code error | The specified instruction code does not exist. | inverter output is not shut off. | | |
| HC | Data range error | Invalid data has been specified for parameter writing, frequency setting, etc. | | | |
| HD | — | — | — | | |
| HE | — | — | — | | |
| HF | Normal (no error) | - | — | | |

Response time

Data sending time (refer to the following formula)



[Formula for data transmission time]

- 1 Communication specifications = data transmission time (s) speed (bps) = data transmission time (s)
- *1 Refer to page 508.
- *2 Communication specifications

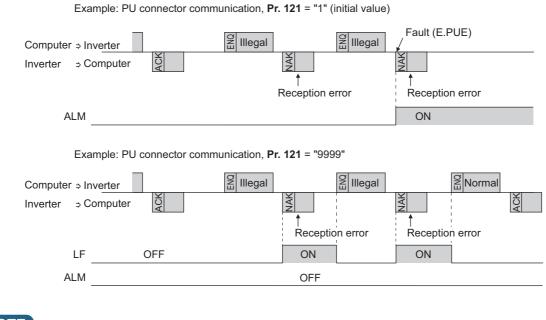
| Name | | Number of bits | | | | |
|-----------------|-----------------|------------------|--|--|--|--|
| Stop bit length | 1 bit 2 bits | | | | | |
| Data length | | 7 bits 8 bits | | | | |
| Parity check | With | 1 bit | | | | |
| Failty check | Without | 0 | | | | |

In addition to the above, 1 start bit is necessary. Minimum number of total bits: 9 bits Maximum number of total bits: 12 bits *3 Data check time

| Item | Check time |
|--|-----------------|
| Monitoring, operation command, frequency setting (RAM) | Less than 12 ms |
| Parameter read/write, frequency setting (EEPROM) | Less than 30 ms |
| Parameter clear / All parameter clear | Less than 5 s |
| Reset command | No reply |

Retry count setting (Pr.121, Pr.335)

- Set the permissible number of retries at data receive error occurrence. (Refer to page 511 for data receive error for retry.)
- When the data receive errors occur consecutively and the number of retries exceeds the permissible number setting, a communication fault (PU connector communication: E.PUE, RS-485 terminal communication: E.SER) occurs and the inverter output is shut off.
- When a data transmission error occurs while "9999" is set, the inverter does not shut off its output but outputs the Alarm (LF) signal. To use the LF signal, set "98 (positive logic) or 198 (negative logic)" in any parameter from Pr.190 to Pr.196 (Output terminal function selection) to assign the function to an output terminal.

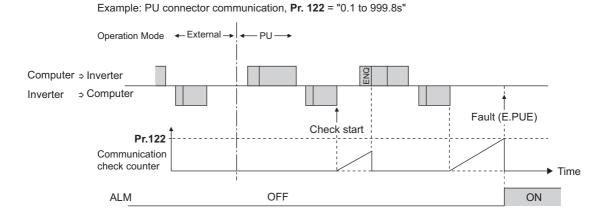


NOTE

For the RS-485 terminal communication, the operation at a communication error occurrence depends on the **Pr.502 Stop mode selection at communication error** setting. (Refer to page 500.)

Signal loss detection (Pr.122, Pr.336 RS-485 communication check time interval)

- If signal loss is detected between the inverter and computer, the communication error (PU connector communication: E.PUE, RS-485 terminal communication: E.SER) will occur and the inverter output will be shut off.
- The LF signal is not output when a signal loss is detected. However, when a signal loss is detected via communication through the RS-485 terminals while **Pr.502** = "3 or 4", the LF signal is output.
- When the setting is "9999", communication check (signal loss detection) is not made.
- When the setting is "0", communication through the PU connector is not possible. The monitor items and parameter settings can be read during communication via RS-485 terminals, but a communication error (E.SER) occurs instantly when the operation mode is switched to the Network operation.
- Setting any value from 0.1 s to 999.8 s will enable signal loss detection. To detect signal loss, data must be sent from the
 computer within the communication check time interval (for further information on control codes, refer to page 509). The
 inverter makes a communication check (clearing of communication check counter) regardless of the station number setting
 of the data sent from the master.
- Communication check is started at the first communication in the operation mode having the operation source (PU operation mode for PU connector communication in the initial setting or Network operation mode for RS-485 terminal communication).



5

Programming instructions

- When data from the computer has any error, the inverter does not accept that data. Hence, in the user program, always insert a retry program for data error.
- All data communication, for example, run command or monitoring, are started when the computer gives a communication request. The inverter does not return any data without the computer's request. Hence, design the program so that the computer gives a data read request for monitoring, etc. as required.
- Program example: To switch to the Network operation mode

Microsoft® Visual C++® (Ver.6.0) programming example

```
#include <stdio.h>
#include <windows.h>
void main(void){
     HANDLE
                       hCom:
                                         // Communication handle
     DCB
                                         // Structure for setting communication settings
                       hDcb;
                                hTim; // Structure for setting timeouts
     COMMTIMEOUTS
                       szTx[0x10]:
                                                  // Send buffer
     char
                       szRx[0x10]:
                                                 // Receive buffer
     char
                       szCommand[0x10];// Command
     char
     int
                       nTx,nRx:
                                                 // For storing buffer size
                                                 // For calculating sum code
     int
                       nSum:
     BOOL
                       bRet<sup>.</sup>
                       nRet:
     int
     int
                       i:
     // **** Open COM1 port ****
     hCom = CreateFile("COM1", (GENERIC_READ | GENERIC_WRITE), 0, NULL, OPEN_EXISTING, FILE_ATTRIBUTE_NORMAL, NULL);
     if(hCom != NULL) {
              // **** Set COM1 port communication ****
              GetCommState(hCom,&hDcb);
                                                                                     // Get current communication information
              hDcb.DCBlength = sizeof(DCB);
                                                                                     // Structure size setting
              hDcb.BaudRate = 19200;
                                                                                     // Communication speed = 19200 bps
              hDcb.ByteSize = 8;
                                                                                     // Data length = 8 bits
              hDcb.Parity = 2:
                                                                                     // Parity check at even numbers
              hDcb.StopBits = 2;
                                                                                     // Stop bit = 2 bits
              bRet = SetCommState(hCom,&hDcb);
                                                                                     // Setting of changed communication information
              if(bRet == TRUE) {
                       // **** Set COM1 port timeout ****
                       GetCommTimeouts(hCom,&hTim);
                                                                                     // Get current timeout values
                       hTim.WriteTotalTimeoutConstant = 1000:
                                                                                     // Write timeout 1 second
                       hTim.ReadTotalTimeoutConstant = 1000;
                                                                                     // Read timeout 1 second
                       hTim.ReadTotalTimeoutConstantSetCommTimeouts(hCom,&hTim);// Setting of changed timeout values
                       // **** Setting of command for switching the station number 1 inverter to the Network operation mode ****
                       sprintf(szCommand,"01FB10000");
                                                                                     // Send data (NET operation write)
                       nTx = strlen(szCommand);
                                                                                     // Send data size
                       // **** Generate sum code ****
                       nSum = 0;
                                                                                     // Initialize sum data
                       for(i = 0; i < nTx; i++) \{
                                nSum += szCommand[i];
                                                                                     // Calculate sum code
                                nSum &= (0xff);
                                                                                     // Mask data
                       }
                       // **** Generate send data ****
                       memset(szTx,0,sizeof(szTx));
                                                                                     // Initialize send buffer
                       memset(szRx,0,sizeof(szRx));
                                                                                     // Initialize receive buffer
                       sprintf(szTx,"\5%s%02X",szCommand,nSum);// ENQ code + send data + sum code
                                                                                     // ENQ code + number of send data + number of sum codes
                       nTx = 1 + nTx + 2;
                       nRet = WriteFile(hCom,szTx,nTx,&nTx,NULL);
                       // **** Send ****
                       if(nRet != 0) {
                                nRet = ReadFile(hCom,szRx,sizeof(szRx),&nRx,NULL);
                       // **** Receive ****
                                if(nRet != 0) {
                                         // **** Display receive data ****
                                         for(i = 0; i < nRx; i++)
                                                 printf("%02X ",(BYTE)szRx[i]);// Output received data to console
                                                  // Display ASCII code in Hexadecimal' In case of 0', "30" is displayed.
                                         printf("\n\r");
                                }
                       }
              CloseHandle(hCom);
                                                                                     // Close communication port
     }
}
```



- Always set the communication check time interval before starting operation to prevent hazardous conditions.
- Data communication is not started automatically but is made only once when the computer provides a communication request. If communication is disabled during operation due to signal cable breakage etc., the inverter cannot be stopped. When the communication check time interval has elapsed, the inverter output will be shut off (E.PUE, E.SER). Turn the RES signal of the inverter ON or shut off the power supply to coast the motor to a stop.
- If communication is broken due to signal cable breakage, computer fault etc., the inverter does not detect such a fault. This should be fully noted.

Setting items and set data

• After completion of parameter settings, set the instruction codes and data, then start communication from the computer to allow various types of operation control and monitoring.

| ltem | Read/ write | Instruction code | Data description | Number of data digits (format) ^{*1} |
|----------------|----------------|---------------------|--|--|
| | Read | H7B | H0000: Network operation H0001: External operation, External operation (JOG operation) H0002: PU operation, External/PU combined operation, PUJOG operation | 4 digits (B and E/D) |
| Operation mode | Write | HFB | H0000: Network operation (Setting is available via communication through the RS-485 terminals.) H0001: External operation H0002: PU operation (Setting is available via communication through the PU connector.) | 4 digits (A and C/D) |

| Item | | Read/ write | Instruction code | Data description | Number of data digits (format) ^{*1} | |
|--------------------------------|-----------------------------------|--|---------------------|---|--|--|
| | Output frequency / speed | Read | H6F | H0000 to HFFFF: Output frequency in 0.01Hz increments (The display can be changed to the rotations per minute using Pr.37 and Pr.144 . (Refer to page 305.)) | 4 digits (B and E/D) | |
| | Output current | Read | H70 | H0000 to HFFFF: Output current (hexadecimal) Increment 0.01 A (FR-F820-02330(55K) or lower, FR-F840-01160(55K) or lower) Increment 0.1 A (FR-F820-03160(75K) or higher, FR-F840-01800(75K) or higher) | 4 digits (B and E/D) | |
| | Output voltage | Read | H71 | H0000 to HFFFF: Output voltage (hexadecimal) in 0.1 V increments | 4 digits (B and E/D) | |
| | Special monitor | Read | H72 | H0000 to HFFFF: Data of the monitor item selected with the instruction code HF3. | 4 digits (B and E/D) | |
| | Special monitor | Read | H73 | Monitor selection data (Refer to page 305 for details on selection No.) | 2 digits (B and E1/D) | |
| | selection No. | Write | HF3 | Monitor selection data (Refer to page 505 for details on selection No.) | 2 digits (A1 and C/D) | |
| | Fault record | $\begin{array}{c c c c c c c c c c c c c c c c c c c $ | | | | |
| • | eration command tended) | Write | HF9 | Control input commands such as the Forward rotation command (STF) signal and the Reverse rotation command (STR) signal can be set. (For the details, | 4 digits (A and C/D) 2 digits (A1 and | |
| | eration command | Write | HFA | refer to page 518.) | C/D) | |
| mo | erter status onitor (extended) | Read | H79 | The status of the output signals such as the Forward rotation output, Reverse rotation output, and Inverter running (RUN) signals can be monitored. (For | 4 digits (B and E/D) | |
| mo | erter status nitor | Read | H7A | the details, refer to page 519.) | 2 digits (B and E1/D) | |
| | t frequency AM) | Read | H6D | Read the set frequency/speed from the RAM or EEPROM. H0000 to HFFFF: Set frequency in 0.01 Hz increments (The display can be | 4 digits (B and | |
| | t frequency EPROM) | rioud | H6E | changed to the rotations per minute using Pr.37 and Pr.144 . (Refer to page 305.)) | E/D) | |
| | t frequency AM) | | HED | Write the set frequency/speed into the RAM or EEPROM. H0000 to HE678 (0 to 590.00 Hz): Set frequency in 0.01 Hz increments (The | | |
| Set frequency (RAM, EEPROM) | | Write | HEE | display can be changed to the rotations per minute using Pr.37 and Pr.144. (Refer to page 305.)) To change the set frequency consecutively, write data to the inverter RAM. (Instruction code: HED) | 4 digits (A and C/D) | |
| Inv | erter reset | Write | HFD | H9696: Inverter reset As the inverter is reset at the start of communication by the computer, the inverter cannot send reply data back to the computer. H9966: Inverter reset | 4 digits (A and C/D) | |
| | | | | • When data is sent normally, ACK is returned to the computer, and then the inverter is reset. | 4 digits (A and D) | |
| Fa | ult history clear | Write | HF4 | H9696: Fault history is cleared. | 4 digits (A and C/D) | |

| | Item Read/ Instruction Code Data description | | | | | | |
|--|---|--|---------------------------|--|----------------------------|--|--|
| Parameter clear / All parameter clear | | Write | HFC | All parameters return to initial values. Whether to clear communication parameters or not can be selected according to the data. Parameter clear H9696: Parameters including communication parameters are cleared. H5A5A: Parameters other than communication parameters are cleared. *2 All parameter clear H9966: Parameters including communication parameters are cleared. *2 All parameter clear H9966: Parameters other than communication parameters are cleared. *2 *2 All parameter clear H9966: Parameters other than communication parameters are cleared. *2 *2 For details on whether or not to clear parameters, refer to page 668. When a clear is performed with H9696 or H9966, communication related parameter settings also return to the initial values. When resuming the operation, set the parameters again. Performing a clear will clear the instruction code HEC, HF3, and HFF settings. Only H9966 and H55AA (All parameter clear) are valid when a password is registered (refer to page 208). | 4 digits (A and C/D) | | |
| Pa | ramotor | Read | H00 to H6B | Refer to the instruction code (page 668) and write and/or read parameter values as required. When setting Pr.100 and later, the link parameter | 4 digits (B and E/D) | | |
| Parameter | | Write | H80 to HEB | extended setting must be set. | 4 digits (A and C/D) | | |
| Lin | k parameter | | | Parameter settings are changed according to the instruction code settings. | 2 digits (B and E1/D) | | |
| ext | ended setting | | | For details of the settings, refer to the instruction code (page 668). | 2 digits (A1 and C/D) | | |
| | cond parameter | Read | H6C | When setting the calibration parameters ^{*3} H00: Frequency ^{*4} | 2 digits (B and E1/D) | | |
| | anging(instruction de HFF = 1, 9) | 1.9) Write HEC H01: Parameter-set analog value | | | 2 digits (A1 and C/D) | | |
| Mu | lti command | Read/ write | HF0 | Available for writing 2 commands, and monitoring 2 items for reading data. (Refer to page 519 for details.) | 10 digits (A2 and C1/D) | | |
| profile | Madel The model name can be read in ASCII code. "H20" (blank code) is set for blank area. 2 | | 20 digits (B and E3/D) | | | | |
| Product profile | Capacity | Read | H7D | The capacity in the inverter model can be read in ASCII code. Data read is displayed in increments of 0.1 kW (rounded down to one decimal place). "H20" (blank code) is set for blank area. Example) 0.75K: " 7" (H20, H20, H20, H20, H20, H37) | 6 digits (B and E2/D) | | |

*1 Refer to page 508 for data formats (A, A1, A2, B, C, C1, D, E, E1, E2, E3, F).

*2 Turning OFF the power supply while clearing parameters with H5A5A or H55AA returns the communication parameter settings to the initial settings.

*3 Refer to the following calibration parameter list for details on the calibration parameters.

*4 The gain frequency can be also written using Pr.125 (instruction code: H99) or Pr.126 (instruction code: H9A).

- NOTE

- Set 65520 (HFFF0) as a parameter value "8888" and 65535 (HFFFF) as "9999".
- For the instruction codes HFF, HEC, and HF3, their values once written are held, but cleared to zero when an inverter reset or all clear is performed.
- When a 32-bit parameter setting or monitor item is read and the value to be read exceeds HFFFF, HFFFF is returned.

Example) When reading the C3 (Pr.902) and C6 (Pr.904) settings from the inverter of station No. 0.

| | Computer send data | Inverter send data | Description |
|---|--------------------|--------------------|--|
| а | ENQ 00 FF 0 01 7D | ACK 00 | "H01" is set in the extended link parameter. |
| b | ENQ 00 EC 0 01 79 | ACK 00 | "H01" is set in the second parameter changing. |
| С | ENQ 00 5E 0 0A | STX 00 0000 ETX 20 | C3 (Pr.902) is read. 0% is read. |
| d | ENQ 00 60 0 F6 | STX 00 0000 ETX 20 | C6 (Pr.904) is read. 0% is read. |

To read/write C3 (Pr.902) or C6 (Pr.904) after inverter reset or parameter clear, execute from (a) again.

◆ List of calibration parameters

| Pr. | Name | Instruction code | | | | | | |
|--------------|--|------------------|-------|----------|--|--|--|--|
| F1. | Name | Read | Write | Extended | | | | |
| C2 (902) | Terminal 2 frequency setting bias frequency | 5E | DE | 1 | | | | |
| C3 (902) | Terminal 2 frequency setting bias | 5E | DE | 1 | | | | |
| 125 (903) | Terminal 2 frequency setting gain frequency | 5F | DF | 1 | | | | |
| C4 (903) | Terminal 2 frequency setting gain | 5F | DF | 1 | | | | |
| C5 (904) | Terminal 4 frequency setting bias frequency | 60 | E0 | 1 | | | | |
| C6 (904) | Terminal 4 frequency setting bias | 60 | E0 | 1 | | | | |
| 126 (905) | Terminal 4 frequency setting gain frequency | 61 | E1 | 1 | | | | |
| C7 (905) | Terminal 4 frequency setting gain | 61 | E1 | 1 | | | | |
| C12 (917) | Terminal 1 bias frequency (speed) | 11 | 91 | 9 | | | | |
| C13 (917) | Terminal 1 bias (speed) | 11 | 91 | 9 | | | | |
| C14 (918) | Terminal 1 gain frequency (speed) | 12 | 92 | 9 | | | | |
| C15 (918) | Terminal 1 gain (speed) | 12 | 92 | 9 | | | | |
| C16 (919) | Terminal 1 bias command (torque) | 13 | 93 | 9 | | | | |
| C17 (919) | Terminal 1 bias (torque) | 13 | 93 | 9 | | | | |

| Pr. | Name | Ins | structio | n code |
|--------------|-------------------------------------|------|----------|----------|
| Pr. | | Read | Write | Extended |
| C18 (920) | Terminal 1 gain command (torque) | 14 | 94 | 9 |
| C19 (920) | Terminal 1 gain (torque) | 14 | 94 | 9 |
| C8 (930) | Current output bias signal | 1E | 9E | 9 |
| C9 (930) | Current output bias current | 1E | 9E | 9 |
| C10 (931) | Current output gain signal | 1F | 9F | 9 |
| C11 (931) | Current output gain current | 1F | 9F | 9 |
| C38 (932) | Terminal 4 bias command (torque) | 20 | A0 | 9 |
| C39 (932) | Terminal 4 bias (torque) | 20 | A0 | 9 |
| C40 (933) | Terminal 4 gain command (torque) | 21 | A1 | 9 |
| C41 (933) | Terminal 4 gain (torque) | 21 | A1 | 9 |
| C42 (934) | PID display bias coefficient | 22 | A2 | 9 |
| C43 (934) | PID display bias analog value | 22 | A2 | 9 |
| C44 (935) | PID display gain coefficient | 23 | A3 | 9 |
| C45 (935) | PID display gain analog value | 23 | A3 | 9 |

Operation command

| Item | Instruction code | Bit length | Description ^{*1*4} | Example |
|------------------------------------|------------------|---------------|---|--|
| Operation command | HFA | 8 bits | b0: AU (Terminal 4 input selection) b1: Forward rotation command b2: Reverse rotation command b3: RL (Low-speed operation command) b4: RM (Middle-speed operation command) b5: RH (High-speed operation command) b6: RT (Second function selection) b7: MRS (Output stop)^{*2} | [Example 1] H02 Forward rotation b7 b0 0 0 0 0 1 0 [Example 2] H00 Stop b7 b0 0 0 0 0 0 0 |
| Operation command (extended) | HF9 | 16 bits | b0: AU (Terminal 4 input selection) b1: Forward rotation command b2: Reverse rotation command b3: RL (Low-speed operation command) b4: RM (Middle-speed operation command) b5: RH (High-speed operation command) b6: RT (Second function selection) b7: MRS (Output stop) ^{*2} b8: JOG (Jog operation selection) ^{*3} b9: CS (No function) ^{*3} b10: STP (STOP) (Start self-holding selection) ^{*3} b11: RES (Inverter reset) ^{*3} b12 to b15: – | [Example 1] H0002 Forward rotation b15 b0 0 0 0 0 0 0 0 0 1 0 [Example 2] H0804 Low-speed reverse operation (When Pr. 189 RES terminal function selection is set to "0") b15 b0 0 0 0 1 0 0 0 0 1 0 |

*1 The signal within parentheses () is the initial status. The description changes depending on the setting of **Pr.180 to Pr.189 (Input terminal function selection)** (page 373).

518 ^{5. PARAMETERS}

- *2 The Inverter run enable signal is in the initial status for the separated converter type.
- *3 JOG operation/automatic restart after instantaneous power failure/start self-holding selection/reset cannot be controlled over a network, so in the initial status bit 8 to bit 11 are invalid. To use bit 8 to bit 11, change the signal by Pr.185, Pr.186, Pr.188, or Pr.189 (Input terminal function selection) (page 373) (A reset can be executed by the instruction code HFD.)
- *4 During RS-485 communication through the PU connector, only the Forward rotation command and Reverse rotation command signals can be used.

Inverter status monitor

| Item | Instruction code | Bit length | Description ^{*1} | Example |
|---|---------------------|---------------|---|--|
| Inverter status monitor | H7A | 8 bits | b0: RUN (Inverter running) b1: Forward rotation output b2: Reverse rotation output b3: SU (Up to frequency) b4: OL (Overload warning) b5: IPF (Instantaneous power failure/undervoltage) ^{*2} b6: FU (Output frequency detection) b7: ABC1 (Fault) | $\begin{bmatrix} \text{Example 1} & \text{H03 } \cdots & \text{During forward} \\ b7 & \text{rotation} & b0 \\ \hline 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ \hline 0 & 0 & 0 & 0 & 0 & 1 & 1 \\ \end{bmatrix}$ $\begin{bmatrix} \text{Example 2} & \text{H80 } \cdots & \text{Stop at fault} \\ \text{occurrence} \\ b7 & b0 \\ \hline 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ \hline \end{bmatrix}$ |
| Inverter status monitor (extended) | Н79 | 16 bits | b0: RUN (Inverter running) b1: Forward rotation output b2: Reverse rotation output b3: SU (Up to frequency) b4: OL (Overload warning) b5: IPF (Instantaneous power failure/undervoltage)*2 b6: FU (Output frequency detection) b7: ABC1 (Fault) b8: ABC2 (-) b9: Safety monitor output b10 to b14: - b15: Fault occurrence | [Example 1] H0003 ··· During forward rotation b15 b0 0 0 0 0 0 0 0 0 1 1 [Example 2] H8080 ··· Stop at fault occurrence b15 b0 0 |

*1 The signal within parentheses () is the initial status. The description changes depending on the setting of **Pr.190 to Pr.196 (Output terminal function selection)**.

*2 No function is assigned in the initial status for the separated converter type.

Multi command (HF0)

• Sending data format from computer to inverter

| | Format | | | | | | | | Numbe | r of cl | naract | ers | | | | | | | | |
|--------|--------|-----|------------------|---|----------------|---|---------------|------------------------------------|---------------------------------------|---------|-----------------|-----|----|------|-----------------|----|----|------|-------|-----------|
| Format | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | |
| | A2 | ENQ | Invert statio | | Instru code | | Time delay | Send data type ^{*1} | Receive data type ^{*2} | Data | 1 ^{*3} | | | Data | 2 ^{*3} | | | Sumo | check | CR/ LF |

· Reply data format from inverter to computer (No data error detected)

| Format | | | | | | | N | lumbe | r of c | haract | ters | | | | | | | | |
|--------|-----|--------------------|---|------------------------------------|---------------------------------------|----------------------------------|----------------------------------|-------|-----------------|--------|------|------|-----------------|----|----|-----|-----|-------|-----------|
| Format | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| C1 | STX | Inverte statior | | Send data type ^{*1} | Receive data type ^{*2} | Error code 1 ^{*5} | Error code 2 ^{*5} | Data | 1 ^{*4} | | | Data | 2 ^{*4} | | | ETX | Sum | check | CR/ LF |

*1 Specify the data type of sending data (from computer to inverter).

- *2 Specify the data type of reply data (from inverter to computer).
- *3 Combination of data 1 and data 2 for sending

| Data type | Data 1 | Data 2 | Remarks |
|-----------|---------------------------------|--------------------------------|--|
| 0 | Operation command (extended) | Set frequency (RAM) | Run command (extended) is same as instruction code HF9. (Refer |
| 1 | Operation command (extended) | Set frequency (RAM, EEPROM) | to page 518.) |

*4 Combination of data 1 and data 2 for reply

| Data type | Data 1 | Data 2 | Remarks |
|-----------|---------------------------------------|-----------------------------|---|
| 0 | Inverter status monitor (extended) | Output frequency (speed) | Inverter status monitor (extended) is same as instruction code H79. (Refer to page 519.) Replies the monitor item specified in instruction |
| 1 | Inverter status monitor (extended) | Special monitor | code HF3 for special monitor. (Refer to page 305.) |

*5 The error code for sending data 1 is set in error code 1, and the error code for sending data 2 is set in error code 2. Mode error (HA), instruction code error (HB), data range error (HC) or no error (HF) is replied. (Refer to page 592 for details on the error codes.)

5.12.6 MODBUS RTU communication specification

Operation by MODBUS RTU communication or parameter setting is possible by using the MODBUS RTU communication protocol through the RS-485 terminals of the inverter.

| Pr. | Name | Initial value | Setting range | Dese | cription | | |
|-------------|---|------------------|--|--|--------------------------------------|--|--|
| | | | 0 | Broadcast communication | | | |
| 331 N030 | RS-485 communication station number | 0 | 1 to 247 | Specify the inverter station number. Enter the inverter station numbers when two or more inverters are connected to one personal computer. | | | |
| 332 N031 | RS-485 communication speed | 96 | 3, 6, 12, 24, 48, 96, 192, 384, 576, 768, 1152 | Select the communication spec The setting value × 100 equals For example, enter 96 to set the bps. | | | |
| N033 | RS-485 communication stop bit | 1 | 0 | Stop bit length 1 bit | Valid when Pr.N034 (Pr.334) = | | |
| NUSS | length | 1 | 1 | Stop bit length 2 bits | "0" | | |
| | | | 0 | Stop bit length 1 bit | | | |
| 333 | RS-485 communication stop bit length / data length | 1 | 1 | Stop bit length 2 bits | Valid when Pr.334 = "0" | | |
| 333 | | | 10 | Stop bit length 1 bit | | | |
| | | | 11 | Stop bit length 2 bits | | | |
| | | | 0 | Without parity check Stop bit length 1 bit / 2 bits (depends on the setting of Pr.333) | | | |
| 334 N034 | RS-485 communication parity check selection | 2 | 1 | With parity check at odd numbers. Stop bit length: 1 bit. | | | |
| | | | 2 | With parity check at even numbers. Stop bit length: 1 bit. | | | |
| 343 N080 | Communication error count | 0 | _ | Displays the communication er communication. Read-only. | ror count during MODBUS RTU | | |
| | | | 0 | MODBUS RTU communicatior output is shut off in the NET op | | | |
| 539 N002 | MODBUS RTU communication check time interval | 9999 | 0.1 to 999.8 s | Set the interval of the commun detection) time (Same specific | | | |
| | | | 9999 | No communication check (sign | al loss detection) | | |
| 540 | | | 0 | Mitsubishi inverter protocol (co | mputer link) | | |
| 549 N000 | Protocol selection | 0 | 1 | MODBUS RTU protocol | | | |
| | | | 2 | BACnet MS/TP protocol | | | |

- To use the MODBUS RTU protocol, set "1" in Pr.549 Protocol selection.
- If MODBUS RTU communication is performed from the master to the address 0 (station number 0), the data is broadcasted, and the inverter does not send any reply to the master. To obtain replies from the inverter, set Pr.331 RS-485 communication station number ≠ "0 (initial value)".

Some functions are disabled in broadcast communication. (Refer to page 522.)

• If a communication option is installed with **Pr.550 NET mode operation command source selection** = "9999 (initial value)", commands (operation commands) transmitted via RS-485 terminals become invalid. (Refer to page 251.)

Communication specifications

• The communication specifications are shown in the following table.

| lte | em | Description | Related parameter |
|-------------------|---------------------|--|-------------------|
| Communication | protocol | MODBUS RTU protocol | Pr.549 |
| Conforming stan | dard | EIA-485 (RS-485) | — |
| Number of conne | ctable units | 1: N (maximum 32 units), setting is 0 to 247 stations | Pr.331 |
| Communication s | speed | Selected among 300/600/1200/2400/4800/9600/19200/38400/57600/76800/ 115200 bps. | Pr.332 |
| Control procedur | е | Asynchronous method | — |
| Communication | method | Half-duplex system | — |
| | Character system | Binary (fixed at 8 bits) | — |
| | Start bit | 1 bit | — |
| Communication | Stop bit length | Select from the following three types: | |
| specifications | Parity check | No parity check, stop bit length 1 bit / 2 bits (depends on the setting of Pr.333). Odd parity check, stop bit length 1 bit. Even parity check, stop bit length 1 bit. | Pr.333 Pr.334 |
| | Error check | CRC code check | - |
| Terminator | | Not available | _ |
| Time delay settin | g | Not available | - |

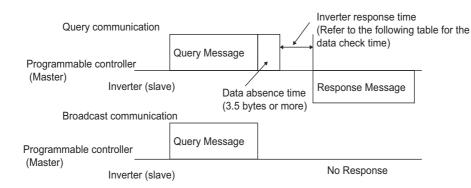
Outline

• The MODBUS communication protocol was developed by Modicon for programmable controllers.

 The MODBUS protocol uses exclusive message frames to perform serial communication between a master and slaves. These exclusive message frames are provided with a feature called "functions" that allows data to be read or written. These functions can be used to read or write parameters from the inverter, write input commands to the inverter or check the inverter's operating status, for example. This product classifies the data of each inverter into holding register area (register address 40001 to 49999). The master can communicate with inverters (slaves) by accessing pre-assigned holding register addresses.

• There are two serial transmission modes, the ASCII (American Standard Code for Information Interchange) mode and the RTU (Remote Terminal Unit) mode. However, this product supports only the RTU mode, which transfers 1 byte data (8 bits) as it is. Also, only communication protocol is defined by the MODBUS protocol. Physical layers are not stipulated.

Message format



· Data check time

| Item | Check time |
|---|-----------------|
| Monitoring, operation command, frequency setting (RAM) | Less than 12 ms |
| Parameter read/write, frequency setting (EEPROM) | Less than 30 ms |
| Parameter clear / All parameter clear | < 5 s |
| Reset command | No reply |

Query

A message is sent to the slave (the inverter) having the address specified by the master.

Normal response

After the query from the master is received, the slave executes the request function, and returns the corresponding normal response to the master.

Error Response

When an invalid function code, address or data is received by the slave, the error response is returned to the master. This response is appended with an error code that indicates the reason why the request from the master could not be executed.

This response cannot be returned for errors, detected by the hardware, frame error and CRC check error.

Broadcast

The master can broadcast messages to all slaves by specifying address 0. All slaves that receive a message from the master execute the requested function. With this type of communication, slaves do not return a response to the master.

NOTE

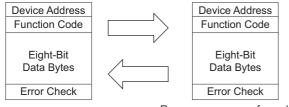
• During broadcast communication, functions are executed regarded of the set inverter station number (Pr.331).

Message frame (protocol)

Communication method

Basically, the master sends a query message (inquiry), and slaves return a response message (response). At normal communication, the device address and function code are copied as they are, and at erroneous communication (illegal function code or data code), bit 7 (= H80) of the function code is turned ON, and the error code is set at data bytes.

Query message from Master



Response message from slave

Message frames comprise the four message fields shown in the figures above.

A slave recognizes message data as one message when a 3.5 character long no-data time (T1: start/end) is added before and after the data.

Details of protocol

The following table explains the four message fields.

| Start | Address | Address Function | | CRC check | | End |
|-----------------|---|--|--|---|---------------------------------|--|
| Т1 | 8 bits | 8 bits | n × 8 bits | L 8 bits | H 8 bits | T1 |
| Message field | | | Description | | | |
| Address field | (instructions to a The response free | all addresses), and "1 to | (8-bit) length field. Set o 247" to send message ains the address set by e slave address. | es to individua | l slaves. | J |
| Function field | be sent to the sla list for details of those in the fund | ave as the request, and the supported function ction code list is set. onse from the slave co | ode in the single-byte (8 d the slave performs the codes. An error respon intains the function code | requested op se is generate | eration. Refer d when a func | to the function code tion code other than |
| Data field | | • • | tion code. (Refer to pag content of holding regis | , | ata, for examp | le, includes the byte |
| CRC check field | re detected. Errors are d in the CRC is appended sytes. Inder that appends the C ceived, and compares th the two values do not r | to the messa CRC to the me ne calculation | ge, the lower b ssage. The rec result against | ytes of the CRC are ceiver recalculates the actual value that | | |

Function code list

| Function name | Read/ write | Code | Outline | Broadcast communication | Message format reference page |
|-------------------------------------|----------------|------|--|-------------------------|--|
| Read holding register | Read | H03 | The data of the holding registers is read. The various data of the inverter can be read from MODBUS registers. System environmental variable (Refer to page 528.) Real time monitor (Refer to page 306.) Fault history (Refer to page 530.) Product profile (Refer to page 530.) Inverter parameters (Refer to page 529.) | Not available | page 523 |
| Preset single register | Write | H06 | Data is written to a holding register. Data can be written to MODBUS registers to output instructions to the inverter or set parameters. System environmental variable (Refer to page 528.) Inverter parameters (Refer to page 529.) | Available | page 524 |
| Diagnostics | Read | H08 | Functions are diagnosed. (communication check only) A communication check can be made since the query message is sent and the query message is returned as it is as the return message (subfunction code H00 function). Subfunction code H00 (Return query data) | Not available | page 525 |
| Preset multiple registers | Write | H10 | Data is written to multiple consecutive holding registers. Data can be written to consecutive multiple MODBUS registers to output instructions to the inverter or set parameters. System environmental variable (Refer to page 528.) Inverter parameters (Refer to page 529.) | Available | page 525 |
| Read holding register access log | Read | H46 | The number of registers that were successfully accessed by the previous communication is read. Queries by function codes H03 and H10 are supported. The number and start address of holding registers successfully accessed by the previous communication are returned. "0" is returned for both the number and start address for queries other than function code H03 and H10. | Not available | page 526 |

◆ Read holding register (reading data of holding registers) (H03 or 03)

Query message

| a. Slave address | b. Function | c. Starting | g address | d. No. o | f points | CRC | check |
|------------------|-------------|-------------|-----------|----------|----------|----------|----------|
| (8 bits) | H03 | H L | | H L | | L | Н |
| (0 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) |

Normal response (Response message)

| a. Slave address | b. Function | e. Byte count | f. Data | | | CRC check | |
|------------------|-----------------|---------------|---------------|---------------|-------------------|---------------|---------------|
| (8 bits) | H03 (8 bits) | (8 bits) | H (8 bits) | L (8 bits) | (n × 16 bits) | L (8 bits) | H (8 bits) |

• Query message setting

| | Message | Description |
|---|------------------|--|
| а | Slave address | Set the address to send messages to. Broadcast communication is not possible. (Invalid when "0" is set.) |
| b | Function | Set H03. |
| с | Starting address | Set the holding register address from which to start reading the data. Starting address = start register address (decimal) - 40001 For example, when starting register address 0001 is set, the data of holding register address 40002 is read. |
| d | No. of points | Set the number of holding registers for reading data. Data can be read from up to 125 registers. |

· Content of normal response

| | Message | Description |
|---|------------|---|
| е | Byte count | The setting range is H02 to HFA (2 to 250). Twice the number of reads specified by (d) is set. |
| f | Data | The amount of data specified by (d) is set. Read data is output Hi bytes first followed by Lo bytes, and is arranged as follows: data of start address, data of start address+1, data of start address+2, and so forth. |

■ Example) Read the register values of 41004 (Pr.4) to 41006 (Pr.6) from slave address 17 (H11).

Query message

| Slave address | Function | Starting address | | No. of | points | CRC check | |
|---------------|----------|------------------|----------|----------|----------|-----------|----------|
| H11 | H03 | H03 | HEB | H00 | H03 | H77 | H2B |
| (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) |

Normal response (Response message)

| Slave address | Function | Byte count | | Data | | | | | CRC check | | |
|---------------|----------|------------|----------|----------|----------|----------|----------|----------|-----------|----------|--|
| H11 | H03 | H06 | H17 | H70 | H0B | HB8 | H03 | HE8 | H2C | HE6 | |
| (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | |

Read value

Register 41004 (**Pr.4**): H1770 (60.00 Hz) Register 41005 (**Pr.5**): H0BB8 (30.00 Hz)

Register 41006 (Pr.6): H03E8 (10.00 Hz)

Preset single register (writing data to holding registers) (H06 or 06)

- The content of the system environmental variables and inverter parameters (refer to page 528) assigned to the holding register area can be written.
- Query message

| a. Slave address | b. Function | c. Register address | | d. Pres | et data | CRC check | |
|------------------|-------------|---------------------|----------|----------|----------|-----------|----------|
| (8 bits) | H06 | Н | L | Н | L | L | Н |
| | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) |

Normal response (Response message)

| a. Slave address | b. Function | c. Register address | | d. Pres | et data | CRC check | |
|------------------|-------------|---------------------|----------|----------|----------|-----------|----------|
| (8 bits) | H06 | Н | L | Н | L | L | Н |
| | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) |

· Query message setting

| | Message | Description |
|---|------------------|---|
| а | Slave address | Set the address to send messages to. Setting "0" enables broadcast communication. |
| b | Function | Set H06. |
| с | Register address | Set the holding register address to write data to. Register address = holding register address (decimal) - 40001 For example, when register address 0001 is set, data is written to holding register address 40002. |
| d | Preset Data | Set the data to write to the holding register. Write data is fixed at 2 bytes. |

· Content of normal response

The contents in the normal response (a to d, including the CRC check) are the same as those in the query messages.

In the case of broadcast communication, no response is returned.

■ Example) Write 60 Hz (H1770) to 40014 (set frequency RAM) of slave address 5 (H05).

Query message

| Slave address | Function | Register address | | Prese | t data | CRC check | | |
|---------------|----------|------------------|----------|----------|----------|-----------|----------|--|
| H05 | H06 | H00 | H0D | H17 | H70 | H17 | H99 | |
| (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | |

Normal response (Response message)

The same data as those in the query message

NOTE

• With broadcast communication, no response is generated even if a query is executed, so when the next query is made, it must be made after waiting for the inverter data processing time after the previous query is executed.

Diagnostics (diagnosis of functions) (H08 or 08)

- A communication check can be made since the query message is sent and the query message is returned as it is as the return message (subfunction code H00 function). Subfunction code H00 (Return query data)
- Query message

| a. Slave address b. Function | | c. Subf | unction | d. D | ata | CRC check | |
|------------------------------|----------|----------|----------|----------|----------|-----------|----------|
| (8 hits) | H08 | H00 | H00 | H | L | L | H |
| | (8 bits) | (8 bits) |

· Normal response (Response message)

| a. Slave address | b. Function | c. Subf | unction | d. C | Data | CRC check | | |
|------------------|-------------|----------|----------|----------|----------|-----------|----------|--|
| (8 bits) | H08 | H00 | H00 | Н | L | L | Н | |
| | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | |

· Query message setting

| | Message | Description |
|---|---------------|--|
| а | Slave address | Set the address to send messages to. Broadcast communication is not possible. (Invalid when "0" is set.) |
| b | Function | Set H08. |
| с | Subfunction | Set H0000. |
| d | Data | Any 2-byte long data can be set. The setting range is H0000 to HFFFF. |

· Content of normal response

The contents in the normal response (a to d, including the CRC check) are the same as those in the query messages.

• NOTE

• With broadcast communication, no response is generated even if a query is executed, so when the next query is made, it must be made after waiting for the inverter data processing time after the previous query is executed.

Preset multiple registers (writing data to multiple holding registers) (H10 or 16)

- · Data can be written to multiple holding registers.
- · Query message

| a. Slave address | b. Function | | arting ress | | o. of sters | e. Byte count | | f. Data | 1 | CRC | check |
|---------------------|-----------------|---------------|----------------|---------------|----------------|---------------|---------------|---------------|-------------------------|---------------|---------------|
| (8 bits) | H10 (8 bits) | H (8 bits) | L (8 bits) | H (8 bits) | L (8 bits) | (8 bits) | H (8 bits) | L (8 bits) | (n × 2 × 8 bits) | L (8 bits) | H (8 bits) |

· Normal response (Response message)

| a. Slave address | b. Function | c. Starting | c. Starting address | | registers | CRC check | | |
|------------------|-------------|-------------|---------------------|----------|-----------|-----------|----------|--|
| (8 bits) | H10 | Н | L | Н | L | L | Н | |
| (8 DIIS) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | |

• Query message setting

| | Message | Description |
|---|------------------|---|
| а | Slave address | Set the address to send messages to. Setting "0" enables broadcast communication. |
| b | Function | Set H10. |
| с | Starting address | Set the holding register address from which to start writing the data. Starting address = start register address (decimal) - 40001 For example, when starting address 0001 is set, data is written to holding register 40002. |
| d | No. of registers | Set the number of holding registers for writing data. Data can be written to up to 125 registers. |
| е | Byte count | The setting range is H02 to HFA (2 to 250). Set twice the value specified by d . |
| f | Data | Set the amount of data specified by d . Write data is output Hi bytes first followed by Lo bytes, and is arranged as follows: data of start address, data of start address+1, data of start address+2, and so forth. |

Content of normal response

The contents in the normal response (a to d, including the CRC check) are the same as those in the query messages.

■ Example) Write 0.5 s (H05) to 41007 (Pr.7) and 1 s (H0A) to 41008 (Pr.8) of slave address 25 (H19).

Query message

| Slave address | Function | Starting | address | No. of r | egisters | Byte count | | Da | ata | | CRC | check |
|------------------|----------|----------|----------|----------|----------|------------|----------|----------|----------|----------|----------|----------|
| H19 | H10 | H03 | HEE | H00 | H02 | H04 | H00 | H05 | H00 | H0A | H86 | H3D |
| (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) |

Normal response (Response message)

| Slave address | Function | Starting | address | No. of r | egisters | CRC | check |
|------------------|----------|----------|----------|----------|----------|----------|----------|
| H19 | H10 | H03 | HEE | H00 | H02 | H22 | H61 |
| (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) |

Read holding register access log (H46 or 70)

- Queries by function codes H03 and H10 are supported. The number and start address of holding registers successfully accessed by the previous communication are returned. "0" is returned for both the number and start address for queries other than the function codes above.
- Query message

| a. Slave address | b. Function | CRC check | | |
|------------------|-------------|-----------|----------|--|
| (8 bits) | H46 | L | H | |
| | (8 bits) | (8 bits) | (8 bits) | |

• Normal response (Response message)

| a. Slave address b. Function | | c. Starting address | | d. No. of points | | CRC check | |
|------------------------------|----------|---------------------|----------|------------------|----------|-----------|----------|
| (0 hite) | H46 | Н | L | Н | L | L | Н |
| (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) |

· Query message setting

| | Message | Description |
|---|---------------|--|
| а | Slave address | Set the address to send messages to. Broadcast communication is not possible. (Invalid when "0" is set.) |
| b | Function | Set H46. |

· Content of normal response

| | Message | Description |
|---|------------------|---|
| с | Starting address | The start address of the holding register that was successfully accessed is returned. Starting address = start register address (decimal) - 40001 For example, when starting address 0001 is returned, the holding register address that was successfully accessed is 40002. |
| d | No. of points | The number of holding registers that were successfully accessed is returned. |

Example) Read the successful register start address and number of successful accesses from slave address 25 (H19).

Query message

| Slave address | Function | CRC | check |
|---------------|----------|----------|----------|
| H19 | H46 | H8B | HD2 |
| (8 bits) | (8 bits) | (8 bits) | (8 bits) |

Normal response (Response message)

| Slave address | Function | Starting address | | No. of points | | CRC check | |
|---------------|----------|------------------|----------|---------------|----------|-----------|----------|
| H19 | H10 | H03 | HEE | H00 | H02 | H22 | H61 |
| (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) |

The number of holding registers that were successfully accessed was returned as two with the start address 41007 (Pr.7).

Error response

• An error response is returned if the query message received from the master contains an illegal function, address or data. No response is returned for parity, CRC, overrun, framing, and busy errors.



· No response is also returned in the case of broadcast communication.

• Error response (Response message)

| a. | . Slave address | b. Function | c. Exception code | CRC | check | |
|------------|-----------------|---|---|---|---------------|--|
| (8 | bits) | H80 + Function (8 bits) | (8 bits) | L (8 bits) | H (8 bits) | |
| | Message | | Description | | | |
| а | a Slave address | | Set the address received from the master. | | | |
| b Function | | The function code requested by the master and H80 is set. | | | | |
| с | Exception code | | The codes in the foll | The codes in the following table are set. | | |

· Error code list

| Code | Error item | Error description |
|------|------------------------------------|---|
| 01 | ILLEGAL FUNCTION | The query message from the master has a function code that cannot be handled by the slave. |
| 02 | ILLEGAL DATA ADDRESS ^{*1} | The query message from the master has a register address that cannot be handled by the slave. (No parameter, parameter cannot be read, parameter cannot be written) |
| 03 | ILLEGAL DATA VALUE | The query message from the master has data that cannot be handled by the slave. (Out of parameter write range, a mode is specified, or other error) |

- *1 An error response is not returned in the following cases:
 - (a) Function code H03 (reading data of holding registers)
 - When the number of registers is specified as one or more and there are one or more holding registers from which data can be read
 - (b) Function code H10 (writing data to multiple holding registers)
 - When the number of registers is specified as one or more and there are one or more holding registers to which data can be written.

In other words, when function code H03 or H10 is used and multiple holding registers are accessed, an error response is not returned even if a nonexistent holding register or holding register that cannot be read or written from/to is accessed.

NOTE

- An error response is returned if none of the accessed holding registers exist. When an accessed holding register does not exist, the read value is 0 and the written data is invalid.
- · Error detection of message data

The following errors are detected in message data from the master. The inverter output is not shut off even if an error is detected.

Error check items

| Error item | Error description | Inverter operation | |
|---------------------|--|--|--|
| Parity error | The data received by the inverter is different from the specified parity (Pr.334 setting). | | |
| Framing error | The data received by the inverter is different from the stop bit length (Pr.333/Pr.334) setting. | W/k on this summer account Dr 242 is | |
| Overrun error | The next data has been sent by the master before the inverter completes receiving the preceding data. | When this error occurs, Pr.343 is incremented by one. When this error occurs, the LF signal is | |
| Message frame error | The data length of the message frame is checked, and an error is generated if the received data length is less than 4 bytes. | output. | |
| CRC check error | An error is generated if the data in the message frame does not match the calculation result. | | |

- NOTE

• The LF signal can be assigned to an output terminal by setting **Pr.190 to Pr.196 (Output terminal function selection)**. Changing the terminal assignment may affect other functions. Set parameters after confirming the function of each terminal.

♦ MODBUS register

- The following shows the MODBUS registers for system environment variables (read/write), real time monitor items (read), parameters (read/write), fault history data (read/write), and model information monitor items (read).
- · System environment variables

| Register | Definition | Read/write | Remarks |
|----------|---|------------|--|
| 40002 | Inverter reset | Write | Any value |
| 40003 | Parameter clear | Write | Set H965A. |
| 40004 | All parameter clear | Write | Set H99AA. |
| 40006 | Parameter clear ^{*1} | Write | Set H5A96. |
| 40007 | All parameter clear ^{*1} | Write | Set HAA99. |
| 40009 | Inverter status / control input command ^{*2} | Read/write | Refer to the following. |
| 40010 | Operation mode / inverter setting ^{*3} | Read/write | Refer to the following. |
| 40014 | Running frequency (RAM value) | Read/write | The display can be changed to the rotations per |
| 40015 | Running frequency (EEPROM value) | Write | minute using Pr.37 and Pr.144 . (Refer to page 305.) |

*1 Settings in the communication parameters are not cleared.

*2 The data is written as a control input command for writing.

The data is read as the inverter status for reading.

- *3 The data is written as an operation mode setting for writing.
- The data is read as the operation mode status for reading.

[Inverter status / control input command]

| Bit | Definition | | | | | |
|-----|---|---|--|--|--|--|
| ы | Control input command | Inverter status | | | | |
| 0 | Stop command | RUN (Inverter running) ^{*6} | | | | |
| 1 | Forward rotation command | Forward rotation output | | | | |
| 2 | Reverse rotation command | Reverse rotation output | | | | |
| 3 | RH (High-speed command) ^{*4} | SU (Up to frequency) ^{*6} | | | | |
| 4 | RM (Middle-speed operation command) ^{*4} | OL (Overload) ^{*6} | | | | |
| 5 | RL (Low-speed operation command) ^{*4} | IPF (Instantaneous power failure) ^{*6*7} | | | | |
| 6 | JOG (JOG operation) ^{*4} | FU (Frequency detection) ^{*6} | | | | |
| 7 | RT (Second function selection) ^{*4} | ABC1 (Fault) ^{*6} | | | | |
| 8 | AU (Current input selection) ^{*4} | ABC2 (-) ^{*6} | | | | |
| 9 | CS (No function) ^{*4} | Safety monitor output | | | | |
| 10 | MRS (Output stop) ^{*4*5} | 0 | | | | |
| 11 | STP (STOP) (Start self-holding) ^{*4} | 0 | | | | |
| 12 | RES (Inverter reset) ^{*4} | 0 | | | | |
| 13 | — | 0 | | | | |
| 14 | _ | 0 | | | | |
| 15 | — | Fault occurrence | | | | |

*4 The signal within parentheses () is the initial status. The description changes depending on the setting of **Pr.180 to Pr.189 (Input terminal function selection)** (page 373).

The signals assigned to the input terminals may be valid or invalid in the NET operation mode. (Refer to page 255.)

*5 The Inverter run enable signal is in the initial status for the separated converter type.

*6 The signal within parentheses () is the initial status. The description changes depending on the setting of **Pr.190 to Pr.196 (Output terminal function selection)** (page 330).

*7 No function is assigned in the initial status for the separated converter type.

[Operation mode / inverter setting]

| Mode | Read value | Write value |
|-------------|------------|---------------------|
| EXT | H0000 | H0010 ^{*8} |
| PU | H0001 | H0011 ^{*8} |
| EXT JOG | H0002 | — |
| PU JOG | H0003 | — |
| NET | H0004 | H0014 |
| PU + EXT | H0005 | — |

- *8 Writing is available depending on the **Pr.79** and **Pr.340** settings. For the details, refer to page 250. Restrictions in each operation mode conform with the computer link specification.
- Real time monitor
 - Refer to page 305 for the register numbers and monitor items of the real time monitor.
- Parameter

| Pr. | Register | Name | Read/write | Remarks |
|-------------------|-------------------|---|------------|---|
| 0 to 999 | 41000 to 41999 | For details on parameter names, refer to the parameter list (page 140). | Read/write | The parameter number + +41000 is the register number. |
| C2 (902) | 41902 | Terminal 2 frequency setting bias (frequency) | Read/write | |
| | 42092 | Terminal 2 frequency setting bias (analog value) | Read/write | Analog value (%) set to C3 (902) |
| C3 (902) 43902 | | Terminal 2 frequency setting bias (terminal analog value) | Read | Analog value (%) of the voltage (current) applied to terminal 2 |
| 125 (903) | 41903 | Terminal 2 frequency setting gain (frequency) | Read/write | |
| C4 (002) | 42093 | Terminal 2 frequency setting gain (analog value) | Read/write | Analog value (%) set in C4 (903) |
| C4 (903) | 43903 | Terminal 2 frequency setting gain (terminal analog value) | Read | Analog value (%) of the voltage (current) applied to terminal 2 |
| C5 (904) | 41904 | Terminal 4 frequency setting bias (frequency) | Read/write | |
| C6 (904) | 42094 | Terminal 4 frequency setting bias (analog value) | Read/write | Analog value (%) set in C6 (904) |
| 00 (004) | 43904 | Terminal 4 frequency setting bias (terminal analog value) | Read | Analog value (%) of the current (voltage) applied to terminal 4 |
| 126 (905) | 41905 | Terminal 4 frequency setting gain (frequency) | Read/write | |
| C7 (905) | 42095 | Terminal 4 frequency setting gain (analog value) | Read/write | Analog value (%) set in C7 (905) |
| | 43905 | 3905 Terminal 4 frequency setting gain (terminal analog value) | | Analog value (%) of the current (voltage) applied to terminal 4 |
| C12 (917) | 41917 | Terminal 1 bias frequency (speed) | Read/write | |
| | 42107 | Terminal 1 bias (speed) | Read/write | Analog value (%) set in C13 (917) |
| C13 (917) | 43917 | Terminal 1 bias (speed) (terminal analog value) | Read | Analog value (%) of voltage applied to terminal 1 |
| C14 (918) | 41918 | Terminal 1 gain frequency (speed) | Read/write | |
| | 42108 | Terminal 1 gain (speed) | Read/write | Analog value (%) set in C15 (918) |
| C15 (918) | 43918 | Terminal 1 gain (speed) (terminal analog value) | Read | Analog value (%) of voltage applied to terminal 1 |
| C16 (919) | 41919 | Terminal 1 bias command (torque) | Read/write | |
| | 42109 | Terminal 1 bias (torque) | Read/write | Analog value (%) set in C17 (919) |
| C17 (919) | 43919 | Terminal 1 bias (torque) (terminal analog value) | Read | Analog value (%) of voltage applied to terminal 1 |
| C18 (920) | 41920 | Terminal 1 gain command (torque) | Read/write | |
| | 42110 | Terminal 1 gain (torque) | Read/write | Analog value (%) set in C19 (920) |
| C19 (920) | 43920 | Terminal 1 gain (torque) (terminal analog value) | Read | Analog value (%) of voltage applied to terminal 1 |
| C8 (930) | 41930 | Current output bias signal | Read/write | |
| C9 (930) | 42120 | Current output bias current | Read/write | Analog value (%) set in C9 (930) |
| C10 (931) | 41931 | Current output gain signal | Read/write | |
| C11 (931) | 42121 | Current output gain current | Read/write | Analog value (%) set in C11 (931) |
| C38 (932) | 41932 | Terminal 4 bias command (torque) | Read/write | |
| | 42122 | Terminal 4 bias (torque) | Read/write | Analog value (%) set in C39 (932) |
| C39 (932) | 43932 | Terminal 4 bias (torque) (terminal analog value) | Read | Analog value (%) of the current (voltage) applied to terminal 4 |
| C40 (933) | 41933 | Terminal 4 gain command (torque) | Read/write | |
| | 42123 | Terminal 4 gain (torque) | Read/write | Analog value (%) set in C41 (933) |
| C41 (933) | 43933 | Terminal 4 gain (torque) (terminal analog value) | Read | Analog value (%) of the current (voltage) applied to terminal 4 |
| C42 (934) | 41934 | PID display bias coefficient | Read/write | |

| Pr. | Register | Name | Read/write | Remarks |
|-----------------|-------------------|---|------------|---|
| | 42124 | PID display bias analog value | Read/write | Analog value (%) set in C43 (934) |
| 4.39.34 | | PID display bias analog value (terminal analog value) | Read | Analog value (%) of the current (voltage) applied to terminal 4 |
| C44 (935) | 41935 | PID display gain coefficient | Read/write | |
| | 42125 | PID display gain analog value | Read/write | Analog value (%) set in C45 (935) |
| C45 (935) | 43935 | PID display gain analog value (terminal analog value) | Read | Analog value (%) of the current (voltage) applied to terminal 4 |
| 1000 to 1999 | 45000 to 45999 | For details on parameter names, refer to the parameter list (page 140). | Read/write | The parameter number + 44000 is the register number. |

· Fault history

| Register | Definition | Read/write | Remarks |
|----------|----------------|------------|--|
| 40501 | Fault record 1 | Read/write | |
| 40502 | Fault record 2 | Read | |
| 40503 | Fault record 3 | Read | Being 2 bytes in length, the data is stored as H0000. |
| 40504 | Fault record 4 | Read | Refer to the lowest 1 byte for the error code. (For details on |
| 40505 | Fault record 5 | Read | error codes, refer to page 592.) The fault history is cleared by writing to register 40501. |
| 40506 | Fault record 6 | Read | Set any value as data. |
| 40507 | Fault record 7 | Read | |
| 40508 | Fault record 8 | Read | |

· Product profile

| Register | Definition | Read/write | Remarks | | | |
|----------|-----------------------------------|------------|--|--|--|--|
| 44001 | Model (1st and 2nd characters) | Read | | | | |
| 44002 | Model (3rd and 4th characters) | Read | | | | |
| 44003 | Model (5th and 6th characters) | Read | | | | |
| 44004 | Model (7th and 8th characters) | Read | The inverter model can be read in ASCII code. | | | |
| 44005 | Model (9th and 10th characters) | Read | "H20" (blank code) is set for blank area. | | | |
| 44006 | Model (11th and 12th characters | | Example) FR-F840-1 (FM type): | | | |
| 44007 | Model (13th and 14th characters) | Read | H46, H52, H2D, H46, H38, H34, H30, H2D, H31, H20H20 | | | |
| 44008 | Model (15th and 16th characters) | Read | | | | |
| 44009 | Model (17th and 18th characters) | Read | | | | |
| 44010 | Model (19th and 20th characters) | Read | | | | |
| 44011 | Capacity (1st and 2nd characters) | Read | The capacity in the inverter model can be read in ASCII code. | | | |
| 44012 | Capacity (3rd and 4th characters) | Read | Data is read in increments of 0.1 kW, and rounds down to 0.01 | | | |
| 44013 | | | kW increments. "H20" (blank code) is set for blank area. Example) 0.75K: " 7" (H20, H20, H20, H20, H20, H37) | | | |

NOTE

• When a 32-bit parameter setting or monitor item is read and the value to be read exceeds HFFFF, HFFFF is returned.

Pr.343 Communication error count

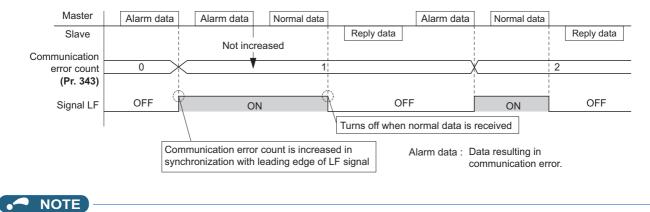
• The communication error occurrence count can be checked.

| Parameter | Setting range | Minimum setting range | Initial value |
|-----------|---------------|-----------------------|---------------|
| 343 | (Read-only) | 1 | 0 |

• The communication error count is temporarily stored in the RAM memory. The value is not stored in EEPROM, and so is cleared to 0 when power is reset and the inverter is reset.

Alarm (LF) signal output (communication error warning)

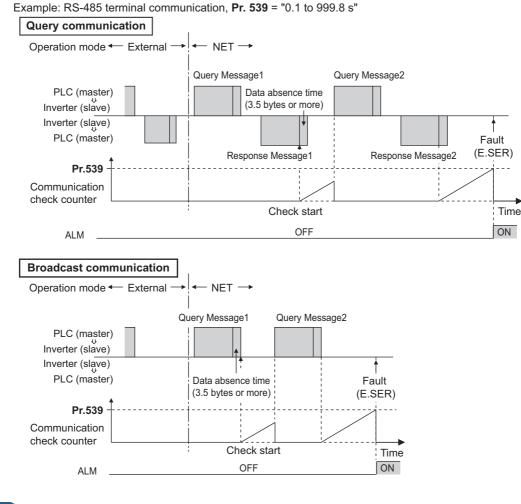
• During a communication error, the Alarm (LF) signal is output by open collector output. Assign the terminal to be used using any of **Pr.190 to Pr.196 (Output terminal function selection)**.



• The LF signal can be assigned to an output terminal by setting **Pr.190 to Pr.196**. Changing the terminal assignment may affect other functions. Set parameters after confirming the function of each terminal.

Signal loss detection (Pr.539 RS-485 communication check time interval)

- If signal loss is detected between the inverter and the master, the Communication fault (inverter) (E.SER) will occur and the inverter output will be shut off.
- When the setting is "9999", communication check (signal loss detection) is not made.
- When the setting is "0", reading, etc. of monitors and parameters is possible, though E.SER occurs instantly when the operation mode is switched to the Network operation.
- Setting any value from 0.1 s to 999.8 s will enable signal loss detection. To detect signal loss, data must be sent from the master within the communication check time interval. (The inverter makes a communication check (clearing of communication check counter) regardless of the station number setting of the data sent from the master).
- The communication check is made from the first communication in the Network operation mode (can be changed by **Pr.551 PU mode operation command source selection**).
- The communication check time by query communication includes a no-data time (3.5 bytes).
 This no-data time differs according to the communication speed, so take this no-data time into consideration when setting the communication check time.



NOTE

 For the RS-485 terminal communication, the operation at a communication error occurrence depends on the Pr.502 Stop mode selection at communication error setting. (Refer to page 500.)

5.12.7 BACnet MS/TP protocol

Using BACnet MS/TP protocol, communication operation and parameter setting are available from the RS-485 terminals of the inverter.

| _ | | Initia | value | • #1 | - | | |
|-------------|--|------------------------|-------|---|--|--|---|
| Pr. | Name | FM | CA | Setting range | Description | | |
| 52 M100 | Operation panel main monitor selection | 0 | | 0 | | 0, 5 to 14, 17, 18, 20, 23 to 25, 34, 38, 40 to 45, 50 to 57, 61, 62, 64, 67 to 69, 81 to 96, 98, 100 | 81: BACnet reception status 82: BACnet token pass counter (Displays the count of received token) 83: BACnet valid APDU counter (Displays the count of |
| 774 M101 | Operation panel monitor selection 1 | | | | valid APDU detection) 84: BACnet communication error counter (Displays the | | |
| 775 M102 | Operation panel monitor selection 2 | 9999 | | 1 to 3, 5 to 14, 17, 18, 20, | count of communication error) 85: Terminal FM/CA output level (Same display as Analog Output 0) | | |
| 776 M103 | Operation panel monitor selection 3 | | | 23 to 25, 34, 38, 40 to 45, 50 to 57, 61, 62, 64, 67 to 69, 81 to 96, 98, 100 | 86: Terminal AM output level (Same display as Analog Output 1) The count of the setting values "82" and "83" returns to "0" if the count exceeds "9999". The upper limit of the count of the setting value "84" is "9999". | | |
| 331 N030 | RS-485 communication station number | 0 | | 0 | | 0 to 127 ^{*1} | Set the inverter station number (node). |
| 332 N031 | RS-485 communication speed | 96 | | 96 | | 96, 192, 384, 576, 768, 1152 ^{*1*2} | Select the communication speed. The setting value × 100 equals the communication speed. For example, enter 96 to set the communication speed of 9600 bps. |
| 390 N054 | % setting reference frequency | 60 Hz | 50 Hz | 1 to 590 Hz | Set a reference frequency of the set frequency. | | |
| = 10 | | | • | 0 | Mitsubishi inverter protocol (computer link) | | |
| 549 N000 | Protocol selection | 0 | | 1 | MODBUS RTU protocol | | |
| 14000 | | | | 2 | BACnet MS/TP protocol | | |
| 726 | Auto Baudrate/Max | drate/Max 255 0 to 255 | | 0 to 255 | Auto baud rate (bit 7) 0: inactive, 1: active | | |
| N050 | Master | | | | Max Master (bit 0 to bit 6) setting range: 0 to 127 Maximum address for master node | | |
| 727 N051 | Max Info Frames | 1 | | 1 to 255 | Set the maximum number of frames that the inverter can transmit while it owns the token. | | |
| 728 N052 | Device instance number (Upper 3 digits) | 0 | | 0 to 419 (0 to 418) | Device identifier When the figure obtained by combining the Pr.728 and Pr.729 settings is not within "0 to 4194302", the setting | | |
| 729 N053 | Device instance number (Lower 4 digits) | 0 | | 0 to 9999 (0 to 4302) | is out of range. When Pr.728 = "419", the setting range of Pr.729 is "0 to 4302". When Pr.729 = "4303" or more, the setting range of Pr.728 is "0 to 418". | | |

*1 When a value outside the setting range is set, the inverter operates at the initial value.

*2 When the Auto baudrate is used, the communication speed is changed to the detected communication speed.

Communication specifications

• The specifications conform to the BACnet standard of physical medium EIA-485.

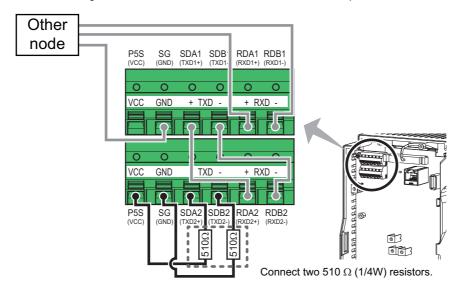
| lte | em | Description | | | | |
|---------------------------|--------------------------|--|--|--|--|--|
| Physical medium | | EIA-485 (RS-485) | | | | |
| | Connection port | RS-485 terminals (PU connector is not available.) | | | | |
| | Data transfer method | NRZ encoding | | | | |
| | Baud rate | 9600 bps, 19200 bps, 38400 bps, 57600 bps, 76800 bps, 115200 bps | | | | |
| | Start bit | Fixed to 1 bit | | | | |
| | Data length | Fixed to 8 bits | | | | |
| | Parity bit | Fixed to none | | | | |
| | Stop bit | Fixed to 1 bit | | | | |
| Network topology | | Bus topology | | | | |
| Communication method | | Token passing (token bus) | | | | |
| Communication method | | Master-slave (Only the master is available for this product.) | | | | |
| Communication protocol | | MS/TP (master-slave/token passing LAN) | | | | |
| Maximum connection | | 255 (up to 32 for one segment, addition with a repeater available) | | | | |
| Node number | | 0 to 127 | | | | |
| | Master | 0 to 127 (This product is the master.) | | | | |
| Supported property of BAC | net standard object type | Refer to page 536. | | | | |
| Supported BIBBs (Annex K |) | Refer to page 544. | | | | |
| BACnet standardized devic | e profile (Annex L) | Refer to page 544. | | | | |
| Segmentation | | Not supported | | | | |
| Device address binding | | Not supported | | | | |

NOTE

- This product is classified as a BACnet Application Specific Controller (B-ASC).
- This product is designed for multiple master network, therefore 2-wire type connection is supported.

Node with network bias resistors

- This product is a node with local bias resistors. Therefore at least one node must be a node with network bias resistors in the network configuration.
- When configuring the network with only this products, refer to the following, and make the node with network bias resistors. (When using two sets in one segment, insert them into both ends of the network.)



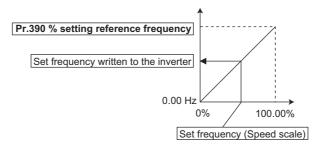
BACnet reception status monitor (Pr.52)

• Set Pr.52 = "81" to monitor the BACnet communication status on the operation panel.

| Monitor value | Status | Description | LF signal output |
|------------------|---------------------------------|--|---------------------|
| 0 | Idle | Never had BACnet communication. | OFF |
| 1 | Automatic baud rate recognition | Automatic baud rate recognition. (Communication error during automatic baud rate recognition is not counted.) | OFF |
| 2 | Not joined the network | Waiting for a token to own node. | OFF |
| 10 | | Received a token to own node. | OFF |
| 11 | Data to own node | Received a supported request to own node (including broadcasting). | OFF |
| 12 | | Received an unsupported request to own node (including broadcasting). | OFF |
| 20 | Data to other node | Received a token to other nodes. | OFF |
| 30 | Node separated | Separated from token passing after joined in it. | OFF |
| 90 | | Detected a communication error. | ON |
| 91 | Fault data | Protocol error (LPDU, NPDU, APDU are not following the format regulations.) | ON |

% setting reference frequency (Pr.390)

Set a reference frequency of the set frequency. The setting value of Pr.390 % setting reference frequency is 100% reference. The reference to the frequency command is converted to the set frequency in the following formula.
 Set frequency = % setting reference frequency × Speed scale (Refer to page 538.)



NOTE

- The % setting reference frequency cannot be set at less than the minimum frequency resolution of the inverter.
- The set frequency is written to RAM.
- The set frequency is applied at the writing of Speed scale. (The set frequency is not applied at the setting of Pr.390.)

Automatic baud rate recognition (Pr.726 Auto Baudrate/Max Master)

 Automatic changing of baud rate is available with Pr.726 setting. When Pr.726 = "128 to 255", turn the power ON from OFF or reset the inverter to start automatic baud rate recognition.

| Pr.726 setting | Operation |
|----------------|--|
| 0 to 127 | Automatic baud rate recognition is disabled. (The Pr.332 setting is used as the baud rate.) |
| 128 to 255 | The inverter monitors the data on the communication bus, and automatically switches the baud rate. The recognized baud rate is written to Pr.332 . |

- After the baud rate recognition, the recognized baud rate is written in EEPROM as the Pr.332 setting regardless of the Pr.342
 Communication EEPROM write selection setting.
- The BACnet status monitor displays "1" during automatic baud rate recognition.
- · The communication error monitor count is not performed during automatic baud rate recognition.
- During automatic baud rate recognition, the inverter does not transmit data, but only accepts data.
- The baud rate switching operation cannot be finished if the inverter is not connected to the communication bus. (BACnet protocol will not be established.)
- The baud rate switching operation cannot be finished if the inverter is continuously receiving abnormal data during automatic baud rate switching. (BACnet protocol will not be established.)

Supported property of BACnet standard object type

R: Read only, W: Read/Write (Commandable values not supported), C: Read/Write (Commandable values supported)

| | | Object support condition | | | | | | | |
|---------------------------------|-----------------|--------------------------|-----------------|-----------------|------------------|-----------------|--------|-----------------|--|
| Property | Analog input | Analog Output | Analog Value | Binary Input | Binary Output | Binary Value | Device | Network Port | |
| APDU Timeout | | | | | | | R | | |
| Application Software Version | | | | | | | R | | |
| Database Revision | | | | | | | R | | |
| Device Address Binding | | | | | | | R | | |
| Event State | R | R | R | R | R | R | | | |
| Firmware Revision | | | | | | | R | | |
| Max APDU Length Accepted | | | | | | | R | | |
| Max Info Frames | | | | | | | W | W | |
| Max Master | | | | | | | W | W | |
| Model Name | | | | | | | R | | |
| Number of APDU Retries | | | | | | | R | | |
| Object Identifier | R | R | R | R | R | R | R | R | |
| Object List | | | | | | | R | | |
| Object Name | R | R | R | R | R | R | R | R | |
| Object Type | R | R | R | R | R | R | R | R | |
| Out Of Service | R | R | R | R | R | R | | R | |
| Polarity | | | | R | R | | | | |
| Present Value | R | С | C ^{*1} | R | С | C ^{*1} | | | |
| Priority Array | | R | R ^{*2} | | R | R ^{*2} | | | |
| Protocol Object Types Supported | | | N | | | N | R | | |
| Protocol Revision | | | | | | | R | | |
| Protocol Services Supported | | | | | | | R | | |
| Protocol Version | | | | | | | R | | |
| | | | -*2 | | D | -*2 | ĸ | | |
| Relinquish Default | | R | R*2 | | R | R*2 | _ | | |
| Segmentation Supported | | | _ | | _ | _ | R | _ | |
| Status Flags | R | R | R | R | R | R | | R | |
| System Status | | | | | | | R | | |
| Unit | R | R | R | | | | | | |
| Vendor Identifier | | | | | | | R | | |
| Vendor Name | | | | | | | R | | |
| Property List | R | R | R | R | R | R | R | R | |
| Current Command Priority | | R | | | R | | | | |
| Reliability | | | | | | | | R | |
| Network Type | | | | | | | | R | |
| Protocol Level | | | | | | | | R | |
| Network Number | | | | | | | | R ^{*3} | |
| Network Number Quality | | | | | | | | R | |
| Changes Pending | | | | | | | | R | |
| APDU Length | | | | | | | | R | |
| Link Speed | | | | | | | | R | |
| MAC Address | | | | | | | | R | |
| IP Address | | | | | | | | R | |
| IP Subnet_Mask | | | | | | | | R | |
| IP Default Gateway | | | | | | | | R | |
| IP DNS Server | | | | | | | | R | |

*1 This property is commandable for some instances of this object. Otherwise it is read/write.

*2 This property is supported only for instances of this object where the Present Value property is commandable.

*3 Writing is possible when the network type is not PTP.

Details of the supported properties

• The details of the properties supported by the network port are as follows.

| Property | Details | | | |
|------------------------|--|--|--|--|
| Max Info Frames | Shows the maximum number of frames that the inverter can transmit while it owns the token. When a value is written, it is reflected to the Pr.727 setting. | | | |
| Max Master | Shows the maximum address for master node. When a value is written, it is reflected to the Pr.726 setting. | | | |
| Object Identifier | Shows the unique numeric code to identify the object. | | | |
| Object Name | Shows the object name. | | | |
| Object Type | Network Port: NETWORK_PORT (56) | | | |
| Out Of Service | FALSE (0) | | | |
| Status Flags | Always 0. | | | |
| Property List | Shows the property identifier list. | | | |
| Reliability | Shows the reliability of the network port. Fixed to no-fault-detected (0) for the FR-F800. | | | |
| Network Type | Shows the communication method of the network. Fixed to MSTP (2) for the FR-F800. | | | |
| Protocol Level | Shows the protocol level. Fixed to BACNET_APPLICATION (2) for the FR-F800. | | | |
| Network Number | Shows the network number. Fixed to 0 for the FR-F800. If a value other than "0" is written, an error code VALUE_OUT_OF_RANGE (37) will be returned. | | | |
| Network Number Quality | Shows the quality of the network port number. Fixed to UNKNOWN (0) for the FR-F800. | | | |
| Changes Pending | If the property value whose change is to be reflected at a reset is changed, TRUE is returned. FALSE is returned after the status is initialized by a reset. | | | |
| APDU Length | Shows the maximum number of octets. Fixed to 50 octets for the FR-F800. | | | |
| Link Speed | Shows the communication speed in the unit of bit/s. The Pr.332 setting value × 100 equals the communication speed. | | | |
| MAC Address | Shows the MAC address of the network port. The Pr.331 setting value is used for the MAC address. For example, the MAC address is 7F when Pr.331 = "127". | | | |
| IP Address | A rejection code (0) is displayed when the property is read. | | | |
| IP Subnet Mask | A rejection code (0) is displayed when the property is read. | | | |
| IP Default Gateway | A rejection code (0) is displayed when the property is read. | | | |
| IP DNS Server | A rejection code (0) is displayed when the property is read. | | | |

Supported BACnet object

ANALOG INPUT

| Object Identifier | Object Name | Present Value Access Type ^{*1} | Description | Unit |
|-------------------|-------------|--|---|-----------------|
| 0 | Terminal 1 | R | Represents actual input voltage of terminal 1. (The range varies depending on the Pr.73 and Pr.267 settings. -10 to +10 V (-100% to +100%), -5 to +5 V (-100% to +100%)) | percent (98) |
| 1 | Terminal 2 | R | Represents actual input voltage (or input current) of terminal 2. (The range varies depending on the Pr.73 and Pr.267 settings. 0 to 10 V (0% to 100%), 0 to 5 V (0% to 100%), 0 to 20 mA (0% to 100%)) | percent (98) |
| 2 | Terminal 4 | R | Represents actual input current (or input voltage) of terminal 4. (The range varies depending on the Pr.73 and Pr.267 settings. 2 to 10 V (0% to 100%), 1 to 5 V (0% to 100%), 4 to 20 mA (0% to 100%)) | percent (98) |

*1 R: Read only, W: Read/Write (Commandable values not supported), C: Read/Write (Commandable values supported)

ANALOG OUTPUT

| Object Identifier | Object Name | Present Value Access Type ^{*1} | Description | Unit |
|-------------------|------------------|--|---|-----------------|
| 0 | Terminal FM (CA) | с | Controls actual output current level of terminal FM/CA. Control is available when Pr.54 FM/CA terminal function selection = "85" ^{*2} . (Setting range: 0% to 200%) | percent (98) |
| 1 | Terminal AM | с | Controls actual output voltage level of terminal AM. Control is available when Pr.158 AM terminal function selection = "86" ^{*2} . (Setting range: -200% to 200%) | percent (98) |

*1 R: Read only, W: Read/Write (Commandable values not supported), C: Read/Write (Commandable values supported)

Values written to the objects that support the commandable values are stored in the Priority Array, even when "Write Access Denied" is returned due to inconsistency of the writing requirements such as the operating mode, on condition that the values are written within the setting range.

- *2 Available regardless of the operation mode, operation command source, and speed command source.
- ANALOG VALUE

| Object Identifier | Object Name | Present Value Access Type ^{*1} | Description | Unit |
|-------------------|-----------------------------------|--|--|------------------------------------|
| 1 | Output frequency | R | Represents the output frequency value. | hertz (27) |
| 2 | Output current | R | Represents the output current value. | amperes (3) |
| 3 | Output voltage | R | Represents the output voltage value. | volts (5) |
| 6 | Running speed | R | Represents the running speed value. | revolution- per-minute (104) |
| 8 | Converter output voltage | R | Represents the converter output voltage value. | volts (5) |
| 14 | Output power | R | Represents the output power value. | kilowatts (48) |
| 17 | Load meter | R | Represents the load meter value. | percent (98) |
| 20 | Cumulative energization time | R | Represents the cumulative energization time value. | hours (71) |
| 23 | Actual operation time | R | Represents the actual operation time value. | hours (71) |
| 25 | Cumulative power | R | Represents the cumulative power value. | kilowatt- hours (19) |
| 52 | PID set point | R | Represents the PID set point. | no-units (95) |
| 54 | PID deviation | R | Represents the PID deviation. (Minus display is available with reference to 0%, in 0.1% increment.) | no-units (95) |
| 67 | PID measured value2 | R | Represents the PID measurement 2. | no-units (95) |
| 92 | Second PID set point | R | Represents the second PID set point. | no-units (95) |
| 94 | Second PID deviation | R | Represents the second PID deviation. (Minus display is available with reference to 0%, in 0.1% increment.) | no-units (95) |
| 95 | Second PID measured value 2 | R | Represents the second PID measurement 2. | no-units (95) |
| 200 | Alarm history 1 | R | Represents the last fault record (fault record 1). | no-units (95) |
| 201 | Alarm history 2 | R | Represents the second most recent fault record (fault record 2). | no-units (95) |
| 202 | Alarm history 3 | R | Represents the third most recent fault record (fault record 3). | no-units (95) |
| 203 | Alarm history 4 | R | Represents the fourth most recent fault record (fault record 4). | no-units (95) |
| 300 | Speed scale ^{*2} | С | Controls the ratio of the frequency command. (Setting range: 0.00 to 100.00) (Refer to page 535.) | percent (98) |

| Object Identifier | Object Name | Present Value Access Type ^{*1} | Description | Unit |
|-------------------|-------------------------------------|--|---|------------------|
| | PID set point | с | Set the PID action set point. | no-units (95) |
| 310 | CMD ^{*2} | | This object is the set point during PID operation if Pr.128 = "60 or | |
| | CIVID | | 61". (Setting range: 0.00 to 100.00) ^{*3} | |
| | PID measured | с | Set the PID measured value. | no-units (95) |
| 311 | value CMD ^{*2} | | This object is the measured value during PID operation if Pr.128 = | |
| | | | "60 or 61". (Setting range: 0.00 to 100.00) ^{*3} | |
| | PID deviation | С | Set the PID deviation. (0.01 increments) | percent (98) |
| 312 | CMD ^{*2} | | This object is the deviation during PID operation if Pr.128 = "50 or | |
| | | | 51". (Setting range: -100.00 to 100.00) | |
| | Second PID set | с | Set the second PID action set point. | no-units (95) |
| 320 | point CMD | | This object is the set point during PID operation if Pr.753 = "60 or | |
| | ' | | 61". (Setting range: 0.00 to 100.00) ^{*3} | · / |
| | Second PID measured value CMD | с | Set the second PID measured value. | no-units (95) |
| 321 | | | This object is the measured value during PID operation if Pr.753 = | |
| | | | "60 or 61". | |
| | | | (Setting range: 0.00 to 100.00)*3 | |
| 200 | Second PID | с | Set the second PID deviation. (0.01 increments) | percent (98) |
| 322 deviat | deviation CMD | | This object is the deviation during PID operation if Pr.753 = "50 or 51". (Setting range: -100.00 to 100.00) | |
| 398 | Mailbox | w | | no-units |
| | parameter | | Access to the properties which are not defined as objects are available. (Refer to page 541.) | (95) |
| 399 | Mailbox value | W | available. (Itelet to page 341.) | no-units (95) |
| | | | Set Pr.7 Acceleration time. | seconds |
| 10007 | Acceleration time | W | | (73) |
| 10008 | Deceleration time | W | Set Pr.8 Deceleration time. | seconds (73) |

*1 R: Read only, W: Read/Write (Commandable values not supported), C: Read/Write (Commandable values supported) Values written to the objects that support the commandable values are stored in the Priority Array, even when "Write Access Denied" is returned due to inconsistency of the writing requirements such as the operating mode, on condition that the values are written within the setting range.

*2 If communication speed command source is other than NET, the setting value can be written, but not to be applied.

*3 When both C42 (Pr.1136) and C44 (Pr.1138) ≠ "9999", the setting range is from the smaller coefficient to the larger coefficient of C42 (Pr.1136)

and C44 (Pr.1138). Depending on the setting, the writing value and the reading value may not be the same at the minimum digit.

BINARY INPUT

| Object Identifier | Object Name | Present Value Access Type ^{*1} | Description (0: Inactive, 1: Active) |
|-------------------|------------------|--|---|
| 0 | Terminal STF | R | Represents actual input of terminal STF. |
| 1 | Terminal STR | R | Represents actual input of terminal STR. |
| 2 | Terminal AU | R | Represents actual input of terminal AU. |
| 3 | Terminal RT | R | Represents actual input of terminal RT. |
| 4 | Terminal RL | R | Represents actual input of terminal RL. |
| 5 | Terminal RM | R | Represents actual input of terminal RM. |
| 6 | Terminal RH | R | Represents actual input of terminal RH. |
| 7 | Terminal JOG | R | Represents actual input of terminal JOG. |
| 8 | Terminal MRS | R | Represents actual input of terminal MRS. |
| 9 | Terminal STOP | R | Represents actual input of terminal STOP. |
| 10 | Terminal RES | R | Represents actual input of terminal RES. |
| 11 | Terminal CS | R | Represents actual input of terminal CS. |
| 100 | Terminal RUN | R | Represents actual output of terminal RUN. |
| 101 | Terminal SU | R | Represents actual output of terminal SU. |
| 102 | Terminal IPF | R | Represents actual output of terminal IPF. |
| 103 | Terminal OL | R | Represents actual output of terminal OL. |
| 104 | Terminal FU | R | Represents actual output of terminal FU. |
| 105 | Terminal ABC1 | R | Represents actual output of terminal ABC1. |
| 106 | Terminal ABC2 | R | Represents actual output of terminal ABC2. |
| 107 | Terminal So (SO) | R | Represents actual output of terminal So (SO). |

*1 R: Read only, W: Read/Write (Commandable values not supported), C: Read/Write (Commandable values supported)

BINARY OUTPUT

| Object Identifier | Object Name | Present Value Access Type ^{*1} | Description (0: Inactive, 1: Active) |
|-------------------|------------------------|--|--|
| 0 | Terminal RUN CMD | 0 | Represents actual output of terminal RUN. |
| 0 | Terminal RON CIVID | C | Available when Pr.190 RUN terminal function selection = "82 or 182". ^{*2} |
| 4 | | 0 | Controls actual output of terminal SU. |
| 1 | Terminal SU CMD | С | Available when Pr.191 SU terminal function selection = "82 or 182". ^{*2} |
| 0 | | 0 | Controls actual output of terminal IPF. |
| 2 | Terminal IPF CMD | С | Available when Pr.192 IPF terminal function selection = "82 or 182".*2 |
| 0 | | | Controls actual output of terminal OL. |
| 3 | Terminal OL CMD | С | Available when Pr.193 OL terminal function selection = "82 or 182". ^{*2} |
| | T | | Controls actual output of terminal FU. |
| 4 | Terminal FU CMD | С | Available when Pr.194 FU terminal function selection = "82 or 182". ^{*2} |
| - | Terminal ABC1 CMD C | 2 | Controls actual output of terminal ABC1. |
| 5 | | С | Available when Pr.195 ABC1 terminal function selection = "82 or 182".*2 |
| | Terminal ABC2 | 2 | Controls actual output of terminal ABC2. |
| 6 | CMD | С | Available when Pr.196 ABC2 terminal function selection = "82 or 182". ^{*2} |

*1 R: Read only, W: Read/Write (Commandable values not supported), C: Read/Write (Commandable values supported)

Values written to the objects that support the commandable values are stored in the Priority Array, even when "Write Access Denied" is returned due to inconsistency of the writing requirements such as the operating mode, on condition that the values are written within the setting range.

*2 Available regardless of the operation mode, operation command source, and speed command source.

BINARY VALUE

| Object Identifier | Object Name | Present Value Access Type ^{*1} | Description | |
|-------------------|--|--|---|--|
| 0 | Inverter running | R | Represents the Inverter running (RUN) signal status. | |
| 11 | Inverter operation ready | R | Represents the Inverter operation ready (RY) signal status. | |
| 98 | Alarm output | R | Represents the Alarm (LF) signal status. | |
| 99 | Fault output | R | Represents the Fault (ALM) signal status. | |
| 200 | Inverter running reverse | R | Represents inverter reverse running status. | |
| 300 | Control input instruction AU | С | Controls the function assigned to terminal AU. Setting 1 in this object turns ON the signal assigned to Pr.184 AU terminal function selection . | |
| 301 | Control input instruction RT | с | Controls the function assigned to terminal RT. Setting 1 in this object turns ON the signal assigned to Pr.183 RT terminal function selection . | |
| 302 | Control input instruction RL | с | Controls the function assigned to terminal RL. Setting 1 in this object turns ON the signal assigned to Pr.180 RL terminal function selection . | |
| 303 | Control input instruction RM | с | Controls the function assigned to terminal RM. Setting 1 in this object turns ON the signal assigned to Pr.181 RM terminal function selection. | |
| 304 | Control input instruction RH | с | Controls the function assigned to terminal RH. Setting 1 in this object turns ON the signal assigned to Pr.182 RH terminal function selection . | |
| 305 | Control input instruction JOG ^{*2} | с | Controls the function assigned to terminal JOG. Setting 1 in this object turns ON the signal assigned to Pr.185 JOG terminal function selection. | |
| 306 | Control input instruction MRS | с | Controls the function assigned to terminal MRS. Setting 1 in this object turns ON the signal assigned to Pr.187 MRS terminal function selection. | |
| 307 | Control input instruction STOP ^{*2} | с | Controls the function assigned to terminal STOP. Setting 1 in this object turns ON the signal assigned to Pr.188 STOP terminal function selection. | |
| 308 | Control input instruction RES ^{*2} | С | Controls the function assigned to terminal RES. Setting 1 in this object turns ON the signal assigned to Pr.189 RES terminal function selection . | |
| 309 | Control input instruction CS ^{*2} | С | Controls the function assigned to terminal CS. Setting 1 in this object turns ON the signal assigned to Pr.186 CS terminal function selection . | |
| 400 | Run/Stop | С | Controls the start/stop command. The start command is written after the Speed scale is applied. ^{*3} 1: Start 0: Stop | |
| 401 | Forward/Reverse | С | Controls the forward/reverse rotation. ^{*3} 1: Reverse rotation 0: Forward rotation | |
| 402 | Fault reset | С | Clears fault output status. (Release of an inverter fault without inverter reset is available.) | |

*1 R: Read only, W: Read/Write (Commandable values not supported), C: Read/Write (Commandable values supported) Values written to the objects that support the commandable values are stored in the Priority Array, even when "Write Access Denied" is returned due to inconsistency of the writing requirements such as the operating mode, on condition that the values are written within the setting range.

*2 The following signals cannot be controlled by the network: JOG operation, selection of automatic restart after instantaneous power failure, start self-holding, and reset. Therefore control input instruction JOG, STOP, RES, and CS are invalid in the initial status. To use the control input instruction JOG, STOP, RES, and CS are invalid in the initial status. To use the control input instruction JOG, STOP, RES, and CS, change the signals with **Pr.185**, **Pr.186**, **Pr.188**, and **Pr.189** (Input terminal function selection). (Refer to page 373.) (Reset is available with ReinitializeDevice.)

*3 If communication operation command source is other than NET, the setting value can be written, but not to be applied.

Mailbox parameter / Mailbox value (BACnet registers)

· Access to the properties which are not defined as objects are available by using "Mailbox parameter" and "Mailbox value".

• To read a property, write the register of the intended property to "Mailbox parameter", and then read "Mailbox value". To write a property, write the register of the intended property to "Mailbox parameter", and then write a value to "Mailbox value".

· System environment variables

| Register | Definition | Read/write | Remarks |
|----------|-----------------------------------|------------|---|
| 40010 | Operation mode / inverter setting | Read/write | The data is written as an operation mode setting for writing. The data is read as the operation mode status for reading. |

[Operation mode / inverter setting]

| Mode | Read value | Write value |
|------------|------------|---------------------|
| EXT | H0000 | H0010 ^{*1} |
| PU | H0001 | H0011 ^{*1} |
| EXT JOG | H0002 | — |
| PU JOG | H0003 | — |
| NET | H0004 | H0014 |
| PU + EXT | H0005 | — |

*1 Writing is available depending on the **Pr.79** and **Pr.340** settings. For the details, refer to page 250. Restrictions in each operation mode conform with the computer link specification.

Real time monitor

The register numbers and the monitor items are the same as those of the MODBUS RTU real time monitor. Refer to the MODBUS RTU real time monitor on page 305.

Parameter

| Pr. | Register | Name | Read/write | Remarks |
|-----------|----------------|---|------------|---|
| 0 to 999 | 41000 to 41999 | For details on parameter names, refer to the parameter list (page 140). | Read/write | The parameter number + +41000 is the register number. |
| C2 (902) | 41902 | Terminal 2 frequency setting bias (frequency) | Read/write | |
| C3 (902) | 42092 | Terminal 2 frequency setting bias (analog value) | Read/write | Analog value (%) set in C3 (902) |
| 03 (902) | 43902 | Terminal 2 frequency setting bias (terminal analog value) | Read | Analog value (%) of the voltage (current) applied to terminal 2 |
| 125 (903) | 41903 | Terminal 2 frequency setting gain (frequency) | Read/write | |
| C4 (903) | 42093 | Terminal 2 frequency setting gain (analog value) | Read/write | Analog value (%) set in C4 (903) |
| 04 (903) | 43903 | Terminal 2 frequency setting gain (terminal analog value) | Read | Analog value (%) of the voltage (current) applied to terminal 2 |
| C5 (904) | 41904 | Terminal 4 frequency setting bias (frequency) | Read/write | |
| C6 (904) | 42094 | Terminal 4 frequency setting bias (analog value) | Read/write | Analog value (%) set in C6 (904) |
| 00 (904) | 43904 | Terminal 4 frequency setting bias (terminal analog value) | Read | Analog value (%) of the current (voltage) applied to terminal 4 |
| 126 (905) | 41905 | Terminal 4 frequency setting gain (frequency) | Read/write | |
| 07 (005) | 42095 | Terminal 4 frequency setting gain (analog value) | Read/write | Analog value (%) set in C7 (905) |
| C7 (905) | 43905 | Terminal 4 frequency setting gain (terminal analog value) | Read | Analog value (%) of the current (voltage) applied to terminal 4 |
| C12 (917) | 41917 | Terminal 1 bias frequency (speed) | Read/write | |
| | 42107 | Terminal 1 bias (speed) | Read/write | Analog value (%) set in C13 (917) |
| C13 (917) | 43917 | Terminal 1 bias (speed) (terminal analog value) | Read | Analog value (%) of voltage applied to terminal 1 |
| C14 (918) | 41918 | Terminal 1 gain frequency (speed) | Read/write | |
| | 42108 | Terminal 1 gain (speed) | Read/write | Analog value (%) set in C15 (918) |
| C15 (918) | 43918 | Terminal 1 gain (speed) (terminal analog value) | Read | Analog value (%) of voltage applied to terminal 1 |
| C16 (919) | 41919 | Terminal 1 bias command (torque) | Read/write | |
| | 42109 | Terminal 1 bias (torque) | Read/write | Analog value (%) set in C17 (919) |
| C17 (919) | 43919 | Terminal 1 bias (torque) (terminal analog value) | Read | Analog value (%) of voltage applied to terminal 1 |

| Pr. | Register | Name | Read/write | Remarks |
|--------------|----------------|---|------------|---|
| C18 (920) | 41920 | Terminal 1 gain command (torque) | Read/write | |
| | 42110 | Terminal 1 gain (torque) | Read/write | Analog value (%) set in C19 (920) |
| C19 (920) | 43920 | Terminal 1 gain (torque) (terminal analog value) | Read | Analog value (%) of voltage applied to terminal 1 |
| C8 (930) | 41930 | Current output bias signal | Read/write | |
| C9 (930) | 42120 | Current output bias current | Read/write | Analog value (%) set in C9 (930) |
| C10 (931) | 41931 | Current output gain signal | Read/write | |
| C11 (931) | 42121 | Current output gain current | Read/write | Analog value (%) set in C11 (931) |
| C38 (932) | 41932 | Terminal 4 bias command (torque) | Read/write | |
| | 42122 | Terminal 4 bias (torque) | Read/write | Analog value (%) set in C39 (932) |
| C39 (932) | 43932 | Terminal 4 bias (torque) (terminal analog value) | Read | Analog value (%) of the current (voltage) applied to terminal 4 |
| C40 (933) | 41933 | Terminal 4 gain command (torque) | Read/write | |
| | 42123 | Terminal 4 gain (torque) | Read/write | Analog value (%) set in C41 (933) |
| C41 (933) | 43933 | Terminal 4 gain (torque) (terminal analog value) | Read | Analog value (%) of the current (voltage) applied to terminal 4 |
| C42 (934) | 41934 | PID display bias coefficient | Read/write | |
| 42124 | | PID display bias analog value | Read/write | Analog value (%) set in C43 (934) |
| C43 (934) | 43934 | PID display bias analog value (terminal analog value) | Read | Analog value (%) of the current (voltage) applied to terminal 4 |
| C44 (935) | 41935 | PID display gain coefficient | Read/write | |
| | 42125 | PID display gain analog value | Read/write | Analog value (%) set in C45 (935) |
| C45 (935) | 43935 | PID display gain analog value (terminal analog value) | Read | Analog value (%) of the current (voltage) applied to terminal 4 |
| 1000 to 1999 | 45000 to 45999 | For details on parameter names, refer to the parameter list (page 140). | Read/write | The parameter number + 44000 is the register number. |

· Fault history

| Register | Definition | Read/write | Remarks |
|----------|----------------|------------|---|
| 40501 | Fault record 1 | Read/write | |
| 40502 | Fault record 2 | Read | |
| 40503 | Fault record 3 | Read | Being 2 bytes in length, the data is stored as H00 $\circ\circ$. |
| 40504 | Fault record 4 | Read | Refer to the lowest 1 byte for the error code. (For details on |
| 40505 | Fault record 5 | Read | error codes, refer to page 592.) The fault history is cleared by writing to register 40501. |
| 40506 | Fault record 6 | Read | Set any value as data. |
| 40507 | Fault record 7 | Read | |
| 40508 | Fault record 8 | Read | |

Product profile

| Register | Definition | Read/write | Remarks |
|----------|-----------------------------------|------------|---|
| 44001 | Model (1st and 2nd characters) | Read | |
| 44002 | Model (3rd and 4th characters) | Read | |
| 44003 | Model (5th and 6th characters) | Read | |
| 44004 | Model (7th and 8th characters) | Read | The model name can be read in ASCII code. |
| 44005 | Model (9th and 10th characters) | Read | "H20" (blank code) is set for blank area. |
| 44006 | Model (11th and 12th characters) | Read | Example) FR-F840-1 (FM type): |
| 44007 | Model (13th and 14th characters) | Read | H46, H52, H2D, H46, H38, H34, H30, H2D, H31, H20 H20 |
| 44008 | Model (15th and 16th characters) | Read | |
| 44009 | Model (17th and 18th characters) | Read | |
| 44010 | Model (19th and 20th characters) | Read | |
| 44011 | Capacity (1st and 2nd characters) | Read | The inverter rated capacity can be read in ASCII code. |
| 44012 | Capacity (3rd and 4th characters) | Read | Data read is displayed in increments of 0.1 kW (rounded |
| 44013 | Capacity (5th and 6th characters) | Read | down to one decimal place). "H20" (blank code) is set for blank area. Example) 0.75K: " 7" (H20, H20, H20, H20, H20, H37) |

NOTE

• When a 32-bit parameter setting or monitor item is read and the value to be read exceeds HFFFF, HFFFF is returned.

ANNEX A - PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT (NORMATIVE)

(This annex is part of this Standard and is required for its use.)

BACnet Protocol Implementation Conformance Statement

Date: <u>1st Jul 2014</u> Vendor Name: <u>Mitsubishi Electric Corporation</u> Product Name: <u>Inverter</u> Product Model Number: <u>FR-F820-1, FR-F820-2, FR-F840-1, FR-F840-2, FR-F842-1, FR-F842-2, FR-F846-1, FR-F846-2, FR-F820-E1, FR-F820-E2, FR-F840-E1, FR-F840-E2, FR-F842-E1, FR-F842-E2, FR-F846-E2 Application Software Version: <u>XXXX* (Four-digit number followed by a letter)</u> Firmware Revision: <u>2.00</u> BACnet Protocol Revision: <u>19</u></u>

Product Description:

BACnet Standardized Device Profile (Annex L):

- BACnet Cross-Domain Advanced Operator Workstation (B-XAWS)
- BACnet Advanced Operator Workstation (B-AWS)
- BACnet Operator Workstation (B-OWS)
- BACnet Operator Display (B-OD)
- BACnet Advanced Life Safety Workstation (B-ALSWS)
- BACnet Life Safety Workstation (B-LSWS)
- BACnet Life Safety Annunciator Panel (B-LSAP)
- BACnet Advanced Access Control Workstation (B-AACWS)
- BACnet Access Control Workstation (B-ACWS)
- BACnet Access Control Security Display (B-ACSD)
- BACnet Building Controller (B-BC)
- BACnet Advanced Application Controller (B-AAC)
- BACnet Application Specific Controller (B-ASC)
- BACnet Smart Sensor (B-SS)
- BACnet Smart Actuator (B-SA)
- BACnet Advanced Life Safety Controller (B-ALSC)
- BACnet Life Safety Controller (B-LSC)
- BACnet Advanced Access Control Controller (B-AACC)
- BACnet Access Control Controller (B-ACC)
- BACnet Router (B-RTR)
- BACnet Gateway (B-GW)
- BACnet Broadcast Management Device (B-BBMD)
- BACnet Access Control Door Controller (B-ACDC)
- BACnet Access Control Credential Reader (B-ACCR)
- BACnet General (B-GENERAL)

List all BACnet Interoperability Building Blocks Supported (Annex K): DS-RP-B, DS-WP-B, DM-DDB-B, DM-DOB-B, DM-DCC-B, DM-RD-B

Segmentation Capability:

 □ Able to transmit segmented messages
 Window Size

 □ Able to receive segmented messages
 Window Size

Standard Object Types Supported:

An object type is supported if it may be present in the device. For each standard Object Type supported provide the following data:

- **1.** Whether objects of this type are dynamically creatable using the CreateObject service
- 2. Whether objects of this type are dynamically deletable using the DeleteObject service
- **3.** List of the optional properties supported
- **4.** List of all properties that are writable where not otherwise required by this standard
- 5. List of all properties that are conditionally writable where not otherwise required by this standard
- **6.** List of proprietary properties and for each its property identifier, datatype, and meaning
- **7.** List of any property range restrictions

Dynamic object creation and deletion is not supported.

To check the object types supported by the FR-F800 series, refer to page 537.

Data Link Layer Options:

ARCNET (ATA 878.1), 2.5 Mb. (Clause 8)

ARCNET (ATA 878.1), EIA-485 (Clause 8), baud rate(s)

BACnet IP, (Annex J)

BACnet IP, (Annex J), BACnet Broadcast Management Device (BBMD)

BACnet IP, (Annex J), Network Address Translation (NAT Traversal)

- BACnet IPv6, (Annex U)
- BACnet IPv6, (Annex U), BACnet Broadcast Management Device (BBMD)
- BACnet/ZigBee (Annex O)

□ ISO 8802-3, Ethernet (Clause 7)

MS/TP master (Clause 9), baud rate(s): 9600, 19200, 38400, 57600, 76800, 115200

- ☐ MS/TP slave (Clause 9), baud rate(s):
- Point-To-Point, EIA 232 (Clause 10), baud rate(s):
- Point-To-Point, modem, (Clause 10), baud rate(s):
- Other:

Device Address Binding:

Is static device binding supported? (This is currently necessary for two-way communication with MS/TP slaves and certain other devices.) □Yes ⊠No

Networking Options:

□ Router, Clause 6 - List all routing configurations, e.g., ARCNET-Ethernet, Ethernet-MS/TP, etc.

Annex H, BACnet Tunneling Router over IP

5

Character Sets Supported:

Indicating support for multiple character sets does not imply that they can all be supported simultaneously.

 □ ISO 10646 (UTF-8)
 □ IBMTM/MicrosoftTM DBCS
 □ ISO 8859-1

 □ ISO 10646 (UCS-2)
 □ ISO 10646 (UCS-4)
 □ JIS X 0208

Gateway Options:

If this product is a communication gateway, describe the types of non-BACnet equipment/networks(s) that the gateway supports:

If this product is a communication gateway which presents a network of virtual BACnet devices, a separate PICS shall be provided that describes the functionality of the virtual BACnet devices. That PICS shall describe a superset of the functionality of all types of virtual BACnet devices that can be presented by the gateway.

Network Security Options:

- □ Non-secure Device is capable of operating without BACnet Network Security
- □ Secure Device is capable of using BACnet Network Security (NS-SD BIBB)
- □ Multiple Application-Specific Keys
- □ Supports encryption (NS-ED BIBB)
- □ Key Server (NS-KS BIBB)

5.12.8 USB device communication

A personal computer and an inverter can be connected with a USB cable. Setup of the inverter can be easily performed with FR Configurator2.

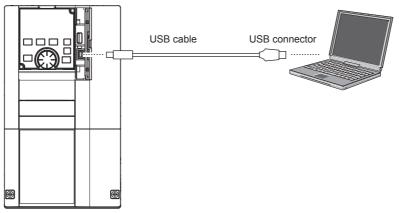
The inverter can be connected easily to a personal computer by a USB cable.

| Pr. | Name | Initial value | Setting range | Description | |
|---------------------------|---|------------------|---------------|--|--|
| 547 ^{*1} N040 | USB communication station number 0 to 31 | | 0 to 31 | Specify the inverter station number. | |
| | | С | 0 | USB communication is possible, however the inverter output is shut off (E.USB) when the mode changes to the PU operation mode. | |
| 548 ^{*1} N041 | | | | Set the communication check time interval. If a no-communication state persists for longer than the permissible time, the inverter output is shut off (E.USB). | |
| | | | 9999 | No communication check | |

*1 The changed value is applied after the next power-ON or inverter reset.

USB communication specifications

| Interface | Conforms to USB1.1 (USB2.0 full speed) | |
|-----------------------|--|--|
| Transmission speed | 12 Mbps | |
| Wiring length | Maximum 5 m | |
| Connector | USB mini B connector (receptacle) | |
| Power supply | Self-powered | |
| Recommended USB cable | MR-J3USBCBL3M (cable length 3 m) | |



- At the initial setting (**Pr.551 PU mode operation command source selection** = "9999"), communication with FR Configurator2 can be made in the PU operation mode simply by connecting a USB cable. To fix the command source to the USB connector in the PU operation mode, set "3" in **Pr.551**.
- Parameter setting and monitoring can be performed by using FR Configurator2. For details, refer to the Instruction Manual of FR Configurator2.

Parameters referred to

Pr.551 PU mode operation command source selection F page 251

5.12.9 Automatic connection with GOT

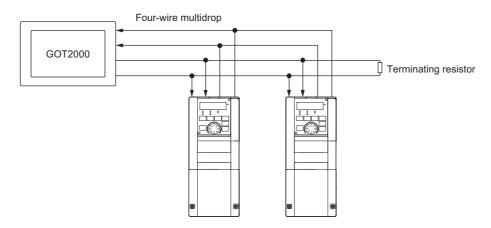
When the automatic connection is enabled in the GOT2000 series, the inverter can communicate with the GOT2000 series with only setting the station number and connecting the GOT. This eliminates the need for the communication parameter setting.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|---|---------------|---------------------------------------|--|
| 117 N020 | PU communication station number | 0 | 0 to 31 | Specify the inverter station number. The inverter station number setting is required when multiple inverters are connected to one GOT (PU connector communication). |
| 331 N030 | RS-485 communication station number | 0 | 0 to 31 (0 to 247) ^{*1*2} | Specify the inverter station number. The inverter station number setting is required when multiple inverters are connected to one GOT (RS-485 terminal communication). |

*1 When Pr.549 Protocol selection = "1" (MODBUS RTU protocol), the setting range is as shown in the parentheses.

*2 When a value outside the setting range is set, the inverter operates at the initial value.

Automatic connection system configuration



♦ GOT2000 series automatic recognition

- When the GOT2000 series is connected, the parameters required for the GOT connection are automatically changed by setting the automatic recognition on the GOT2000 series side.
- Set the station number (Pr.117 or Pr.331) of the inverter before the automatic recognition is performed.
- Connect all the stations of inverters with GOT before the automatic recognition is performed. The inverter newly added after automatic recognition will not be recognized automatically. (When an inverter is added, perform the initial setting in **Pr.999 Automatic parameter setting** or set the automatic recognition on the GOT side again.)

| Automatic change item | Automatic cha | inge parameter | Setting value after change |
|-----------------------------------|--|----------------|---|
| Automatic change item | PU connector connection RS-485 terminal connect | | Setting value after change |
| Communication speed | Pr.118 | Pr.332 | |
| Data length / stop bit | Pr.119 | Pr.333 | Demonstration of the contract of |
| Parity | Pr.120 | Pr.334 | Depending on the setting of the connected device on the GOT side. |
| Time delay setting | Pr.123 | Pr.337 | device on the GOT side. |
| CR/LF selection | Pr.124 | Pr.341 | |
| Number of communication retries | Pr.121 | Pr.335 | 9999 (fixed) |
| Communication check time interval | Pr.122 | Pr.336 | 9999 (fixed) |
| Protocol selection | (Pr.549 holds the value before the automatic recognition.) | Pr.549 | 0 (fixed to Mitsubishi inverter protocol) |



- If the automatic recognition cannot be performed, initial setting in **Pr.999** is required.
- For connecting the inverter to the GOT2000 series using the RS-485 terminal block, set **Pr.549 Protocol selection** = "0 (initial value) or 1".
- For connection to a device other than the GOT2000 series, initial setting in **Pr.999** is required.
- For details, refer to the GOT2000 Series Connection Manual (Mitsubishi Product).

Parameters referred to

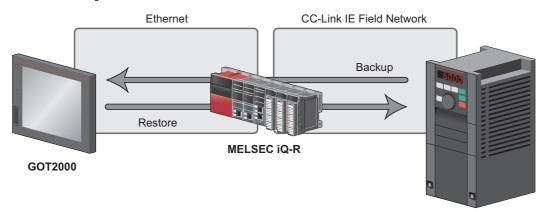
Pr.999 Automatic parameter setting CP page 211

5.12.10 Backup/restore

The GOT can be used for backing up inverter parameters and the data used in the PLC function of inverter. The backup data stored in the GOT can be used to restore the data in the inverter.

| Pr. | Name | Initial value | Setting range | Description | ł |
|---------------------------|--------------------------------|------------------|---------------|---|---|
| 434 N110 ^{*1} | Network number (CC-Link IE) | 0 | 0 to 255 | Enter the network number of the inverter. | |
| 435 N111 ^{*1} | Station number (CC Link IE) 0 | | 0 to 255 | Enter the station number of the inverter. | I |

*1 The setting is available in the inverter on which the FR-A8NCE is installed.



FR-F800 (with the FR-A8NCE installed)

Connected devices

 To enable backup/restore, connect the inverter with the FR-A8NCE to a programmable controller (master station) via the CC-Link IE Field Network.

- NOTE

- The backup/restore function is enabled only when the inverter is connected to a master station programmable controller.
- For details on the connected devices, refer to the GOT2000 Series User's Manual (Monitor).

Data to be backed up and restored

• The following data can be backed up and restored. The data other than those listed in the following table cannot be backed up or restored.

| Item | | | | |
|--|--|--|--|--|
| Inverter parameters | | | | |
| Parameters used for activating the PLC function | | | | |
| Programs (including SFCs) used in the PLC function | | | | |
| Global device comment information used in the PLC function | | | | |
| Function block source information | | | | |

Backup/restore operation

- The GOT backs up all applicable data in all the inverters that can be identified with the network numbers and station numbers in the controller list file.
- The GOT restores all relevant data of the inverters selected based on the network numbers and station numbers using the backup data.
- The backup/restore cannot be performed in the following cases.

| Operation | Inverter status |
|-----------|--|
| Backup | During an inverter reset A password is registered or password protection is enabled (Pr.297 ≠ "9999"). |
| | During parameter copy using an operation panel or USB memory device (during writing to the inverter) During restore |
| | While password protection is enabled for files used in the PLC function (read protection) |
| | While PLC function project data is written to, read from, or verified against a USB memory device |
| Restore | During an inverter reset During running During auto tuning A password is registered or password protection is enabled (Pr.297 ≠ "9999"). While parameter write is disabled (Pr.77 = "1") |
| | During parameter copy using an operation panel or USB memory device (during writing to / reading from / verification against the inverter) During backup operation |
| | During the RUN status of the PLC function |
| | While password protection is enabled for files used in the PLC function (write protection) |
| | While PLC function project data is written to, read from, or verified against a USB memory device |

• On the operation panel, "RD" is displayed during backup, and "WR" is displayed during restore.



- To enable the restore operation, Pr.434 Network number (CC-Link IE) and Pr.435 Station number (CC-Link IE) must be set.
- Backup is performed for parameters for which parameter copy can be performed.
- For details on backup/restore function, refer to the GOT2000 Series User's Manual (Monitor).

5.13 (G) Control parameters

| Purpose | Parame | eter to set | | Refer to page |
|--|---|--|---|---------------|
| To set the starting torque manually | Manual torque boost | P.G000, P.G010 | Pr.0, Pr.46 | 551 |
| To set the motor constant | Base frequency, base frequency voltage | P.G001, P.G002, P.G011 | Pr.3, Pr.19, Pr.47 | 552 |
| To select the V/F pattern matching the application | Load pattern selection | P.G003 | Pr.14 | 554 |
| To improve the torque in a low-speed range | Excitation current low-speed scaling factor | P.G003, P.G080, P.G201, P.G202, P.G301, P.G302 | Pr.14, Pr.85, Pr.86, Pr.565, Pr.566, Pr.617 | 555 |
| To perform energy saving operation | Energy saving operation | P.G030 | Pr.60 | 557 |
| To use a special motor | Adjustable 5 points V/F | P.C100, P.G040 to P.G049 | Pr.71, Pr.100 to Pr.109 | 558 |
| To compensate the motor slip amount when replacing an SF-JR motor with an SF-PR motor | SF-PR slip amount adjustment mode | P.G060, P.G061 | Pr.673, Pr.674 | 559 |
| To adjust the motor braking torque | DC injection brake | P.G100, P.G101, P.G110 | Pr.10 to Pr.12 | 560 |
| To exact the motor to a stor | Output stop function | P.G105 | Pr.522 | 562 |
| To coast the motor to a stop | Selection of motor stop method | P.G106 | Pr.250 | 563 |
| To use the regeneration unit to increase the motor braking torque | Regenerative brake selection | P.E300, P.T721 | Pr.30, Pr.599 | 566 |
| To operate the inverter with DC power supply | DC feeding mode | P.E300 | Pr.30 | 566 |
| To avoid overvoltage fault due to regenerative driving by automatic adjustment of output frequency | Regeneration avoidance function | P.G120 to P.G125 | Pr.882 to Pr.886, Pr.665 | 572 |
| To decrease the deceleration time of the motor | Increased magnetic excitation deceleration | P.G130 to P.G132 | Pr.660 to Pr.662 | 574 |
| To select the control method | Control method selection | P.G200 | Pr.800 | 177 |
| To secure the low-speed torque by compensating the slip of the motor | Slip compensation | P.G203 to P.G205 | Pr.245 to Pr.247 | 576 |
| To adjust the speed control gain | Speed control gain | P.G211, P.G212, P.G311, P.G312 | Pr.820, Pr.821, Pr.830, Pr.831 | 190 |
| To adjust the torque control gain | Torque control gain | P.G213, P.G214, P.G313, P.G314 | Pr.824, P.825, Pr.834, P.835 | 190 |
| To stabilize torque feedback signal | Torque detection filter | P.G216, P.G316 | Pr.827, Pr.837 | 193 |
| To suppress the machine resonance | Speed smoothing control | P.G410, P.G411 | Pr.653, Pr.654 | 577 |
| To adjust the speed gain for Advanced magnetic flux vector control | Speed control gain | P.G932, P.G942 | Pr.89, Pr.569 | 180 |

5.13.1 Manual torque boost

V/F

Voltage drop in the low-frequency range can be compensated, improving reduction of the motor torque in the low-speed range.

- Motor torque in the low-frequency range can be adjusted according to the load, increasing the motor torque at the start up.
- By using the RT signal, it is possible to switch between 2 types of torque boost.

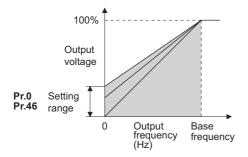
| Pr. | Name | Initial value | Setting range | Description | | |
|------|---------------------|--------------------|---------------|---|--|--|
| | Torque boost | 6% ^{*1} | | | | |
| 0 | | 4% ^{*2} | 0% to 30% | | | |
| | | 3% ^{*3} | | Set the output voltage at 0 Hz in %. | | |
| G000 | | 2% ^{*4} | | | | |
| | | 1.5% ^{*5} | | | | |
| | | 1% ^{*6} | | | | |
| 46 | Second torque boost | 9999 | 0% to 30% | Set the torque boost value at when the RT signal is ON. | | |
| G010 | Second torque boost | 2222 | 9999 | Without the second torque boost. | | |

- *1 Initial value for the FR-F820-00046(0.75K) or lower and FR-F840-00023(0.75K) or lower.
- *2 Initial value for the FR-F820-00077(1.5K) to FR-F820-00167(3.7K) and the FR-F840-00038(1.5K) to FR-F840-00083(3.7K).
- *3 Initial value for the FR-F820-00250(5.5K), FR-F820-00340(7.5K), FR-F840-00126(5.5K), and FR-F840-00170(7.5K).
- *4 Initial value for the FR-F820-00490(11K) to FR-F820-01540(37K), and the FR-F840-00250(11K) to FR-F840-00770(37K).
- *5 Initial value for the FR-F820-01870(45K), FR-F820-02330(55K), FR-F840-00930(45K), and FR-F840-01160(55K).

*6 Initial value for the FR-F820-03160(75K) or higher and FR-F840-01800(75K) or higher.

Starting torque adjustment

- Assuming Pr.19 Base frequency voltage is 100%, set the output voltage at 0 Hz to Pr.0 (Pr.46) in percentage.
- Perform the adjustment of the parameter little by little (approximately 0.5%), and confirm the status of the motor each time. The motor may overheat when the value is set too high. Do not use more than 10% as a guideline.



Setting multiple torque boosts (RT signal, Pr.46)

- When changing the torque boost depending on the application or when using single inverter switching between multiple motors, use the second torque boost.
- Pr.46 Second torque boost is enabled when the RT signal is ON.

• NOTE

- The RT signal is a second function selection signal which also enables other second functions. (Refer to page 377.)
- The RT signal is assigned to terminal RT in the initial status. Set "3" in one of **Pr.178 to Pr.189 (Input terminal function** selection) to assign the RT signal to another terminal.
- Set a larger value when the distance between the inverter and the motor is long or when there is not enough motor torque in the low-speed range. It may cause overcurrent trip when it is set too large.
- Setting for Pr.0 and Pr.46 becomes enabled only when the V/F control is selected.
- When the initial value is set in Pr.0, the Pr.0 setting is automatically changed by changing the Pr.71 Applied motor or Pr.81
 Number of motor poles setting. (Refer to page 379.)
- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.3 Base frequency, Pr.19 Base frequency voltage Spage 552 Pr.71 Applied motor Spage 379 Pr.178 to Pr.189 (Input terminal function selection) page 373

5.13.2 Base frequency voltage

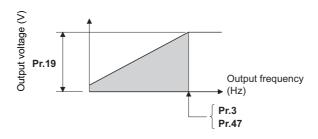
V/F

Use this function to adjust the inverter outputs (voltage, frequency) to match with the motor rating.

| Pr. | Pr. Name | | Initial value | | Description | |
|-----------------|------------------------|-----------------|---------------|-------------|---|--|
| F1. | Name | FM | CA | range | Description | |
| 3 G001 | Base frequency | 60 Hz | 50 Hz | 0 to 590 Hz | Set the frequency at the rated motor torque. (50/60 Hz) | |
| 40 | - | 9999 | 8888 | 0 to 1000 V | Set the base voltage. | |
| 19 G002 | Base frequency voltage | | | 8888 | 95% of the power supply voltage | |
| 0002 | | | | 9999 | Same as the power supply voltage | |
| 47 | Second V/F (base | e 0000 0 to 590 | | 0 to 590 Hz | Set the base frequency when the RL signal is ON. | |
| G011 frequency) | | 9999 | | 9999 | Second V/F disabled | |

Base frequency setting (Pr.3)

- When operating a standard motor, generally set the rated frequency of the motor in Pr.3 Base frequency. When the motor
 operation require switching to the commercial power supply, set the power supply frequency in Pr.3.
- When the frequency described on the motor rating plate is "50 Hz" only, make sure to set to 50 Hz. When it is set to 60 Hz, the voltage will drop too much, causing insufficient torque. As a result, the inverter output may be shut off due to overload. A caution is required especially in case of **Pr.14 Load pattern selection** = "1" (variable torque load).
- When using the Mitsubishi Electric constant torque motor, set Pr.3 to 60 Hz.



Setting multiple base frequencies (Pr.47)

- To change the base frequency when using a single inverter switching between multiple motors, use Pr.47 Second V/F (base frequency).
- Pr.47 is enabled when the RT signal is ON.

NOTE

- The RT signal is a second function selection signal which also enables other second functions. (Refer to page 377.)
- The RT signal is assigned to terminal RT in the initial status. Set "3" in one of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the RT signal to another terminal.

Setting of base frequency voltage (Pr.19)

- Use Pr.19 Base frequency voltage to set the base voltage (for example, rated motor voltage).
- When it is set lower than the power supply voltage, maximum output voltage of the inverter will be the voltage set in Pr.19.
- **Pr.19** can be used in the following cases.
 - (a) When regenerative driving (continuous regeneration, etc.) is performed frequently Output voltage will get higher than the specification during the regenerative driving, which may cause overcurrent trip (E.OC[]) by the increase in motor current.
 - (b) When the fluctuation of power supply voltage is high When the power supply voltage exceeds the rated voltage of the motor, fluctuation of rotation speed or overheating of motor may occur due to excessive torque or increase in motor current.

- NOTE

- When the Advanced magnetic flux vector control or PM motor control is selected, Pr.3, Pr.47, and Pr.19 will become disabled, and Pr.83 and Pr.84 will become enabled.
- However, S-pattern curve with **Pr.29 Acceleration/deceleration pattern selection** = "1" (S-pattern acceleration/deceleration A) will make **Pr.3** or **Pr.47** enabled. (S-pattern curve under PM motor control is the rated frequency of the motor.)
- When Pr.71 Applied motor = "2" (adjustable 5 points V/F), setting for Pr.47 will become disabled. Also, Pr.19 cannot be set to "8888" or "9999".
- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

A Parameters referred to

- Pr.14 Load pattern selection 3 page 554
- Pr.29 Acceleration/deceleration pattern selection is page 231
- Pr.71 Applied motor 37 page 37
- Pr.83 Rated motor voltage, Pr.84 Rated motor frequency 2 page 383
- Pr.178 to Pr.189 (Input terminal function selection) Figure 373

5.13.3 Load pattern selection

V/F

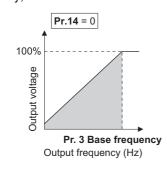
Optimal output characteristics (V/F characteristics) for application or load characteristics can be selected.

| Pr. | Name | Initial value | Setting range | Description |
|------|------------------------|---------------|------------------------|--|
| | Load pattern selection | 1 | 0 | For constant-torque load |
| 14 | | | 1 | For variable-torque load |
| G003 | | | 12 to 15 ^{*1} | Excitation current low-speed scaling factor (Refer to page 555.) |

*1 When the setting value is selected under V/F control, the operation is the same as the one for constant-torque load (Pr.14 = "0").

Application for constant-torque load (Pr.14 = "0")

- The output voltage will change linearly against the output frequency at the base frequency or lower.
- Set this parameter when driving a load that has constant load torque even when the rotation speed is changed, such as conveyor, dolly, or roll drive.



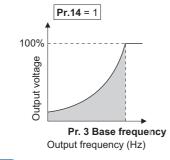
Point P

Select for constant-torque load (setting value "0") even for fan and pump in following cases.

- When accelerating a blower with large moment of inertia (J) in a short period of time.
- When it is a constant-torque load such as rotary pump or gear pump.
- · When the load torque increases in low speed such as screw pump.

Application for variable-torque load (Pr.14 = "1", initial value)

- The output voltage will change in square curve against the output frequency at the base frequency or lower. (1.75th-power curve for FR-F820-01540(37K) or higher, and FR-F840-00770(37K) or higher)
- Set this parameter when driving a load with load torque change proportionally against the square of the rotation speed, such as a fan or pump.





• Pr.14 will become enabled under V/F control.

A Parameters referred to

Pr.0 Torque boost r page 551 Pr.3 Base frequency r page 552

Pr.178 to Pr.189 (Input terminal function selection) 373

5.13.4 Excitation current low-speed scaling factor

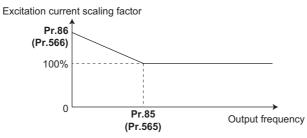
Magnetic flux

Under Advanced magnetic flux vector control, the excitation current scaling factor in the low-speed range can be adjusted.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|---|---------------|------------------|---|
| | | | 0, 1 | Excitation current low-speed scaling factor: Pr.86 Refer to page 554 for details of the operation under V/F control. |
| | | | 12 ^{*1} | Forward rotation excitation current low-speed scaling factor: Pr.86 Reverse rotation excitation current low-speed scaling factor: Pr.617 |
| 14 G003 | Load pattern selection | 0 | 13 ^{*1} | Forward rotation excitation current low-speed scaling factor: Pr.617 Reverse rotation excitation current low-speed scaling factor: Pr.86 |
| | | | 14 ^{*1} | Forward rotation excitation current low-speed scaling factor: Pr.86 Reverse rotation excitation current low-speed scaling factor: Pr.617 |
| | | | 15 ^{*1} | Forward rotation excitation current low-speed scaling factor: Pr.617 Reverse rotation excitation current low-speed scaling factor: Pr.86 |
| | | | 0 to 400 Hz | Set the frequency at which increased excitation is started. |
| 85 G201 | Excitation current break point | 9999 | 9999 | SF-PR/SF-HR/SF-HRCA motor: The predetermined frequency is applied. Motor other than the above: 10 Hz is applied. |
| | | | 0% to 300% | Set an excitation current scaling factor at 0 Hz. |
| 86 G202 | Excitation current low- speed scaling factor | 9999 | 9999 | SF-PR/SF-HR/SF-HRCA motor: The predetermined scaling factor is applied. Motor other than the above: 130% is applied. |
| 617 | Reverse rotation excitation | | 0% to 300% | Set an excitation current scaling factor when different excitation current scaling factors are used for forward and reverse rotation. |
| G080 | current low-speed scaling factor | 9999 | 9999 | SF-PR/SF-HR/SF-HRCA motor: The predetermined scaling factor is applied. Motor other than the above: 130% is applied. |
| | | | 0 to 400 Hz | Set an excitation current break point when the RT signal is ON. |
| 565 G301 | Second motor excitation current break point | 9999 | 9999 | SF-PR/SF-HR/SF-HRCA motor: The predetermined frequency is applied. Motor other than the above: 10 Hz is applied. |
| 566 | Second motor excitation | 9999 | 0% to 300% | Set an excitation current low-speed scaling factor when the RT signal is ON. |
| 566 G302 | current low-speed scaling factor | | 9999 | SF-PR/SF-HR/SF-HRCA motor: The predetermined scaling factor is applied. Motor other than the above: 130% is applied. |

*1 The function is enabled under Advanced magnetic flux vector control. When **Pr.14** = "12 to 15" and V/F control is selected, the operation is the same as the one for constant-torque load (**Pr.14** = "0"). (Refer to page 554.)

- Under Advanced magnetic flux vector control, excitation current in the low-speed range can be increased to improve torque. When **Pr.14** = "12 to 15", the excitation current scaling factor can be switched for the forward/reverse rotation.
- Increased excitation is applied when the output frequency is equal to or lower than the setting in Pr.85 Excitation current break point. The excitation current scaling factor at 0 Hz is set in Pr.86 Excitation current low-speed scaling factor. Use Pr.565 Second motor excitation current break point and Pr.566 Second motor excitation current low-speed scaling factor for the setting for using the second motor (RT signal-ON).



• An excitation current low-speed scaling factor set in the parameter shown in the table is used according to the **Pr.14** setting and other conditions.

| Pr.14 setting | During forw | ard rotation | During reverse rotation | | |
|---------------|---------------|--------------|-------------------------|--------------|--|
| P1.14 Setting | RT signal OFF | RT signal ON | RT signal OFF | RT signal ON | |
| 0, 1 | Pr.86 | Pr.566 | Pr.86 | Pr.566 | |
| 12 | Pr.86 | Pr.566 | Pr.617 | Pr.617 | |
| 13 | Pr.617 | Pr.617 | Pr.86 | Pr.566 | |
| 14 | Pr.86 | Pr.566 | Pr.617 | Pr.566 | |
| 15 | Pr.617 | Pr.566 | Pr.86 | Pr.566 | |

• When the SF-PR/SF-HR/SF-HRCA motor is used (**Pr.71** = "40, 43, 44, 50, 53, 54, 70, 73, or 74") and "9999" is set in **Pr.85**/ **Pr.86**, the predetermined setting in the following table is applied.

| Motor | SF-PR | | | | | | SF-HR/SF-HRCA | | | | | | |
|----------|-------------|-------|-------------|-------|-------|-------------|---------------|-------------|-------|-------------|-------|-------------|--|
| capacity | Pr.81 = "2" | | Pr.81 = "4" | | Pr.81 | Pr.81 = "6" | | Pr.81 = "2" | | Pr.81 = "4" | | Pr.81 = "6" | |
| (kW) | Pr.85 | Pr.86 | Pr.85 | Pr.86 | Pr.85 | Pr.86 | Pr.85 | Pr.86 | Pr.85 | Pr.86 | Pr.85 | Pr.86 | |
| 0.4 | — | — | — | — | — | — | 10 Hz | 130% | 10 Hz | 130% | 10 Hz | 130% | |
| 0.75 | 20 Hz | 130% | 20 Hz | 130% | 10 Hz | 130% | 10 Hz | 130% | 10 Hz | 130% | 10 Hz | 130% | |
| 1.5 | 30 Hz | 140% | 10 Hz | 130% | 10 Hz | 130% | 10 Hz | 130% | 10 Hz | 130% | 10 Hz | 130% | |
| 2.2 | 10 Hz | 150% | 10 Hz | 130% | 20 Hz | 130% | 20 Hz | 150% | 10 Hz | 130% | 10 Hz | 130% | |
| 3.7 | 30 Hz | 150% | 25 Hz | 133% | 20 Hz | 130% | 30 Hz | 160% | 30 Hz | 140% | 10 Hz | 130% | |
| 5.5 | 10 Hz | 150% | 10 Hz | 130% | 30 Hz | 130% | 30 Hz | 140% | 30 Hz | 140% | 20 Hz | 140% | |
| 7.5 | 10 Hz | 150% | 30 Hz | 118% | 30 Hz | 130% | 30 Hz | 140% | 30 Hz | 140% | 30 Hz | 150% | |
| 11 | 10 Hz | 150% | 20 Hz | 140% | 10 Hz | 130% | 30 Hz | 140% | 10 Hz | 130% | 30 Hz | 130% | |
| 15 | 10 Hz | 150% | 30 Hz | 130% | 30 Hz | 130% | 20 Hz | 140% | 10 Hz | 130% | 30 Hz | 130% | |
| 18.5 | 10 Hz | 150% | 30 Hz | 130% | 20 Hz | 130% | 30 Hz | 150% | 30 Hz | 140% | 30 Hz | 140% | |
| 22 | 30 Hz | 130% | 10 Hz | 130% | 10 Hz | 130% | 30 Hz | 150% | 30 Hz | 140% | 20 Hz | 140% | |
| 30 | 10 Hz | 150% | 20 Hz | 130% | 10 Hz | 130% | 30 Hz | 150% | 20 Hz | 150% | 10 Hz | 130% | |
| 37 | 20 Hz | 140% | 10 Hz | 140% | 20 Hz | 130% | 20 Hz | 160% | 20 Hz | 150% | 10 Hz | 130% | |
| 45 | 10 Hz | 140% | 20 Hz | 130% | 10 Hz | 130% | 10 Hz | 130% | 20 Hz | 140% | 10 Hz | 140% | |
| 55 | 20 Hz | 140% | 30 Hz | 130% | — | — | 10 Hz | 140% | 20 Hz | 150% | — | — | |

5.13.5 Energy saving control

Magnetic flux

The inverter will automatically perform energy saving operation without setting detailed parameters.

This control method is suitable for applications such as fans and pumps.

| Pr. | Name | Initial value | Setting range | Description |
|------------|---|---------------|---------------|----------------------------|
| | Francisco de la constancia de | 0 | 0 | Normal operation |
| 60 G030 | Energy saving control selection | | 4 | Energy saving operation |
| 9030 | | | 9 | Optimum excitation control |

Energy saving operation (Pr.60 = "4")

- Setting **Pr.60** = "4" will select the energy saving operation.
- With the energy saving operation, the inverter will automatically control the output voltage so the inverter output power during the constant-speed operation will become minimal.
- Energy saving operation will be enabled under V/F control.

◆ Optimum excitation control (Pr.60 = "9")

- Setting **Pr.60** = "9" will select the Optimum excitation control.
- The Optimum excitation control is a control method to decide the output voltage by controlling the excitation current so the efficiency of the motor is maximized.
- Optimum excitation control will be enabled under V/F control and Advanced magnetic flux vector control.

- NOTE

- In the energy saving operation mode, an energy saving effect is not expected for applications with high load torque or with the equipment with frequent acceleration and deceleration.
- In the Optimum excitation control mode, an energy saving effect is not expected when the motor capacity is extremely small compared with the inverter capacity or when multiple motors are connected to a single inverter.
- When the energy saving operation mode or Optimum excitation control mode is selected, the deceleration time may become longer than the setting value. Also, it may cause overvoltage more often compared to constant-torque load characteristics, so set the deceleration time longer.
- When the motor becomes unstable during the acceleration, set the acceleration time longer.
- Output current may increase slightly with the energy saving operation mode or the Optimum excitation control mode since the output voltage is controlled.

5.13.6 Adjustable 5 points V/F

V/F

By setting a desired V/F characteristic from the start up to the base frequency or base voltage with the V/F control (frequency voltage/frequency), a dedicated V/F pattern can be generated.

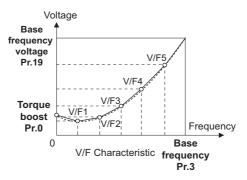
The optimal V/F pattern matching the torque characteristics of the facility can be set.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|---------------------------------|---------------|-------------------|---|
| 71 C100 | Applied motor | plied motor 0 | | Standard motor (such as SF-JR) Adjustable 5 points V/F |
| 0100 | | | Others | Refer to page 379. |
| 100 G040 | V/F1 (first frequency) | 9999 | 0 to 590 Hz, 9999 | |
| 101 G041 | V/F1 (first frequency voltage) | 0 V | 0 to 1000 V | |
| 102 G042 | V/F2 (second frequency) | 9999 | 0 to 590 Hz, 9999 | |
| 103 G043 | V/F2 (second frequency voltage) | 0 V | 0 to 1000 V | |
| 104 G044 | V/F3 (third frequency) | 9999 | 0 to 590 Hz, 9999 | Set each point of the V/F pattern (frequency, voltage). |
| 105 G045 | V/F3 (third frequency voltage) | 0 V | 0 to 1000 V | 9999: Do not set V/F. |
| 106 G046 | V/F4 (fourth frequency) | 9999 | 0 to 590 Hz, 9999 | |
| 107 G047 | V/F4 (fourth frequency voltage) | 0 V | 0 to 1000 V | |
| 108 G048 | V/F5 (fifth frequency) | 9999 | 0 to 590 Hz, 9999 | |
| 109 G049 | V/F5 (fifth frequency voltage) | 0 V | 0 to 1000 V | |

By setting the V/F1 (first frequency voltage/first frequency) to V/F5 parameters in advance, a desired V/F characteristic can be obtained.

• For an example, with the equipment with large static friction factor and small dynamic friction factor, large torque is required only at the start up, so a V/F pattern that will raise the voltage only at the low-speed range is set.

- Setting procedure
 - Set the rated motor voltage in Pr.19 Base frequency voltage. (No function at the setting of "9999" or "8888".)
 - 2. Set Pr.71 Applied motor = "2" (adjustable 5 points V/F).
 - 3. Set frequency and voltage to be set in Pr.100 to Pr.109.



Make sure to set the parameters correctly according to the motor used. Incorrect setting may cause the motor to overheat and burn.



- The adjustable 5 points V/F is enabled under V/F control.
- When Pr.19 Base frequency voltage = "8888 or 9999", setting of Pr.71 = "2" is not available. To set "2" in Pr.71, set the rated motor voltage in Pr.19.
- A write disable error " " is generated when the same frequency value is used for multiple points.
- Set frequency or voltage for each point in Pr.100 to Pr.109 within the range of Pr.3 Base frequency or Pr.19 Base frequency voltage.
- When Pr.71 = "2", Pr.47 Second V/F (base frequency) is not available.
- When **Pr.71** = "2", the inverter calculates the characteristic of the electronic thermal relay for a standard motor.
- By simultaneously using **Pr.60 Energy saving control selection** and the adjustable 5 points V/F, further energy saving effect is expected.
- The Pr.0 Torque boost and Pr.12 DC injection brake operation voltage settings are automatically changed according to the Pr.71 setting. (Refer to page 382.)

Parameters referred to

Pr.0 Torque boost 3 page 551

Pr.3 Base frequency, Pr.19 Base frequency voltage F page 552

Pr.12 DC injection brake operation voltage i page 560

Pr.47 Second V/F (base frequency) 2 page 558

Pr.60 Energy saving control selection Page 557 Pr.71 Applied motor, Pr.450 Second applied motor page 379

5.13.7 SF-PR slip amount adjustment mode

V/F

- As compared to our conventional SF-JR motor, the slip amount is small for the high-performance energy-saving SF-PR motor. When replacing the SF-JR to the SF-PR, the slip amount is reduced and the rotations per minute increases. Therefore, when the SF-PR is used with the same frequency setting as that of the SF-JR, power consumption may increase as compared to the SF-JR.
- By setting the slip amount adjustment mode, the frequency command can be adjusted to keep the rotations per minute of the SF-PR equivalent to those of the SF-JR for power consumption reduction.

| Pr. | Name | Initial value | Setting range | Description |
|-----------------------|--------------------------------------|---------------|---------------|--|
| 673 SF-PR slip amount | | | 2, 4, 6 | Set the number of poles of the SF-PR. |
| G060 | adjustment operation | 9999 | 9999 | The slip amount adjustment is disabled. |
| 674 G061 | SF-PR slip amount adjustment gain | 100% | 0% to 500% | Setting is available for fine adjustment of the slip amount. |

By setting the number of SF-PR motor poles in Pr.673 SF-PR slip amount adjustment operation selection, the SF-PR slip amount adjustment mode is activated.

- The SF-PR slip amount adjustment mode is available only under V/F control.
- Use Pr.674 SF-PR slip amount adjustment gain to fine-tune the rotations per minute. To reduce the rotations per minute (to increase the compensation frequency), set a larger value in Pr.674. To increase the rotations per minute (to reduce the compensation frequency), set a smaller value in Pr.674. (Lower rotations per minute reduce the power consumption, and higher rotations per minute increase the power consumption.)



- The slip amount adjustment is not available in the following conditions. During acceleration/deceleration, during DC injection brake operation, during PID control, during stall prevention operation, during regeneration avoidance operation, during traverse operation, and while the slip compensation is valid (**Pr.245**).
- The slip amount adjustment is not available when the applicable motor capacity of the inverter is not compatible with the SF-PR. (For details on applicable motor capacity, refer to page 638.)

5.13.8 DC injection brake

Adjust the braking torque and timing to stop the motor using the DC injection brake.
 By the DC injection brake operation, DC voltage is applied to the motor to prevent rotation of the motor shaft. When a motor shaft is rotated by external force, the motor shaft does not go back to the original position.

| Pr. | Name | Initial value | Setting range | Description | |
|------|---|------------------|---------------|--|--|
| 10 | DC injection brake | 3 Hz | 0 to 120 Hz | Set the operation frequency for the DC injection brake. | |
| G100 | operation frequency | 3 HZ | 9999 | The operation starts at the frequency set in Pr.13 or lower. | |
| | | | 0 | Without DC injection brake. | |
| | DC injection brake operation time | 0.5 s | 0.1 to 10 s | Set the operation time for the DC injection brake. | |
| | | | 8888 | The operation continues while the X13 signal is ON. | |
| | | 4% ^{*1} | | | |
| | DC injection brake operation voltage | 2% ^{*2} | 0% to 30% | Set the DC injection brake voltage (torque). When set to "0", the DC injection brake is not applied. | |
| | | 1% ^{*3} |] | | |

*1 The initial value for the FR-F820-00340(7.5K) or lower and FR-F840-00170(7.5K) or lower.

*2 Initial value for the FR-F820-00490(11K) to FR-F820-02330(55K), and the FR-F840-00250(11K) to FR-F840-01160(55K).

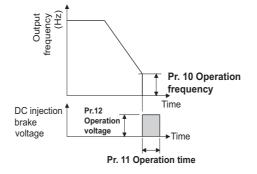
*3 Initial value for the FR-F820-03160(75K) or higher and FR-F840-01800(75K) or higher.

Setting of operating frequency (Pr.10)

- By setting the frequency to operate the DC injection brake to **Pr.10 DC injection brake operation frequency**, the DC injection brake will operate when it reaches this frequency at the time of deceleration.
- When Pr.10 = "9999", DC injection brake will start when the frequency reaches Pr.13 Starting frequency.
- · The DC injection brake operation frequency depends on the stopping method.

| Stopping method | Parameter setting | DC injection brake operation frequency | |
|--|--|--|--|
| | 0.5 Hz or higher in Pr.10 | Pr.10 setting | |
| Press the STOP key on the operation panel. Turn OFF the STF/STR signal. | Lower than 0.5 Hz in Pr.10 , and 0.5 Hz or higher in Pr.13 | 0.5 Hz | |
| | Lower than 0.5 Hz in both Pr.10 and Pr.13 | Pr.10 or Pr.13 setting, whichever larger | |
| Set frequency to 0 Hz | — | Pr.13 setting or 0.5 Hz, whichever smaller | |

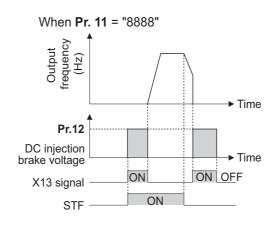
• The DC injection brake operation frequency will be fixed to 0 Hz under PM motor control.



Setting of operation time (X13 signal, Pr.11)

- Set the operation time for the DC injection brake in **Pr.11 DC injection brake operation time**.
- When the motor does not stop due to large load moment (J), increase the setting to ensure the effect.
- The DC injection brake operation is not available when "0" is set in **Pr.11**. (The motor will coast to stop.)
- When Pr.11 = "8888", DC injection brake will operate when the X13 signal is turned ON. DC injection brake will operate when the X13 signal is turned ON even while operating.

• For the X13 signal input, set "13" in any parameter from Pr.178 to Pr.189 to assign the function.



• The X13 signal is disabled during PM motor control.

Setting of operation voltage (torque) (Pr.12)

- Set the percentage against the power supply voltage in Pr.12 DC injection brake operation voltage.
- The DC injection brake operation is not available when "0" is set in Pr.12. (The motor will coast to stop.)

NOTE

• When the setting of Pr.12 is the initial value, the setting corresponding to the motor is set according to the Pr.71 Applied motor setting. (Refer to page 382.) However, when an energy saving motor (SF-HR or SF-HRCA) is used, change the Pr.12 setting as shown below.

| Inverter | Pr.12 setting |
|--|---------------|
| FR-F820-00167(3.7K) or lower | 4% |
| FR-F840-00083(3.7K) or lower | |
| FR-F820-00250(5.5K), FR-F820-00340(7.5K) FR-F840-00126(5.5K), FR-F840-00170(7.5K) | 3% |
| FR-F820-00490(11K) to FR-F820-00930(22K), FR-F820-01540(37K) or higher FR-F840-00250(11K) to FR-F840-00470(22K), FR-F840-00770(37K) or higher | 2% |
| FR-F820-01250(30K) FR-F840-00620(30K) | 1.5% |

• Even if a larger value is set in Pr.12, braking torque is limited so the output current will be within the rated current of the inverter.

∕î∖ CAUTION

Install a mechanical brake to make an emergency stop or to stay stopped for a long time.

Parameters referred to

Pr.13 Starting frequency rage 238, page 239 Pr.71 Applied motor rag page 379

- Pr.80 Motor capacity 🖙 page 383

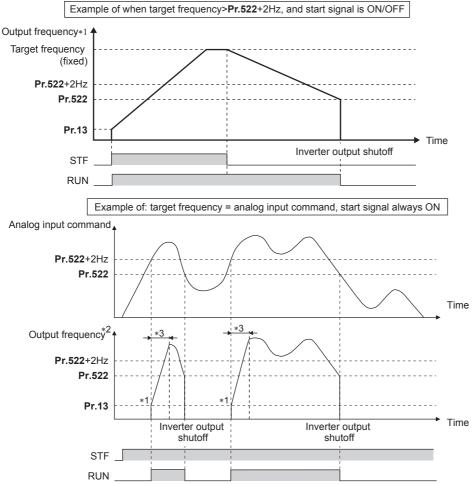
Pr.178 to Pr.189 (Input terminal function selection) F page 373

5.13.9 Output stop function

The motor coasts to a stop (inverter output is shutoff) when the inverter output frequency falls to Pr.522 setting or lower.

| Pr. | Name | Initial value | Setting range | Description |
|----------------------------|-----------------------|---------------|------------------|---|
| 522 | Output aton from anon | 9999 | 0 to 590 Hz | Set the frequency to start coasting to a stop (output shutoff). |
| G105 Output stop frequency | 9999 | 9999 | No function | |

- When both of the frequency setting signal and output frequency fall to the frequency set in Pr.522 or lower, the inverter stops the output and the motor coasts to a stop.
- The motor re-starts when the frequency setting signal exceeds **Pr.522** + 2 Hz and is accelerated at the **Pr.13 Starting** frequency (0.01 Hz under PM motor control).



*1 The output frequency to be compared with the **Pr.522** setting is the output frequency before slip compensation (V/F control or Advanced magnetic flux vector control), or the speed command value converted into the frequency (PM motor control).

*2 The motor is accelerated at the **Pr.13 Starting frequency** (0.01 Hz under PM motor control).

*3 The steepness of the slope depends on the acceleration/deceleration time settings such as Pr.7.



- When the output stop function is enabled (**Pr.522** ≠ "9999"), the DC injunction brake operation is disabled and the motor coasts to stop when the output frequency drops to the **Pr.522** setting or lower.
- The motor starts acceleration again at Pr.13 Starting frequency (0.01 Hz under PM motor control) when the command value exceeds Pr.522 + 2 Hz again if the start signal remains ON while the motor is coasting after the frequency drops to the Pr.522 setting or lower. Re-acceleration during coasting may cause an output shutoff of the inverter depending on the parameter setting. (Activation of the restart function is recommended especially for a PM motor.)
- The output stop frequency function is disabled during PID control, JOG operation, power failure stop, traverse function operation, or offline auto tuning.
- During the output stop due to the output stop function (when forward/reverse command is given, but frequency command is not given), the FWD/REV LED indicator on the operation panel blinks fast. (When the frequency command is not given even if the forward/reverse command is given.)

• A PM motor is a motor with interior permanent magnets. High voltage is generated at motor terminals while the motor is running.

Do not touch motor terminals and other parts until the motor stops to prevent an electric shock.

Parameters referred to

Pr.10 DC injection brake operation frequency, Pr.11 DC injection brake operation time, Pr.12 DC injection brake operation voltage 🖙 page 560 Pr.13 Starting frequency 🖙 page 238, page 239

5.13.10 Start signal operation selection / stop selection

Select the stopping method (deceleration stop or coasting) at turn-OFF of the start signal.

Coasting can be selected for the cases such that the motor is stopped with a mechanical brake at turn-OFF of the start signal. The operation of the start signal (STF/STR) can be selected.

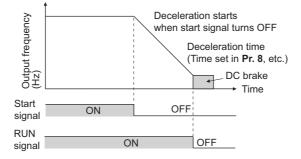
| Pr. | Name | Initial value | Setting range | Description | | | |
|------------|-------------------|--------------------|------------------------------|--|--|--|--|
| PI. Nallie | | Initial value | Setting range | Start signal (STF/STR) | Stop operation | | |
| | Stop selection | 9999 | 0 to 100 s | STF signal: Forward rotation start STR signal: Reverse rotation start | The motor coasts to a stop after a lapse of the setting time when the start signal is turned OFF. | | |
| | | | 1000 to 1100 s ^{*1} | STF signal: Start signal STR signal: Forward/reverse rotation signal | The motor coasts to a stop after a lapse of the (Pr.250 - 1000) seconds when the start signal is turned OFF. | | |
| | | | 9999 | STF signal: Forward rotation start STR signal: Reverse rotation start | The motor is decelerated to a stop | | |
| | | 8888 ^{*1} | 8888 ^{*1} | STF signal: Start signal STR signal: Forward/reverse rotation signal | when the start signal is turned OFF. | | |

*1 Valid only in External operation mode.

Stop selection

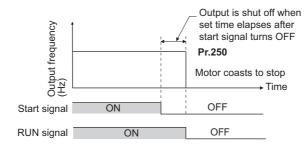
■ To decelerate the motor to a stop

- Set Pr.250 = "9999 (initial value) or 8888".
- The motor is decelerated to a stop when the start signal (STF/STR) is turned OFF.



■ To coast the motor to a stop

- Set the time required to shut off the output after the start signal is turned OFF in Pr.250. When "1000 to 1100" is set, output is shut off after a lapse of the (Pr.250 1000) seconds.
- The output is shut off after a lapse of the setting time of Pr.250 when the start signal is turned OFF. Motor coasts to a stop.
- · The RUN signal is turned OFF when the output is shut off.



• NOTE

The stop selection setting is disabled when the following functions are operating.
 Power failure stop function (Pr.261)
 PU stop (Pr.75)

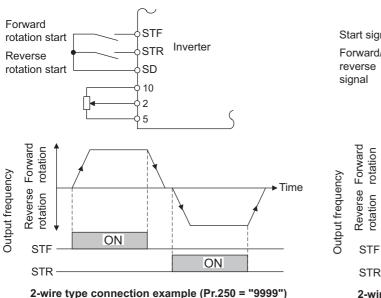
Deceleration stop due to a communication error (**Pr.502**)

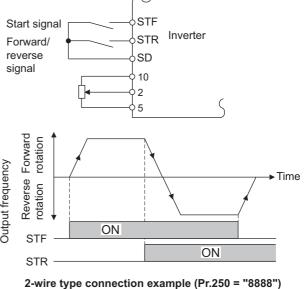
- Offline auto tuning (with motor rotation)
- When **Pr.250** ≠ "9999 or 8888", acceleration/deceleration is performed in accordance to the frequency command until the output is shut off by turning OFF the start signal.
- When the restart signal is turned ON during the motor coasting, the operation is resumed from Pr.13 Starting frequency.

Start signal operation selection

■ 2-wire type (STF signal, STR signal)

- The following figure shows the 2-wire type connection.
- As an initial setting, the forward/reverse rotation signals (STF/STR) acts as both start and stop signals. Either one turned ON will be enabled, and the operation will follow that signal. The motor will decelerate to a stop when both are turned OFF (or both are turned ON) during the operation.
- The frequency can be set by inputting 0 to 10 VDC between the speed setting input terminals 2 and 5, or with **Pr.4 to Pr.6 Multi-speed setting (high speed, middle speed, and low speed)**. (For the multi-speed operation, refer to page 263.)
- By setting Pr.250 = "1000 to 1100, 8888", the STF signal input becomes the start command and the STR signal input becomes the forward/reverse command.



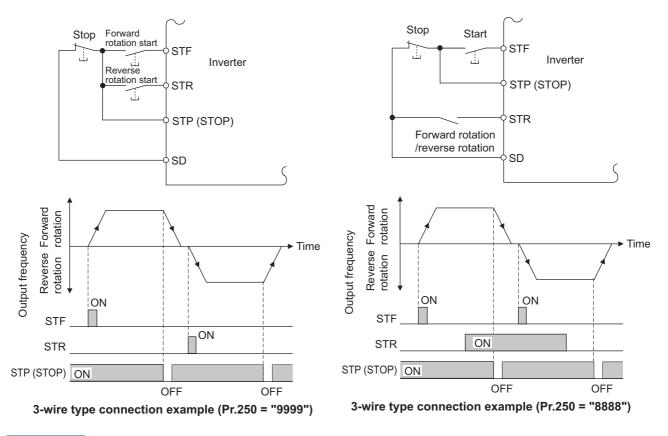




- By setting Pr.250 = "0 to 100, 1000 to 1100", the motor will coast to a stop when the start command is turned OFF.
- The STF and STR signals are assigned to terminals STF and STR in the initial status. The STF signal can be assigned to terminal STF only using **Pr.178 STF terminal function selection**, and the STR signal can be assigned to terminal STR only using **Pr.179 STR terminal function selection**.

■ 3-wire type (STF signal, STR signal, STP (STOP) signal)

- The following figure shows the 3-wire type connection.
- The self-holding function is enabled when the STP (STOP) signal is turned ON. In such case, the forward/reverse signal is simply used as a start signal.
- Even if a start signal (STF or STR) is turned ON and then OFF, the start command remains valid and the motor operation continues. To change the rotation direction, turn the STR (STF) signal ON once and then OFF.
- In order to decelerate the motor to a stop, turn OFF the STP (STOP) signal once.



- NOTE

- The STP (STOP) signal is assigned to terminal STP (STOP) in the initial status. Set "25" in any of Pr.178 to Pr.189 to assign the STP (STOP) signal to another terminal.
- When the JOG operation is enabled by turning ON the JOG signal, the STP (STOP) signal will be disabled.
- Even when the output is stopped by turning ON the MRS signal, the self-holding function is not canceled.

■ Start signal selection

| STF | STR | Pr.250 setting and inverter status | | |
|-----|-----|------------------------------------|----------------------|--|
| 317 | | 0 to 100 s, 9999 | 1000 to 1100 s, 8888 | |
| OFF | OFF | Stop | Stop | |
| OFF | ON | Reverse rotation | Stop | |
| ON | OFF | Forward rotation | Forward rotation | |
| ON | ON | Stop | Reverse rotation | |

A Parameters referred to

Pr.7 Acceleration time, Pr.8 Deceleration time ☞ page 228 Pr.4 to Pr.6 (Multi-speed setting) ☞ page 263 Pr.13 Starting frequency ☞ page 238, page 239 Pr.75 Reset selection/disconnected PU detection/PU stop selection Sepage 196 Pr.178 to Pr.189 (Input terminal function selection) Sepage 373 Pr.261 Power failure stop selection selection 478

Pr.502 Stop mode selection at communication error is page 500

5.13.11 Regenerative brake selection and DC feeding mode

- For operation with frequent starts and stops, the regenerative power can be consumed by using the optional brake unit (FR-BU2, BU, or FR-BU).
- The multifunction regeneration converter (FR-XC in power regeneration mode), power regeneration common converter (FR-CV), and power regeneration converter (MT-RC) are used for continuous operation during regenerative driving. The high power factor converter (FR-HC2) and multifunction regeneration converter (FR-XC in common bus regeneration mode) can also be used to reduce harmonics, improve power factor, and operate continuously during regenerative driving.
- It is possible to choose between the DC feeding mode 1, which will operate with DC power supply (terminals P and N), and DC feeding mode 2, which will normally operate in AC power supply (terminals R, S, and T) and operate in DC power supply (terminal P and N), such as batteries, at the time of power failure.
- While the power is supplied only to the control circuit, the reset operation when the power is supplied to the main circuit can be selected.

| Pr. | Name | Initial value | Setting range | Description |
|--------|-----------------------|--------------------------------------|---|--|
| - | Regenerative function | | 0, 2, 10, 11, 20, 21, 100 to 102, 110, 111, 120, 121 ^{*1} | Set the applied regeneration unit, the terminal used for |
| | selection | 0 ^{*1*3} , 10 ^{*2} | 2, 10, 11, 102, 110, 111 ^{*2} | power supply, and whether to reset the inverter when the |
| | | | 0, 2, 10, 20, 100, 102, 110, | power is supplied to the main circuit. |
| | | | 120 ^{*3} | |
| 599 | X10 terminal input | 0 ^{*1} , 1 ^{*2} | 0 | Normally open input |
| T721 s | selection | 0',1- | 1 | Normally closed input (NC contact input specification) |

*1 The initial value or setting range for the standard model.

*2 The initial value or setting range for the separated converter type.

*3 The initial value or setting range for the IP55 compatible model.

Details of the setting value

• FR-F820-02330(55K) or lower, FR-F840-01160(55K) or lower

| Regeneration unit | Power supply terminals of inverter | Pr.30 setting ^{*1} |
|---|------------------------------------|-----------------------------|
| Brake unit | R, S, T | 0 (initial value), 100 |
| (FR-BU2 (GZG/GRZG/FR-BR), FR-BU, BU) | P, N | 10, 110 |
| | R, S, T/P, N | 20, 120 |
| Multifunction regeneration converter (FR-XC) (power regeneration mode 1 or 2) | R, S, T | 0 (initial value) |
| High power factor converter (FR-HC2), multifunction regeneration converter (FR-XC) (common bus regeneration mode), power regeneration common converter (FR- CV) | P, N | 2, 102 |
| For manufacturer setting. Do not set. | 1, 11, 21, 101, 111, 121 | |

• FR-F820-03160(75K) or higher and FR-F840-01800(75K) or higher

| Regeneration unit | Power supply terminals of inverter | Pr.30 setting ^{*1} |
|---|------------------------------------|-----------------------------|
| | R, S, T | 0 (initial value), 100 |
| Without regenerative function | P, N | 10, 110 |
| | R, S, T/P, N | 20, 120 |
| | R, S, T | 1, 101 |
| Brake unit (FR-BU2 (MT-BR5)) | P, N | 11, 111 |
| | R, S, T/P, N | 21, 121 |
| Power regeneration converter (MT-RC) | R, S, T | 1, 101 |
| High power factor converter (FR-HC2) | P, N | 2, 102 |
| Multifunction regeneration converter (FR-XC) (power regeneration mode 1 or 2) | R, S, T | 0 (initial value) |

• FR-F842-07700(355K) or higher

| Regeneration unit | Pr.30 setting ^{*1} |
|--|-----------------------------|
| Without regenerative function (FR-CC2) | 10 (initial value), 110 |
| Brake unit (FR-CC2+FR-BU2 (MT-BR5)) | 11, 111 |
| High power factor converter (FR-HC2) | 2, 102 |

*1 While the power is supplied only to the control circuit with **Pr.30** = "100 or higher", the inverter reset is not performed when the power is supplied to the main circuit.

When using a brake unit (FR-BU2, BU, FR-BU) (FR-F820-02330(55K) or lower, FR-F840-01160(55K) or lower)

• When using the built-in brake, using the FR-BU2 in combination with the GZG/GRZG/FR-BR, or using the BU or FR-BU, set **Pr.30** = "0 (initial value), 10, 20, 100, 110, or 120".

When using a brake unit (FR-BU2) (FR-F820-03160(75K) or higher, FRF840-01800(75K) or higher)

- To use the FR-BU2 in combination with the MT-BR5, set as follows.
- Set "1, 11, or 21" in Pr.30.
- Set the brake unit FR-BU2, Pr.0 Brake mode selection = "2".

• The stall prevention (overvoltage), oL, does not occur while Pr.30 = "1, 11, or 21".

When using the power regeneration converter (MT-RC)

- Set "1 or 101" in **Pr.30**.
- When using the high power factor converter (FR-HC2), multifunction regeneration converter (FR-XC), power regeneration common converter (FR-CV), or converter unit (FR-CC2)
- To use the FR-HC2 or FR-CV, set Pr.30 = "2 or 102".
- To use the FR-XC in common bus regeneration mode, set Pr.30 = "2 or 102".
 To use the FR-XC in power regeneration mode 1 or 2, set Pr.30 = "0".
- When using the FR-CC2, set Pr.30 = "10" (initial value of the separated converter type).
- Use any of **Pr.178 to Pr.189 (Input terminal function assignment)** to assign the following signals to the contact input terminals.
 - (a) Inverter run enable (X10) signal: FR-HC2 connection, FR-XC connection, FR-CV connection, FR-CC2 connection To ensure coordinated protection of the FR-HC2, FR-XC (common bus regeneration mode), FR-CV, or FR-CC2, use the X10 signal to shut off the inverter output.

Input the RDY signal of the FR-HC2 (the RYB signal of the FR-XC, the RDYB signal of FR-CV, or the RDA signal of FR-CC2).

(b) FR-HC2/FR-CC2 connection, instantaneous power failure detection (X11) signal: FR-HC2 connection, FR-CC2 connection

During the operation using RS-485 communication, with the remote output and analog remote output functions enabled, the X11 signal is used to store the status when the inverter is set to store the status before an instantaneous power failure.

Input the FR-HC2/FR-CC2 connection, instantaneous power failure detection signal.

• For the terminal used for the X10 or X11 signal, set "10" (X10) or "11" (X11) in any parameter from **Pr.178 to Pr.189** and assign the function. (For the separated converter type, the X10 signal is assigned to terminal MRS in the initial setting.)

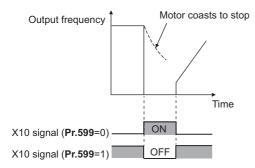
NOTE



- For details on connecting the brake unit, high power factor converter (FR-HC2), multifunction regeneration converter (FR-XC), or power regeneration common converter (FR-CV), refer to page 80. For details of each option, refer to the Instruction Manual of each option.
- Setting Pr.30 = "2" will reset the inverter, and "Err" is displayed on the operation panel during the reset.

Logic reversing of the Inverter run enable signal (X10 signal, Pr.599)

- Use Pr.599 X10 terminal input selection to select the X10 signal input specification between normally open (NO contact) and normally closed (NC contact). With the normally closed (NC contact) input specification, the inverter output is shut off by turning OFF (opening) the X10 signal.
- Changing the inverter logic (NO/NC contact) with the **Pr.599** setting is required according to the logic of the Inverter run enable signal sent from the option unit.
- The response time of the X10 signal is within 2 ms.



· Relationship between Pr.599 and the Inverter run enable signal of each option unit

| Pr.599 setting | Corres | sponding signals | Operation according to the X10 | | | |
|---|--|------------------|--------------------------------|--------|---|--|
| F1.555 Setting | FR-HC2 | FR-XC | FR-CV | FR-CC2 | signal status | |
| 0 (initial value of standard models and IP55 compatible models) | RDY (negative logic) (initial setting) | RYB | RDYB | RDB | X10-ON: Inverter output shutoff (NO contact) | |
| 1 (initial value of separated converter types) | RDY (positive logic) | RYA | RDYA | RDA | X10-OFF: Inverter output shutoff (NC contact) | |

NOTE

- If the X10 signal is unassigned while Pr.30 = "2 or 102" (FR-HC2/FR-XC/FR-CV connection) or "10, 11, 110, or 111" (DC feeding mode 1), the MRS signal can be used as the X10 signal. At this time, logic setting for the signal will follow Pr.17 MRS input selection.
- The X10 signal is valid when **Pr.30** = "2, 10, 11, 102, 110, or 111".
- The MRS signal is valid from either of communication or external, but when the MRS signal is to be used as the Inverter run enable (X10) signal, it must be input from external.
- When the FR-HC or MT-HC is connected, set Pr.599 = "0 (initial value)".
- When the terminal assignment is changed with **Pr.178 to Pr.189 (Input terminal function selection)**, wiring may be mistaken due to different terminal name and signal contents, or may affect other functions. Set parameters after confirming the function of each terminal.

Selection between resetting or not resetting during power supply to main circuit (Pr.30 = "100, 101, 102, 110, 111, 120, or 121")

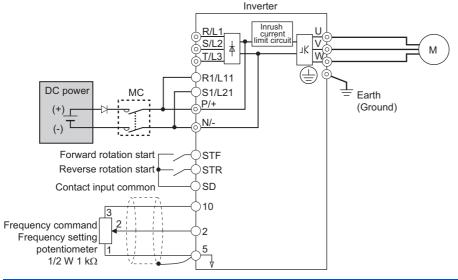
- Inverter reset is not performed if Pr.30 = "100" or more, and supplying power to the main circuit (input through terminals R/L1, S/L2, and T/L3) is started when power is supplied only to the control circuit (input through terminals R1/L11 and S1/L12, or 24 V external power supply input).
- When a communication option, etc. is used, communication interruption due to the inverter reset can be avoided.

NOTE

• When supplying power to the main circuit is started while the protective function of the inverter is activated, inverter reset is performed even when "not resetting after power-ON" is selected.

DC feeding mode 1 (Pr.30 = "10 or 11") (standard models and IP55 compatible models)

- For standard models and IP55 compatible models, setting **Pr.30** = "10 or 11" allows operation with a DC power supply.
- Keep the AC power supply connection terminals R/L1, S/L2, and T/L3 open, and connect the DC power supply between terminals P/+ and N/-. Also, for the standard model, remove the jumpers between terminals R/L1 and R1/L11 and between terminals S/L2 and S1/L21, and connect the terminals R1/L11 and S1/L21 to the terminals P/+ and N/- respectively.
- The following diagram shows a connection example.



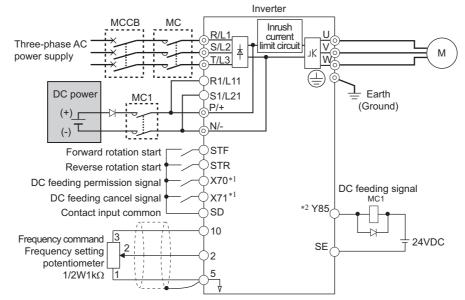
• Do not connect a separated converter type inverter to a DC power supply. Doing so may damage the inverter.

DC feeding mode 2 (Pr.30 = "20 or 21") (standard models and IP55 compatible models)

- When **Pr.30** = "20 or 21", it will normally operate with AC power supply and operate with DC power supply such as batteries at the time of power failure.
- Connect the AC power supply to the AC power supply connecting terminals R/L1, S/L2, and T/L3, and connect the DC power supply to the terminals P/+ and N/-. Also, for the standard model, remove the jumpers between terminals R/L1 and R1/L11 and between terminals S/L2 and S1/L21, and connect the terminals R1/L11 and S1/L21 to the terminals P/+ and N/- respectively.
- Operation with DC current is possible by turning ON the DC feeding operation permission (X70) signal. For details on the I/O signals, refer to following table.

| Signa | l name | Name | Description | Parameter setting |
|--------|--------|------------------------------------|--|---|
| | X70 | DC feeding operation permission | To operate with DC feeding, turn ON the X70 signal. When the inverter output is shutoff due to power failure, it will be possible to start up 200 ms after turning ON the X70 signal. (Automatic restart after instantaneous power failure can start after the time set in Pr.57 has elapsed.) When the X70 signal is turned OFF while operating the inverter, output shutoff (Pr.261 = "0") or deceleration stop (Pr.261 \neq "0") will occur. | Set "70" in any parameter from Pr.178 to Pr.189 . |
| Input | X71 | DC feeding cancel | Set "71" in any parameter from Pr.178 to Pr.189 . | |
| Output | Y85 | DC current feeding | This signal will turn ON during power failure or undervoltage of the AC power supply. It will turn OFF when the X71 signal turns ON or power restoration. The Y85 signal will not turn OFF even with the power restoration while the inverter is running, but turns OFF after stopping the inverter. When the Y85 signal is turned ON due to undervoltage, the Y85 signal will not turn OFF even when the undervoltage is resolved. The ON/OFF status is maintained when the inverter is reset. | Set "85 (positive logic)" or "185 (negative logic)" in any parameter from Pr.190 to Pr.196 . |

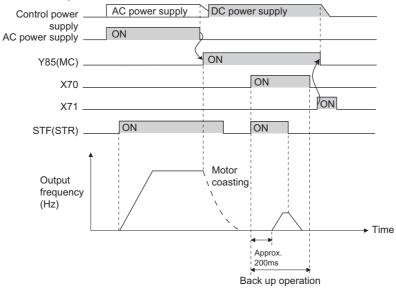
• Following is the connection diagram of switching to DC power supply using the power failure detection of the inverter.



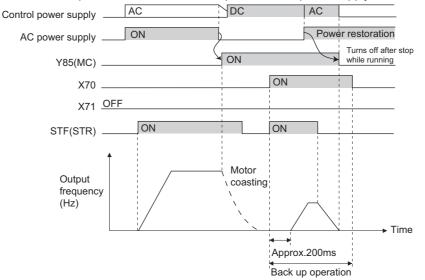
*1 Assign the function using **Pr.178 to Pr.182 (Input terminal function selection)**.

*2 Assign the function using Pr.190 to Pr.196 (Output terminal function selection).

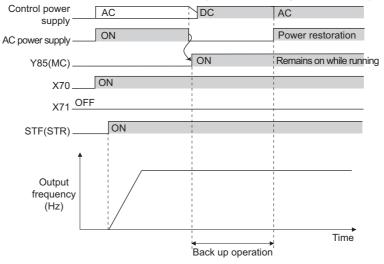
· Operation example at the time of power failure occurrence 1



· Operation example at the time of power failure occurrence 2 (when the AC power supply is restored)



• Operation example at the time of power failure occurrence 3 (when continuing the operation)



Power supply specification for DC feeding (standard models and IP55 compatible models)

| 200 V class | Rated input DC voltage | 283 to 339 VDC |
|-------------|-------------------------|--------------------|
| | Permissible fluctuation | 240 to 373 VDC |
| 400 V class | Rated input DC voltage | 537 VDC to 707 VDC |
| | Permissible fluctuation | 457 VDC to 777 VDC |

NOTE

- The voltage between terminals P and N briefly increases to 415 V (830 V) or higher during the regenerative driving, so take caution on the selection of the DC power supply.
- When an AC power supply is connected to terminals R/L1, S/L2, and T/L3 during DC feeding with Pr.30 = "2, 10, or 11" (DC feeding), an option fault (E.OPT) will occur.
- When the input voltage is insufficient during inverter operation with Pr.30 = "2, 10, 11, 20, or 21" (DC feeding), the inverter output will be shut off. (The undervoltage protection function (E.UVT) is not activated.)
- When the inverter is operated with Pr.30 = "2, 10, 11, 20, or 21" (DC feeding), detection of Instantaneous power failure (E.IPF) is not performed.
- · When the DC power is switched ON, an inrush current higher than that for the AC power flows in the inverter. Minimize the number of power-ON events.
- · Changing the terminal assignment using Pr.178 to Pr.189 (Input terminal function selection) or Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

≪ Parameters referred to ≫

Pr.17 MRS input selection Page 375 Pr.57 Restart coasting time Page 466, page 472

Pr.178 to Pr.189 (Input terminal function selection) F page 373

Pr.190 to Pr.196 (Output terminal function selection) i page 330

Pr.261 Power failure stop selection page 478

5.13.12 Regeneration avoidance function

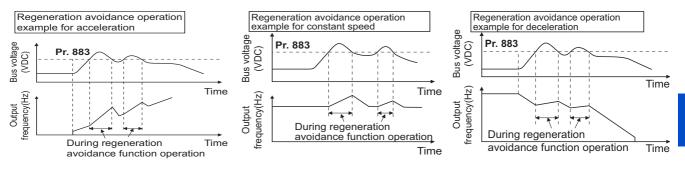
The regenerative status can be detected and avoided by raising the frequency.

• The operation frequency is automatically increased to prevent the regenerative operations. This function is useful when a load is forcibly rotated by another fan in the duct.

| Pr. | Name | Initial | value | Setting range | Description |
|-------------|--|---------------------------------|---------|------------------|--|
| | Regeneration avoidance operation | 0 | | 0 | The regeneration avoidance function is disabled. |
| 882 | | | | 1 | The regeneration avoidance function is always enabled. |
| G120 | selection | | | 2 | The regeneration avoidance function is enabled only during constant-speed operation. |
| 883 G121 | Regeneration avoidance operation level | 200 V class | 380 VDC | | Set the bus voltage level to operate the regeneration avoidance operation. When the bus voltage level is set low, it will be harder to generate overvoltage error, but actual deceleration time will be longer. Set the setting value higher than the (power supply voltage × |
| | | 400 V class | 760 VDC | 300 to 1200 V | |
| | | | | | $\sqrt{2}$) value. |
| 884 | Regeneration avoidance at | 0 | | 0 | The regeneration avoidance is disabled due to bus voltage change rate. |
| G122 | deceleration detection sensitivity | | | 1 to 5 | Set the sensitivity to detect the bus voltage change rate. Setting value 1 (detection sensitivity: low) to 5 (detection sensitivity: high) |
| 885 | Regeneration avoidance | 6 Hz | | 0 to 590 Hz | Set the limit value for frequency to rise when the regeneration avoidance function is activated. |
| G123 | compensation frequency limit value | | | 9999 | The frequency limit is disabled. |
| 886 G124 | Regeneration avoidance voltage gain | ret voltage gain 100% ration | | 0% to 200% | Adjust the response during the regeneration avoidance operation. Increasing the setting improves the response to change in the bus voltage. However, the output frequency may become unstable. If setting a smaller value in Pr.886 does not suppress the vibration, set a smaller value in Pr.665 . |
| 665 G125 | Regeneration avoidance frequency gain | | | 0% to 200% | |

Regeneration avoidance operation (Pr.882, Pr.883)

- When the regenerative voltage increases, the DC bus voltage will rise, which may cause an overvoltage fault (E.OV[]). The regenerative status can be avoided by detecting this rise of bus voltage, and raising the frequency when the bus voltage level exceeds **Pr.883 Regeneration avoidance operation level**.
- The regeneration avoidance operation can be selected to operate constantly or operate only during constant speed.
- The regeneration avoidance function is enabled by setting "1 or 2" in **Pr.882 Regeneration avoidance operation** selection.



- The slope of frequency rising or lowering by the regeneration avoidance operation will change depending on the regenerative status.
- The DC bus voltage of the inverter will be approximately $\sqrt{2}$ times of the normal input voltage.
 - The bus voltage is about 311 VDC (622 VDC) when the input voltage is 220 VAC (440 VAC).

However, it may vary depending on the input power supply waveform.

- Make sure that the setting value of **Pr.883** will not get under DC bus voltage level. The frequency will rise with operation of the regeneration avoidance function even during operation other than the regenerative operation.
- The stall prevention (overvoltage) (oL) will only operate during deceleration, stopping the lowering of output frequency, but on the other hand, the regeneration avoidance function will constantly operate (Pr.882 = "1") or operate only at constant speed (Pr.882 = "2"), and raise the frequency depending on the amount of regeneration.
- When the motor becomes unstable due to operation of the stall prevention (overcurrent) (OL) during the regeneration avoidance operation, increase the deceleration time or lower the setting of **Pr.883**.

Detecting the regenerative status faster during deceleration (Pr.884)

Since a rapid change in bus voltage cannot be handled by bus voltage level detection during the regeneration avoidance operation, deceleration is stopped by detecting the change in bus voltage and if it is equal to or lower than Pr.883 Regeneration avoidance operation level. Set the detectable bus voltage change rate as the detection sensitivity in Pr.884 Regeneration avoidance at deceleration detection sensitivity. A larger set value increases the detection sensitivity.

NOTE

• When the setting value is too small (detection sensitivity is not good), detection will not be possible, and regeneration avoidance will operate even with the bus voltage change caused by a change in the input power.

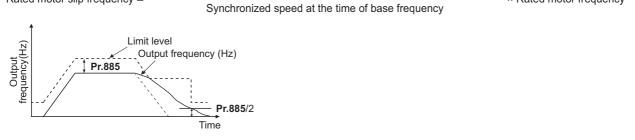
Limiting the regeneration avoidance operation frequency (Pr.885)

- It is possible to assign a limit to the output frequency corrected (rise) by the regeneration avoidance operation.
- Limit of the frequency is output frequency (frequency before regeneration avoidance operation) + Pr.885 Regeneration
 avoidance compensation frequency limit value for during acceleration and constant speed. During deceleration, when
 the frequency increases due to the regeneration avoidance operation and exceeds the limit value, the limit value will be
 retained until the output frequency is reduced to be the half the Pr.885 setting.
- When the frequency that have increased by the regeneration avoidance operation exceeds **Pr.1 Maximum frequency**, it will be limited to the maximum frequency.
- When Pr.885 = "9999", the regeneration avoidance compensation frequency limit is disabled.

5

• Set the frequency around the motor rated slip frequency. Increase the setting value if the overvoltage protection function (E.OV[]) is activated at the start of deceleration.

Rated motor slip frequency = Synchronized speed at the time of base frequency – rated rotation speed × Rated motor frequency



Adjusting the regeneration avoidance operation (Pr.665, Pr.886)

- If the frequency becomes unstable during regeneration avoidance operation, decrease the setting of Pr.886 Regeneration avoidance voltage gain. On the other hand, if an overvoltage fault occurs due to a sudden regeneration, increase the setting.
- If setting a smaller value in **Pr.886** does not suppress the vibration, set a smaller value in **Pr.665** Regeneration avoidance frequency gain.

NOTE

- During the regeneration avoidance operation, the stall prevention (overvoltage) "oL" is displayed and the Overload warning (OL) signal is output. Set the operation pattern at an OL signal output using Pr.156 Stall prevention operation selection. Use Pr.157 OL signal output timer to set the OL signal output timing.
- The stall prevention is enabled even during regeneration avoidance operation.
- The regeneration avoidance function cannot decrease the actual deceleration time for the motor to stop. Since the actual
 deceleration time is determined by the regenerative power consumption performance, consider using a regeneration unit (FRBU2, BU, FR-BU, FR-CV, FR-HC2, or FR-XC) to decrease the deceleration time.
- When using a regeneration unit (FR-BU2, BU, FR-BU, FR-CV, FR-HC2, or FR-XC) to consume the regenerative power at constant speed, set Pr.882 = "0 (initial value)" to disable the regeneration avoidance function. When consuming the regenerative power at the time of deceleration with the regeneration unit, etc., set Pr.882 = "2" (enables regeneration avoidance function only at the constant speed).

Parameters referred to

- Pr.1 Maximum frequency is page 287
- Pr.8 Deceleration time Page 228 Pr.22 Stall prevention operation level Page 290

5.13.13 Increased magnetic excitation deceleration

Magnetic flux

Increase the loss in the motor by increasing the magnetic flux during deceleration. The deceleration time can be reduced by suppressing the stall prevention (overvoltage) (oL).

The deceleration time can further be shortened without a brake resistor.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|--|---------------|------------------|--|
| 660 | Increased magnetic | 0 | 0 | Without the increased magnetic excitation deceleration function |
| G130 | excitation deceleration operation selection | | 1 | With the increased magnetic excitation deceleration function |
| 661 | Magnetic excitation | 9999 | 0% to 40% | Set the increase of excitation. |
| G131 | increase rate | | 9999 | and Advanced magnetic flux vector control. |
| 662 G132 | Increased magnetic excitation current level | 100% | 0% to 300% | The increased magnetic excitation rate is automatically lowered when the output current exceeds the setting value during increased magnetic excitation deceleration. |

Setting of increased magnetic excitation rate (Pr.660, Pr.661)

- To enable the increased magnetic excitation deceleration, set **Pr.660 Increased magnetic excitation deceleration** operation selection = "1".
- Set the amount of excitation increase in Pr.661 Magnetic excitation increase rate.

- Increased magnetic excitation deceleration will be disabled when Pr.661 = "0". When "8888 or 9999" is not set in Pr.19 under V/F control, increased magnetic excitation deceleration will be enabled even when Pr.661 = "0".
- When the DC bus voltage exceeds the increased magnetic excitation deceleration operation level during the deceleration, excitation is increased in accordance with the setting value in **Pr.661**.
- The increased magnetic excitation deceleration will continue even if the DC bus voltage goes under the increased magnetic excitation deceleration operation level during increased magnetic excitation deceleration.

| Inverter | Increased magnetic excitation deceleration operation level |
|------------------|--|
| 200 V class | 340 V |
| 400 V class | 680 V |
| With 500 V input | 740 V |

- When the stall prevention (overvoltage) occurs during the increased magnetic excitation deceleration operation, increase the deceleration time or raise the setting value of **Pr.661**. When the stall prevention (overcurrent) occurs, increase the deceleration time or lower the setting value of **Pr.661**.
- Increased magnetic excitation deceleration is enabled under V/F control and Advanced magnetic flux vector control.

 Increased magnetic excitation deceleration will be disabled in the following conditions: PM motor control, power failure stop, operation with the FR-HC2, FR-XC (common bus regeneration mode), or FR-CV, energy saving operation, and Optimum excitation control.

Overcurrent prevention function (Pr.662)

- The overcurrent prevention function is enabled under V/F control and Advanced magnetic flux vector control.
- The increased magnetic excitation rate is lowered automatically when the output current exceeds the level set in Pr.662 during increased magnetic excitation deceleration.
- When the inverter protective function (E.OC[], E.THT) is activated due to increased magnetic excitation deceleration, adjust the level set in Pr.662.
- The overcurrent preventive function is disabled when Pr.662 = "0".

• When the level set in **Pr.662** is more than the one set in **Pr.22 Stall prevention operation level**, the overcurrent preventive function is activated at the level set in **Pr.22**. (The level set in **Pr.662** is applied when **Pr.22** = "0".)

≪ Parameters referred to 🚿

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Pr.22 Stall prevention operation level ☞ page 290
Pr.30 Regenerative function selection ☞ page 566
Pr.60 Energy saving control selection ☞ page 557
Pr.162 Automatic restart after instantaneous power failure selection ☞ page 466, page 472
Pr.261 Power failure stop selection ☞ page 478
```

5.13.14 Slip compensation

V/F

Under V/F control, the slip of the motor is estimated from the inverter output current to maintain the rotation of the motor constant.

| Pr. | Name | Initial value | Setting range | Description |
|----------------|---|---------------|------------------|---|
| 245 Rated slip | | 9999 | 0.01% to 50% | Set the rated motor slip. |
| G203 | | | 0, 9999 | No slip compensation |
| 246 G204 | Slip compensation time constant 0.5 s | | 0.01 to 10 s | Set the response time of the slip compensation. Reducing the value improves the response, but the regenerative overvoltage (E.OV[]) error is more likely to occur with a larger load inertia. |
| 247 G205 | Constant output range slip compensation selection | 9999 | 0 | No slip compensation in the constant power range (frequency range higher than the frequency set in Pr.3). |
| G205 | | | 9999 | Slip compensation is performed in the constant power range. |

Calculate the rated motor slip and set the value in Pr.245 to enable slip compensation.
 Slip compensation is not performed when Pr.245 = "0 or 9999".

Rated slip = <u>Synchronized speed at the time of base frequency - rated rotation speed</u> × 100 [%] Synchronized speed at the time of base frequency

• When the slip compensation is performed, the output frequency may become larger than the set frequency. Set **Pr.1 Maximum frequency** higher than the set frequency.

Slip compensation will be disabled in the following conditions:

Stall prevention (oL, OL) operation, regeneration avoidance operation, auto tuning

Parameters referred to

Pr.1 Maximum frequency 3 page 287

Pr.3 Base frequency rage 552

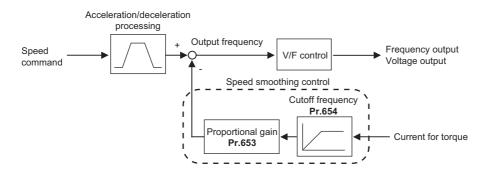
5.13.15 Speed smoothing control

V/F

The output current (torque) of the inverter sometimes becomes unstable due to vibration caused by mechanical resonance. Such vibration can be suppressed by reducing fluctuation of the output current (torque) by changing the output frequency.

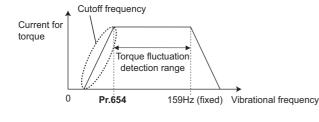
| Pr. | Name | Initial value | Setting range | Description |
|-------------|-------------------------------------|---------------|------------------|---|
| 653 G410 | Speed smoothing control | 0% | 0% to 200% | Check the effect by increasing and decreasing the value at around 100%. |
| 654 G411 | Speed smoothing cutoff frequency | 20 Hz | 0 to 120 Hz | Set the minimum frequency for the torque variation cycle. |

Control block diagram



Setting method

- When vibration caused by mechanical resonance occurs, set 100% in **Pr.653 Speed smoothing control**, perform operation at the frequency with the largest vibration, and check if the vibration is suppressed after few seconds.
- If the setting is not effective, gradually increase the value set in **Pr.653** and repeat the operation to check the effect to determine the most effective value (**Pr.653**).
- If the vibration increases by increasing the value in **Pr.653**, decrease the value in **Pr.653** from 100% to check the effect.
- When the vibrational frequency at which mechanical resonance occurs (during fluctuation of torque, speed, or converter output voltage) is measured using an instrument such as a tester, set 1/2 to 1 times of the vibrational frequency in Pr.654
 Speed smoothing cutoff frequency. (Setting the resonance frequency range mitigates vibration more effectively.)



• Depending on the equipment, the vibration may not be suppressed sufficiently or the setting is not effective.

5.14 Parameter clear / All parameter clear

Point P

- Set "1" to Pr.CLR Parameter clear or ALL.CL All parameter clear to initialize all parameters. (Parameters cannot be cleared when Pr.77 Parameter write selection = "1".) · Pr.CLR does not clear calibration parameters or the terminal function selection parameters. · Refer to the parameter list on page 668 for parameters cleared with this operation. Operating procedure 1. Turning ON the power of the inverter The operation panel is in the monitor mode. 2. Changing the operation mode Press $\left\| \frac{PU}{EXT} \right\|$ to choose the PU operation mode. The [PU] indicator turns ON. 3. Selecting the parameter setting mode Press MODE to choose the parameter setting mode. (The parameter number read previously appears.) 4. Selecting the parameter SET . " 🚺 " (initial value) appears. 5. Parameter clear (" -) are displayed alternately after parameters are cleared. • Turn 🕄 to read another parameter. Press SET to show the setting again.
 - Press SET twice to show the next parameter.

| Setting | Description | | |
|---------|--|---|--|
| Setting | Pr.CL Parameter clear | ALLC All parameter clear | |
| 0 | Initial display (Parameters are not cleared.) | | |
| 1 | The settings of parameters except for calibration parameters and terminal function selection parameters are initialized. | The settings of all the parameters, including calibration parameters and terminal function selection parameters, are initialized. | |

• NOTE

DPU turns ON, and " **|** " appears on the monitor. (When **Pr.79** ="0" (initial value))

2) Press SET to clear the parameter.

1) Press PU FXT

- · Stop the inverter first. Writing error occurs if parameter clear is attempted while the inverter is running.
- To clear parameters, the inverter must be in the PU operation mode even if "2" is set to Pr.77.
- For availability of the Parameter clear or All parameter clear operation for each parameter, refer to the parameter list on page 668.

5.15 Copying and verifying parameters on the operation panel

| Pr.CPY setting value Description | |
|----------------------------------|---|
| 0 | Initial display |
| 1.RD | Read the parameters from the source inverter and store them to the operation panel. |
| 2.WR | Write the parameters stored in the operation panel to the target inverter. |
| 3.VFY | Verify parameters in the inverter and operation panel. (Refer to page 581.) |

NOTE

- Refer to the parameter list on page 668 for the availability of parameter copy.
- When the power is turned OFF or an operation panel is disconnected, etc. during parameter copy writing, write again or check the setting values by parameter verification.
- When parameters are copied from a different-capacity inverter, there are parameters with different initial values depending on the inverter capacity, so the setting values of some parameters will be automatically changed. After performing a parameter copy from a different-capacity inverter, check all the parameter settings. (Refer to the parameter list (page 140) for details of parameters with different initial values depending on individual inverter capacity.)
- While password protection is enabled, parameter copy and parameter verification cannot be performed. (Refer to page 208.)
- If parameters are copied from an older inverter to a newer inverter that has additional parameters, out-of-range setting values may be written in some parameters. In that case, those parameters operate as if they were set to initial values.

5.15.1 Parameter copy

· Inverter parameter settings can be copied to another inverter.

Reading the parameter settings in the inverter and storing them in the operation panel

Operating procedure

- **1.** Connect the operation panel to the source inverter.
- 2. Selecting the parameter setting mode

Press MODE to choose the parameter setting mode. (The parameter number read previously appears.)

3. Selecting the parameter

Turn to "For -- [For --]" (Parameter copy) and press SET "[-- -- -- " appears.

4. Reading to and storing in the operation panel

Turn to change the set value to " H = 1". Press set to start reading the parameter settings by the operation panel. (It takes about 30 seconds to read and store all the settings. During reading, " H = 1" blinks.)

- **5.** End of reading and storing
 - " []] and "-] []] are displayed alternately after the reading and storing are completed.

Writing parameter settings stored in the operation panel to the inverter

Operating procedure

- 1. Connect the operation panel to the destination inverter.
- 2. Selecting the parameter setting mode

Press MODE to choose the parameter setting mode. (The parameter number read previously appears.)

3. Selecting the parameter

Turn to " -- -- [--] '-- " (Parameter copy) and press SET

- **4.** Selecting parameter write
 - Turn 🕄 to change the set value to "------", then press
- **5.** Writing to the inverter

- Perform this step while the inverter is stopped. (Parameter settings cannot be copied during operation.)
- **6.** End of copying

7. When parameters are written to the destination inverter, reset the inverter before operation by, for example, turning the power supply OFF.

• NOTE

• "-- - E - - " appears when a parameter write error occurred. Perform the operation from step 3 again.

• " and " are displayed alternately when parameter copy is performed between the FR-F820-02330(55K) or lower or FR-F840-01800(55K) or lower inverters and the FR-F820-03160(75K) or higher or FR-F840-01800(75K) or higher inverters. When CP and 0.00 are displayed alternately, set **Pr.989 Parameter copy alarm release** as shown below (initial value).

| Pr.989 setting | Operation |
|----------------|---|
| 10 | Cancels the warning of FR-F820-02330(55K) or lower and FR-F840-01160(55K) or lower. |
| 100 | Cancels the warning of FR-F820-03160(75K) or higher and FR-F840-01800(75K) or higher. |

After setting Pr.989, perform setting of Pr.9, Pr.30, Pr.51, Pr.56, Pr.57, Pr.72, Pr.80, Pr.82, Pr.90 to Pr.94, Pr.453, Pr.455, Pr.458 to Pr.462, Pr.557, Pr.859, Pr.860, and Pr.893 again.

5.15.2 Parameter verification

· Whether the parameter settings of inverters are the same or not can be checked.

Operating procedure

- **1.** Copy the parameter settings of the verification source inverter to the operation panel according to the procedure on page 579.
- **2.** Detach the operation panel from the source inverter and attach it to the verification target inverter.
- **3.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- **4.** Selecting the parameter setting mode

Press MODE to choose the parameter setting mode. (The parameter number read previously appears.)

5. Selecting the parameter

6. Parameter verification

Press SET . Verification of the parameter settings copied to the operation panel and the parameter settings of the verification destination inverter is started. (It takes about 60 seconds to verify all the settings. During verification,

• If there are different parameters, the different parameter number and "-- 🔚 🚽 " are displayed alternately.

- To continue verification, press SET .

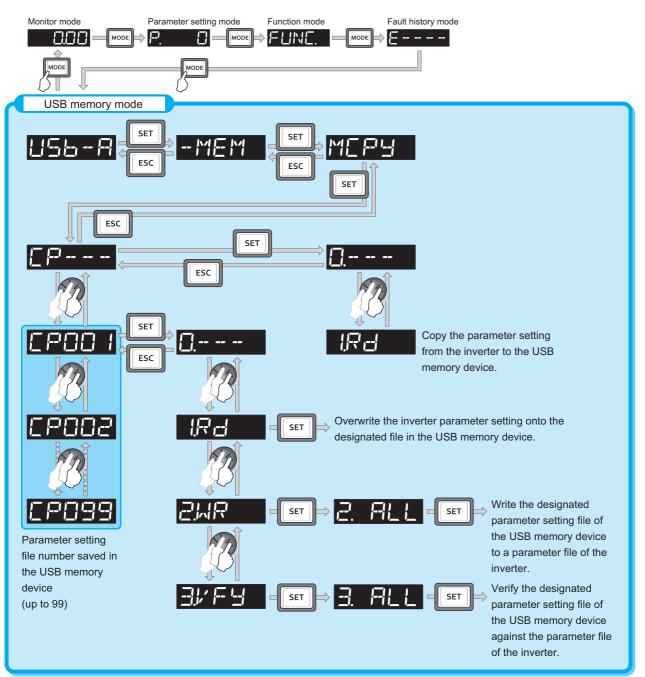


5.16 Copying and verifying parameters using a USB memory

- Inverter parameter settings can be copied to a USB memory device.
- Parameter setting data stored in a USB memory device can be copied to another inverter or verified to see if they differ from the parameter settings of another inverter.
- Parameter settings can also be imported to a personal computer and edited in FR Configurator2.

Changes in the USB memory copy operation states

 Insert the USB memory device into the inverter. The USB memory mode is displayed and the USB memory operations are enabled.





- When parameter settings are copied to the USB memory without specifying a parameter setting file number in the USB memory, numbers are automatically assigned.
- Up to 99 files can be saved in the USB memory. When the USB memory already has 99 files, attempting copying of another file to the USB memory causes the file quantity error (rE7).
- Refer to the Instruction Manual of FR Configurator2 for the details on importing files to FR Configurator2.
- While password protection is enabled, parameter copy and parameter verification cannot be performed. (Refer to page 208.)

Reading the parameter settings in the inverter and storing them in the USB memory

Operating procedure

- **1.** Insert the USB memory device into the copy source inverter.
- **2.** USB memory mode

Press MODE to change to the USB memory mode.

3. Displaying the file selection screen

Press SET three times to display " - - - - " (file selection screen) and press SET. (To overwrite files on

the USB memory, display the file selection screen, turn 😵 to select the file number, and press [SET].)

4. Reading to and storing in the USB memory

Turn 😳 to change to "

takes about 15 seconds to read and store all the settings. During reading, "

" IF I and the file number are displayed alternately after the reading and storing are completed.

Writing parameter settings stored in the USB memory to the inverter

Operating procedure

- **1.** Insert the USB memory device into the destination inverter.
- 2. USB memory mode

Press MODE to change to the USB memory mode.

3. Displaying the file selection screen

Press SET three times to display "

4. Selecting the file number

Turn 🕄 to select the file number to copy to the inverter, and press

- **6.** Writing to the inverter

Press SET to start writing the parameter settings stored in the USB memory to the destination inverter. (It takes

". File " and the file number are displayed alternately after copying ends.

- Perform this step while the inverter is stopped.
- **7.** When parameters are written to the destination inverter, reset the inverter before operation by, for example, turning the power supply OFF.



- " F E I " or " F E E " appears when a USB memory device error occurred. Check the connection of the USB memory device and try the operation again.
- " and " are displayed alternately when parameter copy is performed between the FR-F820-02330(55K) or lower or FR-F840-01160(55K) or lower inverters and the FR-F820-03160(75K) or higher or FR-F840-01800(75K) or higher inverters. When CP and 0.00 are displayed alternately, set Pr.989 Parameter copy alarm release as shown below (initial value).

| Pr.989 setting Operation | | Operation |
|--------------------------|-----|---|
| Γ | 10 | Cancels the warning of FR-F820-02330(55K) or lower and FR-F840-01160(55K) or lower. |
| | 100 | Cancels the warning of FR-F820-03160(75K) or higher and FR-F840-01800(75K) or higher. |

After setting Pr.989, perform setting of Pr.9, Pr.30, Pr.51, Pr.56, Pr.57, Pr.61, Pr.70, Pr.72, Pr.80, Pr.82, Pr.90 to Pr.94, Pr.453, Pr.455, Pr.458 to Pr.462, Pr.557, Pr.859, Pr.860, and Pr.893 again.

- When the power is turned OFF or an operation panel is disconnected, etc. during parameter copy writing, write again or check the setting values by parameter verification.
- When parameters are copied from a different-capacity inverter, there are parameters with different initial values depending on the inverter capacity, so the setting values of some parameters will be automatically changed. After performing a parameter copy from a different-capacity inverter, check all the parameter settings. (Refer to the parameter list (page 140) for details of parameters with different initial values depending on individual inverter capacity.)

Procedure for verifying parameters in the USB memory

Operating procedure

| 1. | Copy the parameter settings of the verification source inverter to the USB memory according to the procedure on |
|----|---|
| | page 583. |

- **2.** Move the USB memory device to the inverter to be verified.
- **3.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- **4.** USB memory mode

Press MODE to change to the USB memory mode.

- **5.** Displaying the file selection screen
 - Press SET three times to display "
- **6.** Selecting the file number

Turn 🕄 to select the file number to be verified, and press SET .

7. Parameter verification

| | Parameter vernication |
|----|--|
| | Turn 🕄 to display the setting " |
| | " |
| | Press SET to start verification of the parameter settings copied to the USB memory and the parameter settings of |
| | the verification destination inverter. (It takes about 15 seconds to verify all the settings. During verification, |
| | " |
| | • If there are different parameters, the different parameter number and " 두 🚽 " are displayed alternately. |
| | • To continue verification, press SET. |
| 8. | The verified file number and " |

NOTE

5.17 Checking parameters changed from their initial values (initial value change list)

Parameters changed from their initial values can be displayed.

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- **2.** Selecting the parameter setting mode

Press MODE to choose the parameter setting mode. (The parameter number read previously appears.)

3. Selecting a parameter

Turn 😯 to " 🖓 --- 🌈 --- 🌈 --- 🌈 " (Initial value change list), and press 💷

4. Checking the Initial value change list

Turn 🚱. The parameter numbers that have been changed from their initial value appear in order.

• When SET is pressed with a changed parameter displayed, the parameter settings can be changed as they are. (Parameter numbers are no longer displayed in the list when they are returned to their initial values.)

Other changed parameters appear by turning 🕄.

- NOTE

- The calibration parameters (C0 (Pr.900) to C7 (Pr.905), C42 (Pr.934) to C45 (Pr.935)) are not displayed even when these are changed from the initial settings.
- Only the simple mode parameters are displayed when the simple mode is set (Pr.160 ="9999").
- Only user groups are displayed when user groups are set (Pr.160 = "1").
- Pr.160 is displayed independently of whether the setting value is changed or not.

CHAPTER 6 PROTECTIVE FUNCTIONS

| 6.1 | Inverter fault and alarm indications | |
|-----|---|--|
| 6.2 | Reset method for the protective functions | |
| 6.3 | Check and clear of the fault history | |
| 6.4 | List of fault displays | |
| 6.5 | Causes and corrective actions | |
| 6.6 | Check first when you have a trouble | |

This chapter explains the "PROTECTIVE FUNCTIONS" that operate in this product. Always read the instructions before use.

6.1 Inverter fault and alarm indications

- When the inverter detects a fault, depending on the nature of the fault, the operation panel displays an error message or warning, or a protective function is activated to shut off the inverter output.
- When any fault occurs, take an appropriate corrective action, then reset the inverter, and resume the operation. Restarting the operation without a reset may break or damage the inverter.
- When a protective function is activated, note the following points.

| Item | Description |
|---------------------------|---|
| Fault output signal | Opening the magnetic contactor (MC) provided on the input side of the inverter at a fault occurrence shuts off the control power to the inverter, therefore, the fault output will not be retained. |
| Fault or alarm indication | When a protective function is activated, the operation panel displays a fault indication. |
| Operation restart method | While a protective function is activated, the inverter output is kept shutoff. Reset the inverter to restart the operation. |

Inverter fault or alarm indications are categorized as follows.

| Displayed item | Description |
|----------------|---|
| Error message | A message regarding operational fault and setting fault by the operation panel and the parameter unit. The inverter output is not shut off. |
| Warning | The inverter output is not shut off even when a warning is displayed. However, failure to take appropriate measures will lead to a fault. |
| Alarm | The inverter output is not shut off. An Alarm (LF) signal can also be output with a parameter setting. |
| Fault | When a protective function is activated, the inverter output is shut off and a Fault (ALM) signal is output. |

NOTE

• The last eight faults can be displayed on the operation panel. (Fault history) (For the operation, refer to page 590.)

6.2 Reset method for the protective functions

Reset the inverter by performing any of the following operations. Note that the accumulated heat value of the electronic thermal relay function and the number of retries are cleared (erased) by resetting the inverter. The inverter recovers about 1 second after the reset is released.

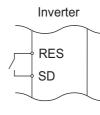
• On the operation panel, press **Stop** to reset the inverter. (This operation is valid only when a protective function for a fault is activated. (Refer to page 600 of the Instruction Manual for faults.))



• Switch the power OFF once, then switch it ON again.



• Turn ON the Reset (RES) signal for 0.1 second or more. (If the RES signal is kept ON, "Err" appears (blinks) to indicate that the inverter is in a reset status.)

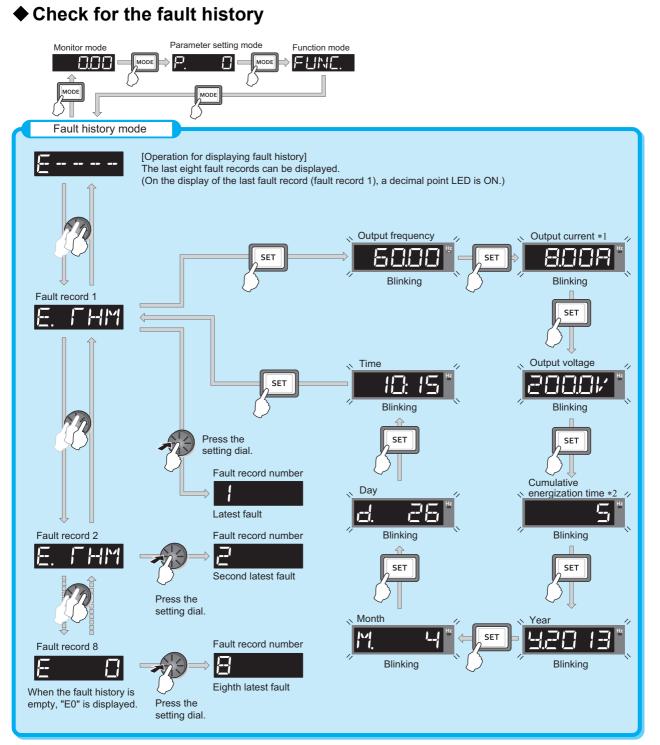




• OFF status of the start signal must be confirmed before resetting the inverter fault. Resetting an inverter fault with the start signal ON restarts the motor suddenly.

6.3 Check and clear of the fault history

The operation panel stores the past eight fault records which appears when a protective function is activated. (Fault history)



*1 When an overcurrent trip occurs by an instantaneous overcurrent, the monitored current value saved in the fault history may be lower than the actual current that has flowed.

*2 The cumulative energization time and actual operation time are accumulated from 0 to 65535 hours, then cleared, and accumulated again from 0.

◆ Fault history clearing procedure

Point P

Set Err.CL Fault history clear = "1" to clear the fault history.

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- 2. Selecting the parameter setting mode

Press MODE to choose the parameter setting mode. (The parameter number read previously appears.)

3. Selecting the parameter number

Turn 🕄 until " 🗲 -- -- , [] [] " (Fault history clear) appears. Press SET to read the present set value. " [] " (initial value) appears.

4. Fault history clear

Turn 🕄 to change the set value to " |". Press SET to start clearing.

- " |" and " - " are displayed alternately after parameters are cleared.
 - Turn 🔂 to read another parameter.
 - Press SET to show the setting again.
 - Press SET twice to show the next parameter.

6.4 List of fault displays

If the displayed message does not correspond to any of the following or if you have any other problem, contact your sales representative.

Error message

• A message regarding operational fault and setting fault by the operation panel and the parameter unit is displayed. The inverter output is not shut off.

| Operation panel indication | Name | Refer to page |
|-------------------------------|-----------------------|------------------|
| HOLd | Operation panel lock | 594 |
| LOEd | Password locked | 594 |
| Er- to Er-4 Er-8 | Parameter write error | 594, 595 |
| r-E to r-E8 | Copy operation fault | 595, 596 |
| Err. | Error | 596 |

Warning

 The inverter output is not shut off even when a warning is displayed. However, failure to take appropriate measures will lead to a fault.

| Operation panel indication | Name | Refer to page |
|----------------------------|--|------------------|
| | Stall prevention (overcurrent) | 597 |
| ol | Stall prevention (overvoltage) | 597 |
| | Electronic thermal relay function pre-alarm | 597 |
| P5 | PU stop | 598 |
| EP | Parameter copy | 598 |
| 58 | Safety stop | 598 |
| MI I to | Maintenance signal output | 598 |
| | USB host error | 598 |
| Ed | Emergency drive in operation | 599 |
| EF | Continuous operation during communication fault | 599 |
| LdF | Load fault warning | 599 |

Alarm

1417 =

• The inverter output is not shut off. An Alarm (LF) signal can also be output with a parameter setting.

Fault

- When a protective function is activated, the inverter output is shut off and a Fault (ALM) signal is output.
- The data code is used for checking the fault detail via communication or with **Pr.997 Fault initiation**.

■ Data code 16 to 199

| Operation pa | | Name | Data | Refer |
|--------------|----------|--|--------------|---------|
| indication | | 0 | code | to page |
| E. OC | 1 | Overcurrent trip during acceleration | 16 (H10) | 600 |
| E. OC | Ē | Overcurrent trip during constant speed | 17 (H11) | 600 |
| E. OC | 3 | Overcurrent trip during deceleration or stop | 18 (H12) | 601 |
| E. 01/ | 1 | Regenerative overvoltage trip during acceleration | 32 (H20) | 601 |
| E. 01/ | 2 | Regenerative overvoltage trip during constant speed | 33 (H21) | 601 |
| E. 01/ | 3 | Regenerative overvoltage trip during deceleration or | 34 (H22) | 602 |
| Е. ГН | [| Inverter overload trip (electronic thermal relay | 48 (H30) | 602 |
| Е. ГН | М | Motor overload trip (electronic thermal relay | 49 (H31) | 602 |
| E. FI | N | Heat sink overheat | 64 (H40) | 602 |
| E. I P | F | Instantaneous power failure | 80 (H50) | 603 |
| E. LIK | [| Undervoltage | 81 (H51) | 603 |
| E. I L | F | Input phase loss | 82 (H52) | 603 |
| E. OL | [| Stall prevention stop | 96 (H60) | 604 |
| E. 50 | [| Loss of synchronism detection | 97 (H61) | 604 |
| E. LU | P | Upper limit fault detection | 98 (H62) | 604 |
| E. Ld | N | Lower limit fault detection | 99 (H63) | 604 |
| E. 6E | | Internal circuit fault | 112 (H70) | 609 |
| E. GF | | Output side earth (ground) fault overcurrent | 128 (H80) | 605 |
| E. LF | | Output phase loss | 129 (H81) | 605 |
| E. OH | [| External thermal relay operation | 144 (H90) | 605 |
| E. Pr | | PTC thermistor operation | 145 (H91) | 605 |
| E. OP | [| Option fault | 160 (HA0) | 605 |

| | Operation panel indication | | | | Refer to page |
|----------------|-------------------------------|-----------|--|--------------|------------------|
| E. | 0P | 1 | Communication option fault | 161 (HA1) | 606 |
| E. | 1 | 6 | | 164 (HA4) | |
| E. E. E. | 1 | 7 | | 165 (HA5) | |
| | 1 | | User definition error by the PLC function | 166 (HA6) | 606 |
| E. | 1 | 3 | | 167 (HA7) | |
| E. | 2 | | | 168 (HA8) | |
| E. | PE | E | Internal storage device fault | 172 (HAC) | 606 |
| E. | PE | | Parameter storage device fault (control circuit board) | 176 (HB0) | 606 |
| E. | PL | E | PU disconnection | 177 (HB1) | 606 |
| E. | RE | - | Retry count excess | 178 (HB2) | 607 |
| E. | PE | 2 | Parameter storage device fault (main circuit board) | 179 (HB3) | 607 |
| E. | [P | | CPU fault | 192 (HC0) | 607 |
| E. | | - | Operation panel power supply short circuit/RS- | 193 (HC1) | 607 |
| E. | PZ | | 24 VDC power fault | 194 (HC2) | 607 |
| E. | Ed | | Abnormal output current detection | 196 (HC4) | 608 |
| E. | | | Inrush current limit circuit fault | 197 (HC5) | 608 |
| E. | 58 | R | Communication fault (inverter) | 198 (HC6) | 608 |
| E. | Fil | E | Analog input fault | 199 (HC7) | 608 |

■ Data code 200 or more

| | ation panel | Name | Data code | Refer to page |
|----------------------|-------------|-------------------------------|--------------|------------------|
| E. | 456 | USB communication fault | 200 (HC8) | 608 |
| £. £. £. £. | SAF | Safety circuit fault | 201 (HC9) | 609 |
| E. | PbF | Internal circuit fault | 202 (HCA) | 609 |
| E. | 13 | | 253 (HFD) | 003 |
| | 85 | Overspeed occurrence | 208 (HD0) | 609 |
| E. | = +- | Abnormal internal temperature | 225 (HE1) | 609 |
| E. | | 4 mA input fault | 228 (HE4) | 609 |
| E. | PEH | Pre-charge fault | 229 (HE5) | 610 |
| E. | PI d | PID signal fault | 230 (HE6) | 610 |
| E. | 1 | | 241 (HF1) | |
| E. | 2 | Option fault | 242 (HF2) | 610 |
| E. | Ē | | 243 (HF3) | |
| | 5 | | 245 (HF5) | |
| E. | 5 | CPU fault | 246 (HF6) | 607 |
| E. | 7 | | 247 (HF7) | |

Others

• The fault history and the operation status of the inverter are displayed. It is not a fault indication.

| Operation panel indication | Name | Refer to page |
|-------------------------------|---|------------------|
| E | Fault history | 590 |
| E. 0 | No fault history | 610 |
| EV | 24 V external power supply operation | 611 |
| Rd | Backup in progress | 611 |
| LIR | Restoration in progress | 611 |

If faults other than the above appear, contact your sales representative.

♦ Error message

A message regarding operational troubles is displayed. Output is not shut off.

| Operation panel indication | HOLD | HOLd |
|-------------------------------|--|------|
| Name | Operation panel lock | |
| Description | Operation lock is set. Operation other than store is invalid. (Refer to page 202.) | |
| Check point | | |
| Corrective action | Press MODE for 2 seconds to release the lock. | |

| Operation panel indication | LOCD | LOEd | |
|-------------------------------|--|--|--|
| Name | Password locked | Password locked | |
| Description | Password function is active. Display and setting of parameters are restricted. | | |
| Check point | | | |
| Corrective action | Enter the password i page 208.) | n Pr.297 Password lock/unlock to unlock the password function before operating. (Refer to | |

| Operation panel indication | Er1 | Er l |
|-------------------------------|--|------|
| Name | Write disable error | |
| Description | Parameter setting was attempted while Pr.77 Parameter write selection is set to disable parameter write. Overlapping range has been set for the frequency jump. Overlapping range has been set for the adjustable 5 points V/F. The PU and inverter cannot make normal communication. IPM parameter initialization was attempted while Pr.72 PWM frequency selection = "25". | |
| Check point | Check the Pr.77 setting. (Refer to page 206.) Check the settings of Pr.31 to Pr.36 (frequency jump). (Refer to page 289.) Check the settings of Pr.100 to Pr.109 (adjustable 5 points V/F). (Refer to page 558.) Check the connection of PU and the inverter. Check the Pr.72 setting. A sine wave filter cannot be used under PM motor control. | |

| Operation panel indication | Er2 | Ere | |
|-------------------------------|---|------------------------------|--|
| Name | Write error during op | Vrite error during operation | |
| Description | Parameter write was attempted while Pr.77 Parameter write selection = "0". | | |
| Check point | Check that the inverter is stopped. | | |
| Corrective action | After stopping the operation, make parameter setting. When setting Pr.77 = "2", parameter write is enabled during operation. (Refer to page 206.) | | |

| Operation panel indication | Er3 | Er 3 | |
|----------------------------|---|-------------------|--|
| Name | Calibration error | Calibration error | |
| Description | Analog input bias and gain calibration values have been set too close. | | |
| Check point | Check the settings of the calibration parameters C3, C4, C6, and C7 (calibration functions). (Refer to page 357.) | | |

| Operation panel indication | Er4 | <u> </u> |
|----------------------------|--|----------|
| Name | Mode designation e | rror |
| Description | Parameter setting was attempted in the External or NET operation mode while Pr.77 Parameter write selection = "1". Parameter write was attempted when the command source is not at the operation panel (FR-DU08). | |
| Check point | Check that the operation mode is the PU operation mode. Check that the Pr.551 PU mode operation command source selection setting is correct. | |
| Corrective action | After setting the operation mode to the "PU operation mode", make parameter setting. (Refer to page 240.) When Pr.77 = "2", parameter write is enabled regardless of the operation mode. (Refer to page 206.) Set Pr.551 = "2". (Refer to page 251.) | |

| Operation panel indication | Er8 | Er8 |
|-------------------------------|---|-------------------|
| Name | USB memory device | e operation error |
| Description | An operation command was given during the USB memory device operation. A copy operation (writing) was performed while the PLC function was in the RUN state. A copy operation was attempted for a password locked project. | |
| Check point | Check if the USB memory device is operating. Check if the PLC function is in the RUN state. Check if the project data is locked with a password. | |
| Corrective action | Perform the operation after the USB memory device operation is completed. Stop the PLC function. (Refer to page 483 and the PLC function programming manual.) Unlock the password of the project data using FR Configurator2. (Refer to the Instruction Manuals of FR Configurator2 and GX Works2.) | |

| Operation panel indication | rE1 | -E | | | |
|-------------------------------|---|----|--|--|--|
| Name | Parameter read erro | r | | | |
| Description | A failure has occurred at the operation panel side EEPROM while reading the copied parameters. A failure has occurred in the USB memory device while copying the parameters or reading the PLC function project data. | | | | |
| Check point | • | | | | |
| Corrective action | Perform parameter copy again. (Refer to page 579 and page 582.) Perform PLC function project data copy again. (Refer to page 483.) The USB memory device may be faulty. Replace the USB memory device. The operation panel (FR-DU08) may be faulty. Contact your sales representative. | | | | |

| Operation panel indication | rE2 | -62 | | | | |
|-------------------------------|--|-----|--|--|--|--|
| Name | Parameter write erro | r | | | | |
| Description | Parameter copy from the operation panel to the inverter was attempted during operation. A failure has occurred at the operation panel side EEPROM while writing the copied parameters. A failure has occurred in the USB memory device while writing the copied parameters or PLC function project data. | | | | | |
| Check point | Check that the inverter is stopped. | | | | | |
| Corrective action | After stopping the operation, perform parameter copy again. (Refer to page 579.) The operation panel (FR-DU08) may be faulty. Contact your sales representative. Perform parameter copy or PLC project data copy again. (Refer to page 483 and page 582.) The USB memory device may be faulty. Replace the USB memory device. | | | | | |

| Operation panel indication | rE3 | -63 | | | |
|-------------------------------|--|---|--|--|--|
| Name | Parameter verification | on error | | | |
| Description | The data in the inverter are different from the data in the operation panel. A failure has occurred at the operation panel side EEPROM during parameter verification. A failure has occurred in the USB memory device during parameter verification. The data in the inverter are different from the data in the USB memory device or the personal computer (FR Configurator2). | | | | |
| Check point | Check the paramet | ter setting of the source inverter against the setting of the destination inverter. | | | |
| Corrective action | Perform parameter The operation panel The USB memory | rification by pressing <u>SET</u> . eter verification again. (Refer to page 581.) anel (FR-DU08) may be faulty. Contact your sales representative. bry device may be faulty. Replace the USB memory device. function project data again. (Refer to page 483.) | | | |

| Operation panel indication | rE4 | r- E -4 | |
|-------------------------------|--|---------|--|
| Name | Model error | | |
| Description | A different model was used when parameter copy from the operation panel or parameter verification was performed. The data in the operation panel were not correct when parameter copy from the operation panel or parameter verification was performed. | | |
| Check point | Check that the parameter copy or verification source inverter is of the same model. Check that parameter copy to the operation panel was not interrupted by switching OFF the power or by disconnecting the operation panel. | | |
| Corrective action | Perform parameter copy and parameter verification between inverters of the same model (FR-F800 series). Try to copy the parameters to the operation panel from the inverter again. | | |

| Operation panel indication | rE5 | r E 5 | |
|-------------------------------|---|-------|--|
| Name | File error | | |
| Description | The file on the USB memory device is corrupt. | | |
| Check point | • | | |
| Corrective action | Delete the copy file in the USB memory device and perform parameter copy again. | | |

| Operation panel indication | rE6 - E E | | | |
|-------------------------------|--|--|--|--|
| Name | File error | | | |
| Description | The parameter copy file in the USB memory device cannot be recognized. An error has occurred in the file system during transfer of the PLC function data or writing to RAM. | | | |
| Check point | • | | | |
| Corrective action | Perform parameter copy again. (Refer to page 582.) Copy the PLC function project data again. (Refer to page 483.) | | | |

| Operation panel indication | rE7 | r-E7 | | |
|----------------------------|---|---------------------|--|--|
| Name | File quantity error | File quantity error | | |
| Description | A parameter copy was attempted to the USB memory device in which the copy files from 001 to 099 had already been saved. | | | |
| Check point | Check if the number of copy files in the USB memory device has reached 99. | | | |
| Corrective action | • Delete the copy file in the USB memory device and perform parameter copy again. (Refer to page 582.) | | | |

| Operation panel indication | rE8 | r E 8 | | |
|-------------------------------|---|---|--|--|
| Name | No PLC function project file | | | |
| Description | The specified PLC function project file does not exist in the USB memory device. | | | |
| Check point | Check that the file exists in the USB memory device. Check that the folder name and the file name in the USB memory device is correct. | | | |
| Corrective action | The data in the USB | The data in the USB memory device may be damaged. | | |

| Operation panel indication | Err. | Err. | | | |
|----------------------------|---|------|--|--|--|
| Description | The RES signal is turned ON. The operation panel and inverter cannot make normal communication (contact faults of the connector). This error may occur when the voltage at the input side of the inverter drops. When using a separate power source for the control circuit power (R1/L11, S1/L21) from the main circuit power (R/L1, S/L2, T/L3), this error may appear at turning ON of the main circuit. It is not a fault. | | | | |
| Corrective action | Turn OFF the RES signal. Check the connection between the operation panel and the inverter. Check the voltage on the input side of the inverter. | | | | |

♦ Warning

Output is not shut off when a protective function is activated.

| Operation panel indication | OL | | FR-LU08 indication | OL | | |
|-------------------------------|---|--|--|---|--|--|
| Name | Stall prevention (overcurrent) | | | | | |
| | When the output current of the inverter increases, the stall prevention (overcurrent) function is activated. The following section explains about the stall prevention (overcurrent) function. | | | | | |
| | During acceleration | prevention operation lev overload current decrease | /el , etc.), this function s es to prevent the inverte t is reduced below stall | Il prevention level (Pr.22 Stall tops the increase in frequency until the er from resulting in overcurrent trip. prevention operation level, this function | | |
| Description | During constant- speed operation | When the inverter output current exceeds the stall prevention level (Pr.22 Stall prevention operation level , etc.), this function decreases the frequency until the overload current decreases to prevent the inverter from resulting in overcurrent trip. When the overload current is reduced below stall prevention operation level, this function increases the frequency up to the set value. | | | | |
| | When the inverter output current exceeds the stall prevention level (Pr.22 Stall prevention operation operation level, etc.), this function stops the decrease in frequency until the overload current decreases to prevent the inverter from resulting in overcurrent trip. When the overload current is reduced below stall prevention operation level, this function decreases the frequency again. | | | | | |
| Check point | Check that the Pr.0 Torque boost setting is not too large. The Pr.7 Acceleration time and Pr.8 Deceleration time settings may be too short. Check that the load is not too heavy. Check for any failures in peripheral devices. Check that the Pr.13 Starting frequency is not too large. Check that Pr.22 Stall prevention operation level is appropriate. | | | | | |
| Corrective action | Gradually increase or decrease the Pr.0 setting by 1% at a time and check the motor status. (Refer to page 551.) Set a larger value in Pr.7 and Pr.8. (Refer to page 228.) Reduce the load. Try Advanced magnetic flux vector control. Change the Pr.14 Load pattern selection setting. The stall prevention operation current can be set in Pr.22 Stall prevention operation level. The acceleration/ deceleration time may change. Increase the stall prevention operation level with Pr.22 Stall prevention operation selection. (Use Pr.156 to set either operation continued or not at OL operation.) | | | | | |

| Operation panel indication | oL | aL | FR-LU08 indication | oL | |
|-------------------------------|--------------------------------|--|--------------------|----|--|
| Name | Stall prevention (over | voltage) | | | |
| Description | The regeneration av page 572.) | When the output voltage of the inverter increases, the stall prevention (overvoltage) function is activated. The regeneration avoidance function is activated due to excessive regenerative power of the motor. (Refer to page 572.) The following section explains the stall prevention (overvoltage) function. If the regenerative power of the motor becomes excessive to exceed the regenerative | | | |
| Check point | | Check for sudden speed reduction. Check if the regeneration avoidance function (Pr.882 to Pr.886) is being used. (Refer to page 572.) | | | |
| Corrective action | The deceleration time | The deceleration time may change. Increase the deceleration time using Pr.8 Deceleration time . | | | |

| Operation panel indication | тн | <i> </i> ¯ <i> </i> -1 | FR-LU08 indication | тн |
|-------------------------------|--|------------------------|--------------------|----|
| Name | Electronic thermal rela | ay function pre-alarm | | |
| Description | Appears if the cumulative value of the electronic thermal O/L relay reaches or exceeds 85% of the preset level of Pr.9 Electronic thermal O/L relay . If the specified value is reached, the protection circuit is activated to shut off the inverter output. | | | |
| Check point | Check for large load or sudden acceleration. Check that the Pr.9 setting is appropriate. (Refer to page 266.) | | | |
| Corrective action | Reduce the load and frequency of operation. Set an appropriate value in Pr.9. (Refer to page 266.) | | | |

| Operation panel indication | PS | P5 | FR-LU08 indication | PS | | | |
|-------------------------------|---|--|--------------------|----|--|--|--|
| Name | PU stop | | | | | | |
| Description | The motor is stopped using STOP under the mode other than the PU operation mode. (To enable under the mode other than the PU operation mode, set Pr.75 Reset selection/disconnected PU detection/PU stop selection. Refer to page 196 for details.) | | | | | | |
| Check point | Check for a stop made by pressing STOP RESET of the operation panel. | | | | | | |
| Corrective action | • Turn the start signal | OFF and release with $\begin{bmatrix} PL\\ EX \end{bmatrix}$ | Ē. | | | | |

| Operation panel indication | СР | [P | FR-LU08 indication | СР | | | | |
|-------------------------------|--|---|---|----|--|--|--|--|
| Name | Parameter copy | Parameter copy | | | | | | |
| Description | | Appears when Parameter copy is performed between the FR-F820-02330(55K) or lower / FR-F840-01160(55K) or lower inverters and the FR-F820-03160(75K) or higher / FR-F840-01800(75K) or higher inverters. | | | | | | |
| Check point | Resetting of Pr.9, Pr.30, Pr.51, Pr.56, Pr.57, Pr.72, Pr.80, Pr.82, Pr.90 to Pr.94, Pr.453, Pr.455, Pr.458 to Pr.462, Pr.557, Pr.859, Pr.860, and Pr.893 is necessary. | | | | | | | |
| Corrective action | Set the initial value in | Pr.989 Parameter copy al | Set the initial value in Pr.989 Parameter copy alarm release . | | | | | |

| Operation panel indication | SA | 58 | FR-LU08 indication | - | | | | | | |
|-------------------------------|--|---|--------------------|---|--|--|--|--|--|--|
| Name | Safety stop | Safety stop | | | | | | | | |
| Description | Appears when safety | Appears when safety stop function is activated (during output shutoff). (Refer to page 74.) | | | | | | | | |
| Check point | Check if an emergency stop device is activated. Check if the shorting wire between S1 and PC or between S2 and PC is disconnected when not using the safety stop function. | | | | | | | | | |
| Corrective action | An emergency stop device is active when using the safety stop function. Identify the cause of emergency stop, ensure the safety and restart the system. When not using the safety stop function, short across terminals S1 and PC and across S2 and PC with shorting wire for the inverter to run. If "5 7 " is indicated when wires across S1 and SIC and across S2 and SIC are both conducted while using the safety stop function (drive enabled), internal failure might be the cause. Check the wiring of terminals S1, S2, and SIC and contact your sales representative if the wiring has no fault. | | | | | | | | | |

| Operation panel indication | MT1 to MT3 | | FR-LU08 indication | MT1 to MT3 | | | | |
|----------------------------|--|---|---|---|--|--|--|--|
| Name | Maintenance signal ou | Maintenance signal output | | | | | | |
| Description | time until the MT is dis Maintenance timer 2 | splayed using Pr.504 Main warning output set time | tenance timer 1 warni (MT2), and Pr.689 Main | ceeds the parameter set value. Set the ng output set time (MT1), Pr.687 ntenance timer 3 warning output set nd Pr.689 are initial values (9999). | | | | |
| Check point | The set time of maintenance timer has been exceeded. (Refer to page 224.) | | | | | | | |
| Corrective action | Take appropriate countermeasures according to the purpose of the maintenance timer setting. Setting "0" in Pr.503 Maintenance timer 1 , Pr.686 Maintenance timer 2 , and Pr.688 Maintenance timer 3 clears the indication. | | | | | | | |

| Operation panel indication | UF | LIF- | FR-LU08 indication | UF | | | | |
|-------------------------------|-----------------------|---|--------------------|----|--|--|--|--|
| Name | USB host error | USB host error | | | | | | |
| Description | Appears when an exc | Appears when an excessive current flows into the USB A connector. | | | | | | |
| Check point | Check if a USB device | Check if a USB device other than a USB memory device is connected to the USB A connector. | | | | | | |
| Corrective action | | If a device other than a USB memory device is connected to the USB A connector, remove the device. Setting Pr.1049 USB host reset = "1" or inverter reset clears the UF indication. | | | | | | |

| Operation panel indication | CF | [F | FR-LU08 indication | CF | | | | | |
|-------------------------------|---|--|--------------------|----|--|--|--|--|--|
| Name | Continuous operation | Continuous operation during communication fault | | | | | | | |
| Description | | Appears when the operation continues while an error is occurring in the communication line or communication option (when Pr.502 = "4"). | | | | | | | |
| Check point | - | Check for a break in the communication cable. Check for communication option faults. | | | | | | | |
| Corrective action | Check the connection of communication cable. Replace the communication option. | | | | | | | | |

| Operation panel indication | ED | Ed | FR-LU08 indication | ED | | | | |
|-------------------------------|---|--|-------------------------|------------------|--|--|--|--|
| Name | Emergency drive in op | Emergency drive in operation | | | | | | |
| Description | Appears during emerg | Appears during emergency drive operation. | | | | | | |
| Check point | Emergency drive operation | Emergency drive operation is performed by turning ON the X84 signal. | | | | | | |
| Corrective action | The display is cleare | d when the emergency dri | ve operation ends. (Ref | er to page 279.) | | | | |

| Operation panel indication | LDF | LdF | FR-LU08 indication | LDF | | | | | |
|-------------------------------|--|--|--------------------|-----|--|--|--|--|--|
| Name | Load fault warning | Load fault warning | | | | | | | |
| Description | Appears when the load is deviated from the detection width set in Pr.1488 Upper limit warning detection width or Pr.1489 Lower limit warning detection width . | | | | | | | | |
| Check point | Check if too much load is applied to the equipment, or if the load is too light. Check that the load characteristics settings are correct. | | | | | | | | |
| Corrective action | Inspect the equipme Set the load character | nt. eristics (Pr.1481 to Pr.148 | 7) correctly. | | | | | | |

♦ Alarm

Output is not shut off when a protective function is activated. The Alarm (LF) signal can be output depending on the parameter setting. (Set "98" in **Pr.190 to Pr.196 (Output terminal function selection)**. Refer to page 330.)

| Operation panel indication | FN | FN | FR-LU08 indication | FN | | | | | |
|-------------------------------|---|---|--------------------|----|--|--|--|--|--|
| Name | Fan alarm | Fan alarm | | | | | | | |
| Description | | For the inverter that contains a cooling fan, FN appears on the operation panel when the cooling fan stops due to a fault, low rotation speed, or different operation from the setting of Pr.244 Cooling fan operation selection . | | | | | | | |
| Check point | 0 | When the cooling fan is replaced, check that the fan is not installed upside down. Check the cooling fan for a failure. | | | | | | | |
| Corrective action | Install the fan correctly. (Refer to page 626.) If the fan alarm still occurs after the fan is installed correctly, the fan may be faulty. Contact your sales representative. | | | | | | | | |

| Operation panel indication | FN2 | FNP | FR-LU08 indication | FN2 | | | | |
|-------------------------------|-------------------------|--|--------------------|-----|--|--|--|--|
| Name | Internal fan alarm (IP5 | Internal fan alarm (IP55 compatible models only) | | | | | | |
| Description | FN2 appears on the op | FN2 appears on the operation panel when the internal air circulation fan stops due to a fault or low rotation speed. | | | | | | |
| Check point | Check the internal air | Check the internal air circulation fan for a failure. | | | | | | |
| Corrective action | The fan may be faulty. | The fan may be faulty. Contact your sales representative. | | | | | | |

♦ Fault

When a protective function is activated, the inverter output is shut off and a Fault signal is output.

| Operation panel indication | E.OC1 | E. | | 1 | FR-LU08 indication | OC During Acc | | |
|-------------------------------|---|----|--|---|--------------------|---------------|--|--|
| Name | Overcurrent trip during acceleration | | | | | | | |
| Description | When the inverter output current reaches or exceeds approximately 170% (LD rating) / 148% (SLD rating) of the rated current during acceleration, the protection circuit is activated and the inverter output is shut off. | | | | | | | |
| Check point | Check for sudden speed acceleration. Check if the downward acceleration time is too long in a lift application. Check for output short-circuit. Check that the Pr.3 Base frequency setting is not 60 Hz when the motor rated frequency is 50 Hz. Check that the Pr.3 Base frequency setting is set too high. Check if the fast-response current limit operation is disabled. Check that the regenerative driving is not performed frequently. (Check if the output voltage becomes larger than the V/F reference voltage at regenerative driving and overcurrent occurs due to increase in the motor current.) Check that the inverter capacity matches with the motor capacity. (PM motor control) Check if a start command is given to the inverter while the motor is coasting. (PM motor control) | | | | | | | |
| Corrective action | Check if a start command is given to the inverter while the motor is coasting. (PM motor control) Set the acceleration time longer. (Shorten the downward acceleration time of the lift.) If "E.OC1" always appears at start, disconnect the motor once and restart the inverter. If "E.OC1" still appears, contact your sales representative. Check the wiring to make sure that output short circuit does not occur. Set 50 Hz in Pr.3 Base frequency. (Refer to page 552.) Lower the stall prevention operation level. Activate the fast-response current limit operation. (Refer to page 290.) Set the base voltage (rated voltage of the motor, etc.) in Pr.19 Base frequency voltage. (Refer to page 552.) Choose inverter and motor capacities that match. (PM motor control) Input a start command after the motor stops. Alternatively, use the automatic restart after instantaneous power failure/flying start function. (Refer to page 472.) (PM motor control) | | | | | | | |

| Operation panel indication | E.OC2 | E. | 962 | FR-LU08 indication | OC During Cnst Spd | | | |
|-------------------------------|--|---|----------|--------------------|--------------------|--|--|--|
| Name | Overcurrent trip during | j constan | it speed | | | | | |
| Description | | When the inverter output current reaches or exceeds approximately 170% (LD rating) / 148% (SLD rating) of the rated current during constant-speed operation, the protection circuit is activated and the inverter output is shut off. | | | | | | |
| Check point | Check for a short-cir Check if the stall pre disabled. Check that the inver | Check that the inverter capacity matches with the motor capacity. (PM motor control) | | | | | | |
| Corrective action | Check if a start command is given to the inverter while the motor is coasting. (PM motor control) Keep the load stable. Check the wiring to make sure that output short circuit does not occur. Lower the stall prevention operation level. Activate the fast-response current limit operation. (Refer to page 290.) Choose inverter and motor capacities that match. (PM motor control) Input a start command after the motor stops. Alternatively, use the automatic restart after instantaneous power failure/flying start function. (Refer to page 472.) (PM motor control) | | | | | | | |

| Operation panel indication | E.OC3 | E. | 003 | FR-LU08 indication | OC During Dec | | | | | | |
|-------------------------------|---|---|--|--------------------------|---|--|--|--|--|--|--|
| Name | Overcurrent trip during | Overcurrent trip during deceleration or stop | | | | | | | | | |
| Description | rated current during d | When the inverter output current reaches or exceeds approximately 170% (LD rating) / 148% (SLD rating) of the rated current during deceleration (other than acceleration or constant speed), the protection circuit is activated and the inverter output is shut off. | | | | | | | | | |
| Check point | Check for a short-cir Check for too fast op Check if the stall predisabled. Check that the invertigent of the statement of | Check for sudden speed reduction. Check for a short-circuit in the output circuit. Check for too fast operation of the motor's mechanical brake. Check if the stall prevention operation level is set too high. Check if the fast-response current limit operation is disabled. Check that the inverter capacity matches with the motor capacity. (PM motor control) Check if a start command is given to the inverter while the motor is coasting. (PM motor control) | | | | | | | | | |
| Corrective action | Check the mechanic Lower the stall preve 290.) Choose inverter and Input a start command | make sure al brake o ention ope motor ca nd after th | e that output sh operation. eration level. Ac apacities that m ne motor stops. | atch. (PM motor control) | current limit operation. (Refer to page omatic restart after instantaneous power | | | | | | |

| Operation panel indication | E.OV1 | E. | | 1 | FR-LU08 indication | OV During Acc | | |
|-------------------------------|--|------------|-------------|---------|--------------------|---------------|--|--|
| Name | Regenerative overvolt | age trip c | luring acce | leratio | ו | | | |
| Description | If regenerative power causes the inverter's internal main circuit DC voltage to reach or exceed the specified value, the protection circuit is activated to stop the inverter output. The circuit may also be activated by a surge voltage produced in the power supply system. | | | | | | | |
| Check point | Check for too slow acceleration. (e.g. during downward acceleration in vertical lift load) Check that the Pr.22 Stall prevention operation level is not set to the no load current or lower. Check if the stall prevention operation is frequently activated in an application with a large load inertia. | | | | | | | |
| Corrective action | Set the acceleration time shorter. Use the regeneration avoidance function (Pr.882 to Pr.886). (Refer to page 572.) Set a value larger than the no load current in Pr.22. Set Pr.154 Voltage reduction selection during stall prevention operation = "10 or 11". (Refer to page 290.) | | | | | | | |

| Operation panel indication | E.OV2 | E. | 022 | FR-LU08 indication | OV During Cnst Spd | | | | | |
|-------------------------------|---|---|---|--|---|--|--|--|--|--|
| Name | Regenerative overvoltage trip during constant speed | | | | | | | | | |
| Description | If regenerative power causes the inverter's internal main circuit DC voltage to reach or exceed the specified value, the protection circuit is activated to stop the inverter output. The circuit may also be activated by a surge voltage produced in the power supply system. | | | | | | | | | |
| Check point | Check for sudden load change. Check that the Pr.22 Stall prevention operation level is not set to the no load current or lower. Check if the stall prevention operation is frequently activated in an application with a large load inertia. Check that acceleration/deceleration time is not too short. | | | | | | | | | |
| Corrective action | Use the brake unit, r (FR-CV) as required Set a value larger th Set Pr.154 Voltage Set the acceleration/ | n avoidan nultifuncti an the no reductior decelerat | ion regeneration of load current in P n selection durin ion time longer. (I | r.22 . g stall prevention oper Jnder Advanced magne | page 572.) ower regeneration common converter ration = "10 or 11". (Refer to page 290.) tic flux vector control, the output torque oot in speed, resulting in an occurrence | | | | | |

| Operation panel indication | E.OV3 | E. | 0K 3 | FR-LU08 indication | OV During Dec | | | | |
|-------------------------------|---|---|--|---|---|--|--|--|--|
| Name | Regenerative overvolt | age trip o | during deceler | ation or stop | · | | | | |
| Description | If regenerative power causes the inverter's internal main circuit DC voltage to reach or exceed the specified value, the protection circuit is activated to stop the inverter output. The circuit may also be activated by a surge voltage produced in the power supply system. | | | | | | | | |
| Check point | | Check for sudden speed reduction. Check if the stall prevention operation is frequently activated in an application with a large load inertia. | | | | | | | |
| Corrective action | Make the brake cycl Use the regeneration Use the brake unit, r (FR-CV) as required | e longer. n avoidar nultifunct | nce function (F ion regenerati | r.882 to Pr.886) . (Refer to on converter (FR-XC), or p | ches the moment of inertia of the load.) page 572.) ower regeneration common converter ration = "10 or 11". (Refer to page 290.) | | | | |

| Operation panel indication | E.THT | E. | ; }-;; | FR-LU08 indication | Inv. overload trip | | | | | |
|-------------------------------|--|--|--------------------------------|--------------------|--------------------|--|--|--|--|--|
| Name | Inverter overload trip (| Inverter overload trip (electronic thermal relay function) ^{*1} | | | | | | | | |
| Description | If the temperature of the output transistor elements exceeds the protection level with a rated output current or higher flowing without the overcurrent trip (E.OC[]), the inverter output is stopped. (Overload capacity 120% 60 s) | | | | | | | | | |
| Check point | Check that acceleration/deceleration time is not too short. Check that torque boost setting is not too large (small). Check that load pattern selection setting is appropriate for the load pattern of the machine. Check the motor for the use under overload. | | | | | | | | | |
| Corrective action | Check the motor for the use under overload. Set the acceleration/deceleration time longer. Adjust the torque boost setting. Set the load pattern selection setting according to the load pattern of the using machine. Reduce the load. | | | | | | | | | |

*1 Resetting the inverter initializes the internal cumulative heat value of the electronic thermal relay function.

| Operation panel indication | E.THM | E. | [| | F | R-LU08 indication | Motor overload trip | |
|-------------------------------|---|--|--------|-------------|--------|-------------------|---------------------|--|
| Name | Motor overload trip (el | ectronic | therma | al relay fu | nctior | ו) ^{*2} | | |
| Description | reduced cooling capat Electronic thermal O specified value, the pr dedicated motor, such | The electronic thermal O/L relay function in the inverter detects motor overheat, which is caused by overload or reduced cooling capability during low-speed operation. When the cumulative heat value reaches 85% of the Pr.9 Electronic thermal O/L relay setting, pre-alarm (TH) is output. When the accumulated value reaches the specified value, the protection circuit is activated to stop the inverter output. When the inverter is used to drive a dedicated motor, such as a multiple-pole motor, or several motors, the motor cannot be protected by the electronic thermal O/L relay. Install an external thermal relay on the inverter output side. | | | | | | |
| Check point | Check that the settir | Check the motor for the use under overload. Check that the setting of Pr.71 Applied motor for motor selection is correct. (Refer to page 379.) Check that the stall prevention operation setting is correct. | | | | | | |
| Corrective action | Reduce the load. For a constant-torqu Set the stall prevent | , | | | | | 0.) | |

*2 Resetting the inverter initializes the internal cumulative heat value of the electronic thermal relay function.

| Operation panel indication | E.FIN | E. | }= { | Ņ | FR-LU08 indication | Heatsink overheat | | |
|-------------------------------|---|---|------------|-----------|--------------------|-------------------|--|--|
| Name | Heat sink overheat | | | | | • | | |
| Description | When the heat sink overheats, the temperature sensor is activated, and the inverter output is stopped. The FIN signal can be output when the temperature becomes approximately 85% of the heat sink overheat protection operation temperature. For the terminal used for the FIN signal output, assign the function by setting "26 (positive logic) or 126 (negative logic)" from Pr.190 to Pr.196 (output terminal function selection) . (Refer to page 330.) | | | | | | | |
| Check point | Check for heat sink | Check for too high surrounding air temperature. Check for heat sink clogging. Check that the cooling fan is not stopped. (Check that FN is not displayed on the operation panel.) | | | | | | |
| Corrective action | Set the surrounding Clean the heat sink. Replace the cooling | | erature to | within th | e specifications. | | | |

| Operation panel indication | E.IPF | E. | 1 | FF | FR-LU08 indication | Instant Pwr failure |
|-------------------------------|--|------------|--------|----------------|------------------------|---|
| Name | Instantaneous power | ailure (St | anda | ard models a | nd IP55 compatible mod | dels only) |
| Description | If a power failure occurs (or when power input to the inverter is shut off) for longer than 15 ms ^{*3} , the instantaneous power failure protective function is activated to shut off the inverter output in order to prevent the control circuit from malfunctioning. If a power failure persists for 100 ms or longer, the fault warning output is not provided, and the inverter restarts if the start signal is ON upon power restoration. (The inverter continues operating if an instantaneous power failure is within 15 ms ^{*3} .) In some operating status (load magnitude, acceleration/deceleration time setting, etc.), overcurrent or other protection may be activated upon power restoration. When instantaneous power failure protection is activated, the IPF signal is output. (Refer to page 466 and page 472.) | | | | | |
| Check point | Find the cause of insta | antaneous | s pov | ver failure oc | currence. | |
| Corrective action | Remedy the instanta Prepare a backup po Set the function of a 472.) | ower supp | oly fo | r instantaned | | Pr.57) . (Refer to page 466 and page |

*3 10 ms for IP55 compatible models

| Operation panel indication | E.UVT | E. | | FR-LU08 indication | Under Voltage | | | |
|-------------------------------|---|-----------|------------------|---------------------|---------------|--|--|--|
| Name | Undervoltage (Standa | rd models | s and IP55 compa | atible models only) | | | | |
| Description | If the power supply voltage of the inverter decreases, the control circuit will not perform normal functions. In addition, the motor torque will be insufficient and/or heat generation will increase. To prevent this, if the power supply voltage decreases to about 150 VAC (300 VAC for the 400 V class) or below, this function shuts off the inverter output. When a jumper is not connected across P/+ and P1, the undervoltage protective function is activated. When undervoltage protection is activated, the IPF signal is output. (Refer to page 466 and page 472.) | | | | | | | |
| Check point | Check if a high-capaCheck if the jumper | , | | als P/+ and P1. | | | | |
| Corrective action | Check the devices on the power supply line such as the power supply itself. If this function is activated due to unstable voltage in the power supply, change the undervoltage level (DC bus voltage value). (Refer to page 275.) Do not remove the jumper across terminals P/+ and P1 except when connecting a DC reactor. If the problem still persists after taking the above measure, contact your sales representative. | | | | | | | |

| Operation panel indication | E.ILF | E. | 1 | L | F | FR-LU08 indication | Input phase loss |
|-------------------------------|--|--|---------|-------|---------|-----------------------|------------------|
| Name | Input phase loss (Star | dard mo | dels a | nd II | P55 cor | npatible models only) | |
| Description | is lost, the inverter out | When Pr.872 Input phase loss protection selection is enabled ("1") and one of the three-phase power input is lost, the inverter output is shut off. This protective function is not available when Pr.872 is set to the initial value (Pr.872 = "0"). (Refer to page 276.) | | | | | |
| Check point | Check for a break in the | ie cable f | for the | thre | ee-phas | e power supply input. | |
| Corrective action | Wire the cables prop Repair a break portion | , | cable. | | | | |

| Operation panel indication | E.OLT | E. | | ., | FR-LU08 indication | Stall prevention STP | | | | |
|-------------------------------|--|---|---------|-----------|------------------------|--|--|--|--|--|
| Name | Stall prevention stop | | | | | | | | | |
| | | If the output frequency has fallen to 0.5 Hz by stall prevention operation and remains for 3 seconds, a fault (E.OLT) appears and the inverter is shut off. OL appears while stall prevention is being activated. | | | | | | | | |
| Description | During speed control, a fault (E.OLT) appears and the inverter output is shut off if the frequency value converted from the motor rotation speed drops to 1.5 Hz or lower by stall prevention operation and the output torque exceeds the Pr.874 OLT level setting (refer to page 290) and remains there for 3 s. | | | | | | | | | |
| Check point | Check the motor for the use under overload. Check that the Pr.874 setting is correct. (Check the Pr.22 Stall prevention operation level setting under V/F control and Advanced magnetic flux vector control.) Check if a motor is connected under PM motor control. | | | | | | | | | |
| Corrective action | vector control.) • For the test operatio 177.) | n without tall preve | connect | ing a mol | or, select the PM moto | control and Advanced magnetic flux r control test operation. (Refer to page stall prevention (overvoltage) warning | | | | |

| Operation panel indication | E.SOT | E. | 50/ | FR-LU08 indication | Motor Step Out | | | | | | | |
|-------------------------------|---|---|--|-------------------------|--|--|--|--|--|--|--|--|
| Name | Loss of synchronism of | Loss of synchronism detection | | | | | | | | | | |
| Description | The inverter output is s PM motor control.) | The inverter output is shut off when the motor operation is not synchronized. (This function is only available under PM motor control.) | | | | | | | | | | |
| Check point | Check that the PM motor is not driven overloaded. Check if a start command is given to the inverter while the PM motor is coasting. Check if a motor is connected under PM motor control. Check if a PM motor other than the MM-EFS or MM-THE4 series is driven. | | | | | | | | | | | |
| Corrective action | restart after instanta • Check the connectio • For the test operatio 177.) • Drive an IPM motor | s during c neous por n of the II n without (MM-EFS | coasting, set Pr.5 wer failure. PM motor. connecting a mot or MM-THE4 ser | or, select the PM motor | e ≠ "9999", and select the automatic r control test operation. (Refer to page offline auto tuning must be performed. | | | | | | | |

| Operation panel indication | E.LUP | E. | LLIP | FR-LU08 indication | Upper limit fault | | | | |
|-------------------------------|-------------------------|---|------|--------------------|-------------------|--|--|--|--|
| Name | Upper limit fault detec | Upper limit fault detection | | | | | | | |
| Description | | The inverter output is shut off when the load exceeds the upper limit fault detection range. This protective function is not available in the initial setting of Pr.1490 (Pr.1490 = "9999"). | | | | | | | |
| Check point | | Check if too much load is applied to the equipment. Check that the load characteristics settings are correct. | | | | | | | |
| Corrective action | | Inspect the equipment. Set the load characteristics (Pr.1481 to Pr.1487) correctly. | | | | | | | |

| Operation panel indication | E.LDN | E. | | FR-LU08 indication | Lower limit fault | | | | |
|----------------------------|---|--|--|--------------------|-------------------|--|--|--|--|
| Name | Lower limit fault detec | Lower limit fault detection | | | | | | | |
| Description | The inverter output is shut off when the load falls below the lower limit fault detection range. This protective function is not available in the initial setting of Pr.1491 (Pr.1491 = "9999"). | | | | | | | | |
| Check point | | Check if the equipment load is too light. Check that the load characteristics settings are correct. | | | | | | | |
| Corrective action | Inspect the equipment. Set the load characteristics (Pr.1481 to Pr.1487) correctly. | | | | | | | | |

| Operation panel indication | E.GF | E. | GF | FR-LU08 indication | Ground Fault | | | | |
|-------------------------------|--|--|----------|--------------------|--------------|--|--|--|--|
| Name | Output side earth (gro | Output side earth (ground) fault overcurrent | | | | | | | |
| Description | The inverter output is shut off if an earth (ground) fault overcurrent flows due to an earth (ground) fault that occurred on the inverter's output side (load side). | | | | | | | | |
| Check point | Check for a ground fault in the motor and connection cable. | | | | | | | | |
| Corrective action | Remedy the earth (gro | ound) fault p | portion. | | | | | | |

| Operation panel indication | E.LF FR-LU08 indication Output phase loss | | | | | | |
|-------------------------------|---|--|--|--|--|--|--|
| Name | Output phase loss | | | | | | |
| Description | The inverter output is shut off if one of the three phases (U, V, W) on the inverter's output side (load side) is lost. | | | | | | |
| Check point | Check the wiring. (Check that the motor is normally operating.) Check that the capacity of the motor used is not smaller than that of the inverter. Check if a start command is given to the inverter while the motor is coasting. (PM motor control) | | | | | | |
| Corrective action | Wire the cables properly. Input a start command after the motor stops. Alternatively, use the automatic restart after instantaneous power failure/flying start function (page 472). (PM motor control) | | | | | | |

| Operation panel indication | E.OHT | E. | []}-{] | FR-LU08 indication | Ext TH relay oper | | | |
|-------------------------------|--|---|--------|--------------------|-------------------|--|--|--|
| Name | External thermal relay | operatio | n | | | | | |
| Description | mounted thermal relay signal) is set in any pa | The inverter output is shut off if the external thermal relay provided for motor overheat protection or the internally mounted thermal relay in the motor, etc. switches ON (contacts open). This function is available when "7" (OH signal) is set in any parameter from Pr.178 to Pr.189 (Input terminal function selection) . This protective function is not available in the initial status. (OH signal is not assigned.) | | | | | | |
| Check point | | Check for motor overheating. Check that the value "7" (OH signal) is set correctly to any of Pr.178 to Pr.189 (Input terminal function | | | | | | |
| Corrective action | Reduce the load and operation duty. Even if the relay contacts are reset automatically, the inverter will not restart unless it is reset. | | | | | | | |

| Operation panel indication | E.PTC | E. | PFE | FR-LU08 indication | PTC thermistor oper | | | | |
|----------------------------|--|--|-----|--------------------|---------------------|--|--|--|--|
| Name | PTC thermistor operation | PTC thermistor operation | | | | | | | |
| Description | is equal to or higher the longer than the setting | The inverter output is shut off if resistance of the PTC thermistor connected between terminal 2 and terminal 10 is equal to or higher than the Pr.561 PTC thermistor protection level setting for a continuous time equal to or longer than the setting value in Pr.1016 PTC thermistor protection detection time . When the initial value (Pr.561 = "9999") is set, this protective function is not available. | | | | | | | |
| Check point | Check the connection with the PTC thermistor. Check the Pr.561 and Pr.1016 settings. Check the motor for operation under overload. | | | | | | | | |
| Corrective action | Reduce the load. | | | | | | | | |

| Operation panel indication | E.OPT | E. | 0PC | FR-LU08 indication | Option Fault | | | |
|-------------------------------|--|--|-----|--------------------|--------------|--|--|--|
| Name | Option fault | | | | • | | | |
| Description | Appears if the AC power supply is accidentally connected to terminal R/L1, S/L2, or T/L3 when a high power factor converter (FR-HC2), multifunction regeneration converter (FR-XC in common bus regeneration mode), or power regeneration converter (FR-CV) is connected to the inverter while Pr.30 Regenerative function selection = "2". Appears when the switch for manufacturer setting of the plug-in option is changed. Appears when a communication option is connected while Pr.296 Password lock level = "0 or 100". | | | | | | | |
| Check point | common bus regene | Check that the AC power supply is not connected to terminal R/L1, S/L2, or T/L3 when the FR-HC2, FR-XC (in common bus regeneration mode), or FR-CV is connected to the inverter while Pr.30 = "2". Check for the password lock with a setting of Pr.296 = "0, 100". | | | | | | |
| Corrective action | Check the Pr.30 setting and wiring with the FR-HC2, FR-XC, or FR-CV. The inverter may be damaged if the AC power supply is connected to terminal R/L1, S/L2, or T/L3 when a high power factor converter is connected. Contact your sales representative. Set the switch on the plug-in option, which is for manufacturer setting, back to the initial setting. (Refer to the Instruction Manual of each option.) To apply the password lock when installing a communication option, set Pr.296 ≠ "0, 100". (Refer to page 208.) | | | | | | | |

| Operation panel indication | E.OP1 | E. | 0P | 1 | FR-LU08 indication | Option1 Fault | | |
|----------------------------|--|----|----|---|--------------------|---------------|--|--|
| Name | Communication option fault | | | | | | | |
| Description | The inverter output is shut off if a communication line error occurs in the communication option. | | | | | | | |
| Check point | Check for an incorrect option function setting and operation. Check that the plug-in option is plugged into the connector securely. Check for a break in the communication cable. Check that the terminating resistor is fitted properly. | | | | | | | |
| Corrective action | Check the option function setting, etc. Connect the plug-in option securely. Check the connection of communication cable. | | | | | | | |

| Operation panel indication | E.16 to E.20 | E. | | FR-LU08 indication | Fault 16 to Fault 20 | | | | |
|----------------------------|---|--|--|--------------------|----------------------|--|--|--|--|
| Name | User definition error b | User definition error by the PLC function | | | | | | | |
| Description | inverter output is shut The protective function the initial setting (Pr.4 | The protective function is activated by setting "16 to 20" in the special register SD1214 for the PLC function. The inverter output is shut off when the protective function is activated. The protective function is activated when the PLC function is enabled. This protective function is not available in the initial setting (Pr.414 = "0"). Any character string can be displayed on FR-LU08 or FR-PU07 by sequence programs. | | | | | | | |
| Check point | Check if "16 to 20" is set in the special register SD1214. | | | | | | | | |
| Corrective action | Set a value other than "16 to 20" in the special register SD1214. | | | | | | | | |

| Operation panel indication | E.PE6 | E. | PE6 | FR-LU08 indication | Fault | | |
|-------------------------------|--|---------|-----|--------------------|-------|--|--|
| Name | Internal storage device | e fault | | | • | | |
| Description | This protective function is activated by an inverter reset if writing data fails due to power-OFF or a data fault occurs in the storage device during parameter operations ^{*1} . | | | | | | |
| Check point | Check if the power was turned OFF during parameter operations. | | | | | | |
| Corrective action | Check the power supply or the devices on the power system to check that the devices have no fault. When E.PE6 occurs due to power-OFF during parameter operations: Check the read value of Pr.890. When the value is "7" or smaller, perform All parameter clear and then an inverter reset. The parameters that had been changed before All parameter clear must be set again. When E.PE6 occurs due to other reason (such as turning OFF/ON the power or an inverter reset): Contact your sales representative. | | | | | | |

*1 For example, when parameter clear, All parameter clear, Parameter copy, or offline auto tuning is performed in the inverter, or when parameter batch write is performed in FR Configurator2.

| Operation panel indication | E.PE | E. | PE | FR-LU08 indication | Corrupt Memory | | | |
|----------------------------|---|----|----|--------------------|----------------|--|--|--|
| Name | Parameter storage device fault (control circuit board) | | | | | | | |
| Description | The inverter output is shut off if a fault occurs in the parameter stored. (EEPROM failure) | | | | | | | |
| Check point | Check for too many number of parameter write times. | | | | | | | |
| Corrective action | Contact your sales representative. Set "1" in Pr.342 Communication EEPROM write selection (write to RAM) for the operation which requires frequent parameter writing via communication, etc. Note that writing to RAM goes back to the initial status at power OFF. | | | | | | | |

| Operation panel indication | E.PUE | E. | PLIE | FR-LU08 indication | PU disconnection | | |
|-------------------------------|--|------------|-------------------|--------------------|------------------|--|--|
| Name | PU disconnection | | | | | | |
| Description | The inverter output is shut off if communication between the inverter and PU is suspended, e.g. the operation panel or parameter unit is disconnected, when the disconnected PU disconnection function is valid in Pr.75 Reset selection/disconnected PU detection/PU stop selection. The inverter output is shut off if communication errors occurred consecutively for more than permissible number of retries when Pr.121 PU communication retry count ≠ "9999" during the RS-485 communication. The inverter output is shut off if communication is broken within the period of time set in Pr.122 PU communication the RS-485 communication via the PU connector. | | | | | | |
| Check point | Check that the operation panel or the parameter unit is connected properly. Check the Pr.75 setting. | | | | | | |
| Corrective action | Fit the operation pane | l or the p | arameter unit sec | urely. | | | |

| Operation panel indication | E.RET | E. | REF | FR-LU08 indication | Retry count excess | | |
|-------------------------------|---|-----------|-------------------|--------------------|--|--|--|
| Name | Retry count excess | | | | | | |
| Description | | fault occ | urrence. This fur | | within the number of retries set in Pr.67 Pr.67 is set. This protective function is | | |
| Check point | Find the cause of the fault occurrence. | | | | | | |
| Corrective action | Eliminate the cause of | the fault | preceding this fa | ult indication. | | | |

| Operation panel indication | E.PE2 | E. | PE2 | FR-LU08 indication | PR storage alarm | | |
|-------------------------------|------------------------|-------------|---------------------|-------------------------|------------------|--|--|
| Name | Parameter storage de | vice fault | (main circuit boar | d) | | | |
| Description | The inverter output is | shut off if | a fault occurs in t | he parameter stored. (I | EEPROM failure) | | |
| Check point | | | | | | | |
| Corrective action | Contact your sales rep | oresentati | ive. | | | | |

| | E.CPU | E. | EPU | FR-LU08 indication | CPU Fault | | | |
|-------------------|---|---|----------------|-----------------------------|------------|--|--|--|
| Operation panel | E. 5 | E. | Ш | | Fault 5 | | | |
| indication | E. 6 | E. | 5 | | Fault 6 | | | |
| | E.7 E. 7 | | Fault 7 | | | | | |
| Name | CPU fault | | | | | | | |
| Description | The inverter output is | shut off if th | e communicatio | on fault of the built-in Cl | PU occurs. | | | |
| Check point | Check for devices producing excess electrical noises around the inverter. | | | | | | | |
| Corrective action | 0 | Take measures against noise if there are devices producing excessive electrical noises around the inverter. Contact your sales representative. | | | | | | |

| Operation panel indication | E.CTE | E. | | Ē | FR-LU08 indication | Circuit fault | |
|-------------------------------|--|---|---|---|--|--|--|
| Name | Operation panel powe | r supply ຮ | short circ | cuit/RS-48 | 35 terminals power supp | oly short circuit | |
| Description | inverter output is shu the PU connector an To reset, enter the F switch power OFF th • When the power sup At this time, commu | it off. The e disabled ES signal en ON ag ply for the nication fre | use of t d. I from th gain. e RS-48 om the I | he operat le termina 5 termina RS-485 te | ion panel (parameter ur al, reset through commu ls are short circuited, th erminals cannot be mad | ed, the power output is shutoff and the hit) and the RS-485 communication via unication via the RS-485 terminals, or his function shuts off the power output. e. witch power OFF then ON again. | |
| Check point | Check that the PU connector cable is not shorted. Check that the RS-485 terminals are connected correctly. | | | | | | |
| Corrective action | Check PU and the c Check the connection | | RS-485 t | erminals. | | | |

| Operation panel indication | E.P24 | E. | P24 | FR-LU08 indication | 24 VDC power fault | | | |
|-------------------------------|--|-------------|-------------------|--------------------|--|--|--|--|
| Name | 24 VDC power fault | | | | | | | |
| Description | • When the 24 VDC power output from the PC terminal is shorted, this function shuts off the power output. At this time, all external contact inputs switch OFF. The inverter cannot be reset by entering the RES signal. To reset it, use the operation panel, or switch power OFF, then ON again. | | | | | | | |
| Check point | Check for a short circle Check that the 24 V | | | | | | | |
| Corrective action | | 24 V. (If 1 | the power with in | | blied to the 24 V input circuit for a long age the inverter, supply power at the | | | |

| Operation panel indication | E.CDO | E. | 640 | FR-LU08 indication | OC detect level | | |
|-------------------------------|--|------------|-------------------------------|------------------------|--|--|--|
| Name | Abnormal output curre | nt detecti | on | | | | |
| Description | | able when | n "1" is set in Pr.1 0 | 67 Output current dete | utput current detection level setting. ection operation selection. When the | | |
| Check point | Check the settings of Pr.150, Pr.151 Output current detection signal delay time, Pr.166 Output current detection signal retention time, and Pr.167. (Refer to page 339.) | | | | | | |

| | eration panel ndication | E.IOH | E. | 1 | []}-{ | FR-LU08 indication | Inrush overheat | |
|------|----------------------------|--|--------------|------|-------------|---|-----------------------|--|
| | Name | Inrush current limit cire | cuit fault (| Stan | dard models | and IP55 compatible m | nodels only) | |
| D | escription | The inverter output is shut off when the resistor of the inrush current limit circuit is overheated. The inrush current limit circuit is faulty. | | | | | | |
| с | heck point | Check that frequent power ON/OFF is not repeated. Check if the input side fuse (5A) in the power supply circuit of the inrush current limit circuit contactor (FR-F840-03250(132K) or higher) is blown. Check that the power supply circuit of inrush current limit circuit contactor is not damaged. | | | | | | |
| Corr | ective action | Configure a circuit when If the problem still personal still still personal still s | | | | F is not repeated. measure, contact your | sales representative. | |

| Operation panel indication | E.SER | E. | SER | FR-LU08 indication | VFD Comm error | | |
|-------------------------------|-----------------------------------|--------------------------------|---|---|---|--|--|
| Name | Communication fault (| inverter) | | | | | |
| Description | retries or more when I | Pr.335 RS rminals. 1 | 5-485 communic Γhe inverter outpι | ation retry count ≠ "99 ut is also shut off if com | utively for the permissible number of 199" during RS-485 communication munication is broken for the period of | | |
| Check point | Check the RS-485 terminal wiring. | | | | | | |
| Corrective action | Perform wiring of the I | RS-485 te | rminals properly. | | | | |

| Operation panel indication | E.AIE | E. | F | E | FR-LU08 indication | Analog input fault |
|-------------------------------|--|--------------------|-----------|------------------|-----------------------------------|---|
| Name | Analog input fault | | | | | |
| Description | The inverter output is shut off when a 30 mA or higher current or a 7.5 V or higher voltage is input to terminal 2 while the current input is selected by Pr.73 Analog input selection , or to terminal 4 while the current input is selected by Pr.267 Terminal 4 input selection . | | | | | |
| Check point | Check the Pr.73, Pr.2 | 67 , and th | ne voltag | e/curren | t input switch settings. (| Refer to page 349.) |
| Corrective action | Either give a current le input and input a volta | | 80 mA, o | r set Pr. | 73, Pr.267 , and the volta | age/current input switch to the voltage |

| Operation panel indication | E.USB | E. | 456 | FR-LU08 indication | USB comm error | | | |
|-------------------------------|---|--|--------------------|--------------------|----------------|--|--|--|
| Name | USB communication f | ault | | | | | | |
| Description | The inverter output is s check time interval. | The inverter output is shut off when the communication is cut off for the time set in Pr.548 USB communication check time interval. | | | | | | |
| Check point | Check that the USB | communi | cation cable is co | nnected securely. | | | | |
| Corrective action | Check the Pr.548 setting. Connect the USB communication cable securely. Increase the Pr.548 setting or set "9999." (Refer to page 547.) | | | | | | | |

| Operation panel indication | E.SAF | E. | SAF | FR-LU08 indication | Safety circuit fault | | | | | | | |
|-------------------------------|---|----------------------|------------------|----------------------|---|--|--|--|--|--|--|--|
| Name | Safety circuit fault | Safety circuit fault | | | | | | | | | | |
| Description | The inverter output is shut off when a safety circuit fault occurs. The inverter output is shut off if the either of the wire between S1 and SIC or S2 and SIC becomes non-conductive while using the safety stop function. When the safety stop function is not used, the inverter output is shut off when the shorting wire between terminals S1 and PC or across S2 and PC is disconnected. Settings of the switches (SW3 and SW4) for manufacturer setting may have been changed from the initial settings. | | | | | | | | | | | |
| Check point | Check if the shorting stop function. | wire betw | een S1 and PC or | between S2 and PC is | n using the safety stop function. disconnected when not using the safety | | | | | | | |
| Corrective action | Check that the initial position of each switch was not changed. When using the safety stop function, check that wiring of terminal S1, S2 and SIC is correct and the safety stop input signal source such as a safety relay module is operating properly. Refer to the Safety Stop Function Instruction Manual for causes and countermeasures. (Contact your sales representative for the manual.) When the safety stop function is not used, short across terminals S1 and PC and across S2 and PC with shorting wires. (Refer to page 74.) Set each manufacturer setting switch to the initial position (OFF). (Refer to page 19 for the positions of the switches.) | | | | | | | | | | | |

| | E.PBT | E. | Pbf | PBT fault FR-LU08 indication Internal circu | PBT fault | | | |
|-------------------------------|--|------------------------------------|-----|---|------------------------|--|--|--|
| Operation panel indication | E.13 | E. | 13 | | Internal circuit fault | | | |
| | E.BE | E. | 6E | | Brake transistor err | | | |
| Name | Internal circuit fault | | | | | | | |
| Description | The inverter output is shut off when an internal circuit fault occurs. | | | | | | | |
| Corrective action | Contact your sales rep | Contact your sales representative. | | | | | | |

| Operation panel indication | E.OS | E. | 8 | FR-LU08 indication | Overspeed occurrence | | | | |
|-------------------------------|---|---|---|--------------------|----------------------|--|--|--|--|
| Name | Overspeed occurrence | Overspeed occurrence | | | | | | | |
| Description | motor control. When P | The inverter output is shut off when the motor speed exceeds the Pr.374 Overspeed detection level under PM motor control. When Pr.374 = "9999 (initial value)", the inverter output is shut off when the motor speed exceeds the "maximum motor frequency + 10 Hz". | | | | | | | |
| Check point | Check that the Pr.374 setting is correct. | | | | | | | | |
| Corrective action | Set the Pr.374 correctly. | | | | | | | | |

| Operation panel indication | E.IAH | E. | | F-1}-1 | FR-LU08 indication | Abnormal Intnl Temp | |
|-------------------------------|--|----|--|--------|--------------------|---------------------|--|
| Name | Abnormal internal temperature (IP55 compatible models only) | | | | | | |
| Description | The inverter output is shut off when the inverter internal temperature reaches the specified value or higher. | | | | | | |
| Check point | Check for too high surrounding air temperature. Check if the internal air circulation fan or the cooling fan stops due to a fault. | | | | | | |
| Corrective action | Install an inverter suitable for the installation environment. (Refer to the Instruction Manual (Hardware).) Replace the internal air circulation fan or the cooling fan. | | | | | | |

| Operation panel indication | E.LCI | E. | | FR- | LU08 indication | 4 mA input fault | | |
|-------------------------------|---|----|--|-----|-----------------|------------------|--|--|
| Name | 4 mA input fault | | | | | | | |
| Description | The inverter output is shut off when the analog input current is 2 mA or less for the time set in Pr.778 4 mA input check filter . This function is available when Pr.573 4 mA input check selection = "2 or 3". (Refer to page 369.) This protective function is not available in the initial status. | | | | | | | |
| Check point | Check for a break in the wiring for the analog current input. Check that the Pr.778 setting is not too short. Check the wiring for the analog current input. Set the Pr.778 setting larger. | | | | | | | |
| Corrective action | | | | | | | | |

| Operation panel indication | E.PCH | E. | F1 [}-{ | FR-LU08 | indication | Pre-charge fault | | | | | |
|-------------------------------|--|------------------|----------|---------|------------|------------------|--|--|--|--|--|
| Name | Pre-charge fault | Pre-charge fault | | | | | | | | | |
| Description | The inverter output is shut off when the pre-charge time exceeds Pr.764 Pre-charge time limit . The inverter output is shut off when the measured value exceeds Pr.763 Pre-charge upper detection level during pre-charging. This function is available when Pr.764 and Pr.763 are set (refer to page 445). This protective function is not available in the initial status. | | | | | | | | | | |
| Check point | Check that the Pr.764 setting is not too short. Check that the Pr.763 setting is not too small. Check that the Pr.127 PID control automatic switchover frequency setting is not too low. Check for a break in the connection to the pump. | | | | | | | | | | |
| Corrective action | Set the Pr.764 setting longer. Set the Pr.763 setting larger. Set the Pr.127 setting higher. Check the connection to the pump. | | | | | | | | | | |

| Operation panel indication | E.PID | E. | F | | FR-LU08 indication | PID signal fault | |
|-------------------------------|---|----|---|--|--------------------|------------------|--|
| Name | PID signal fault | | | | | | |
| Description | The inverter output is shut off if the measured value exceeds the PID upper limit or PID lower limit parameter setting, or the absolute deviation value exceeds the PID deviation parameter setting during PID control. Set this function in Pr.131 PID upper limit, Pr.132 PID lower limit, Pr.553 PID deviation limit, and Pr.554 PID signal operation selection. (Refer to page 419.) This protective function is not available in the initial status. The inverter output is shut off when the input pressure reaches the fault level under PID input pressure control. Set this function in Pr.1370 Detection time for PID limiting operation and Pr.1379 PID input pressure fault level. (Refer to page 459.) This protective function is not available in the initial status. Check the meter for a failure or break. Check that the parameter settings are correct. | | | | | | |
| Check point | | | | | | | |
| Corrective action | Check that the meter has no failure or break. Set the parameters correctly. | | | | | | |

| Operation panel indication | E. 1 to E. 3 | E. E. | to | FR-LU08 indication | Fault 1 to Fault 3 | | | |
|----------------------------|--|----------|----|--------------------|--------------------|--|--|--|
| Name | Option fault | | | | | | | |
| Description | The inverter output is shut off when a contact fault is found between the inverter and the plug-in option, or when the communication option is not connected to the connector 1. Appears when the switch for manufacturer setting of the plug-in option is changed. | | | | | | | |
| Check point | Check that the plug-in option is plugged into the connector securely. (1 to 3 indicate connector numbers for connection of options.) Check for excessive noise around the inverter. Check if the communication option is connected to the connector 2 or 3. | | | | | | | |
| Corrective action | Connect the plug-in option securely. Take measures against noises if there are devices producing excessive electrical noises around the inverter. If the problem still persists after taking the above measure, contact your sales representative. Connect the communication option to the connector 1. Set the switch on the plug-in option, which is for manufacturer setting, back to the initial setting. (Refer to the Instruction Manual of each option.) | | | | | | | |

♦ Others

Indicate the status of the inverter. It is not a fault.

| Operation panel indication | E.0 | E. | | FR-LU08 indication | No faults | | |
|-------------------------------|---|----|--|--------------------|-----------|--|--|
| Name | No fault history | | | | | | |
| Description | Appears when no fault records are stored. (Appears when the fault history is cleared after the protective function has been activated.) | | | | | | |

| Operation panel indication | EV | ΕV | FR-LU08 indication | - | | | | | | |
|-------------------------------|---|---|--------------------|---|--|--|--|--|--|--|
| Name | 24 V external power s | 4 V external power supply operation | | | | | | | | |
| Description | Blinks when the main | Blinks when the main circuit power supply is off and the 24 V external power supply is being input. | | | | | | | | |
| Check point | Power is supplied from | Power is supplied from a 24 V external power supply. | | | | | | | | |
| Corrective action | Turning ON the power supply (main circuit) of the inverter clears the indication. If the indication is still displayed after turning ON of the power supply (main circuit) of the inverter, the power supply voltage may be low, or the jumper between terminals P/+ and P1 may be disconnected. | | | | | | | | | |

| Operation panel indication | RD | Rd | FR-LU08 indication | Rd | | | | |
|-------------------------------|--|----|--------------------|----|--|--|--|--|
| Name | Backup in progress | | | | | | | |
| Description | The GOT is used for backing up inverter parameters and the data used in the PLC function of inverter. (Refer to page 549.) | | | | | | | |

| Operation panel indication | WR | | FR-LU08 indication | WR | | | | |
|----------------------------|---|-------------------------|--------------------|----|--|--|--|--|
| Name | Restoration in progres | Restoration in progress | | | | | | |
| Description | The backup data stored in the GOT is used to restore the data in the inverter. (Refer to page 549.) | | | | | | | |

NOTE

• If protective functions with indication of "Fault" on the FR-LU08 or FR-PU07 are activated, "ERR" appears in the fault history of the FR-LU08 or FR-PU07.

• If faults other than the above appear, contact your sales representative.

6.6 Check first when you have a trouble

Point P

• If the cause is still unknown after every check, it is recommended to initialize the parameters, set the required parameter values and check again.

6.6.1 Motor does not start

| Check point | Possible cause | Countermeasure | Refer to page |
|-----------------|---|---|------------------|
| | An appropriate power supply voltage is not applied. (The operation panel display is not | Power on a molded case circuit breaker (MCCB), an earth leakage circuit breaker (ELB), or a magnetic contactor (MC). | — |
| | | Check for the decreased input voltage, input phase loss, and wiring. | _ |
| | operating.) | If only the control power is ON when using a separate power source for the control circuit, turn ON the main circuit power. | 69 |
| Main circuit | The motor is not connected properly. | Check the wiring between the inverter and the motor. If the electronic bypass function is active, check the wiring of the magnetic contactor (MC) between the inverter and the motor. | 50 |
| | The jumper across P/+ to P1 is disconnected. A DC reactor (FR-HEL) is not connected. | Securely fit a jumper across P/+ and P1. When using a DC reactor (FR-HEL), remove the jumper across P/ + to P1, and then connect the DC reactor. Connect the DC reactor securely when required according to the capacity. | 50, 88 |

| Check point | Possible cause | Countermeasure | Refer to page |
|-----------------|--|--|--|
| | A start signal is not input. | Check the start command source, and input a start signal. PU operation mode: FWD / REV External operation mode: STF/STR signal | 244 |
| | Both the forward and reverse rotation start signals (STF, STR) are input simultaneously. | Turn ON only one of the forward and reverse rotation start signals (STF or STR). When the STF and STR signals are turned ON simultaneously in the initial setting, a stop command is given. | 60 |
| | Frequency command is zero. (The [FWD] or [REV] LED indicator on the operation panel is blinking.) | Check the frequency command source and input a frequency command. | 244 |
| | The Terminal 4 input selection (AU) signal is not ON when terminal 4 is used for frequency setting. (The [FWD] or [REV] LED indicator on the operation panel is blinking.) | Turn ON the AU signal. Turning ON the AU signal activates terminal 4 input. | 349 |
| | The Output stop (MRS) signal or Inverter reset (RES) signal is ON. (The [FWD] or [REV] LED indicator on the operation panel is blinking.) | Turn the MRS or RES signal OFF. The inverter starts the operation with a given start command and a frequency command after turning OFF the MRS or RES signal. Before turning OFF, ensure the safety. | 60 |
| Input signal | The CS signal is OFF while the automatic restart after instantaneous power failure function is selected (Pr.57 Restart coasting time ≠ 9999). (The [FWD] or [REV] LED indicator on the operation panel is blinking.) | Turn ON the Selection of automatic restart after instantaneous power failure / flying start (CS) signal. When the CS signal is assigned to an input terminal, automatic restart operation is enabled when the CS signal is turned ON. | 466 |
| Signal | The jumper connector for selecting sink logic or source logic is incorrectly installed. (The [FWD] or [REV] LED indicator on the operation panel is blinking.) | Check that the control logic switchover jumper connector is correctly installed. If it is not installed correctly, the input signal is not recognized. | 64 |
| | The voltage/current input switch is not correctly set for the analog input signal (0 to 5 V, 0 to 10 V, or 4 to 20 mA). (The [FWD] or [REV] LED indicator on the operation panel is blinking.) | Set Pr.73 Analog input selection, Pr.267 Terminal 4 input selection , and a voltage/current input switch correctly, then input an analog signal in accordance with the setting. | 349 |
| | The STOP RESET key was pressed. (The operation panel indication is " (PS).) | During the External operation mode, check the method of restarting from a STOP input stop from PU. | 199, 598 |
| | For the separated converter type, terminals RDA and SE of the converter unit are not connected to terminals MRS (X10 signal) and SD (PC for source logic) of the inverter respectively. | Check for secure wiring connections. | Refer to the Instruction Manual (Hardware) of the FR- F802. |
| | Two-wire or three-wire type connection is incorrect. | Check the connection. Use the Start self-holding selection (STP (STOP)) signal when the three-wire type is used. | 563 |

| Check point | Possible cause | Countermeasure | Refer to page |
|----------------------|---|---|-----------------------|
| | Under V/F control, Pr.0 Torque boost setting is not appropriate. | Increase the Pr.0 setting by 0.5% increments while observing the rotation of a motor. If that makes no difference, decrease the setting. | 551 |
| | Pr.78 Reverse rotation prevention selection is set. | Check the Pr.78 setting. Set Pr.78 when you want to limit the motor rotation to only one direction. | 257 |
| | The Pr.79 Operation mode selection setting is incorrect. | Select the operation mode suitable for the input methods of the start command and frequency command. | 240 |
| | The bias and gain (calibration parameter C2 to C7) settings are not appropriate. | Check the bias and gain (calibration parameter C2 to C7) settings. | 357 |
| | The Pr.13 Starting frequency setting is greater than the running frequency. | Set the running frequency higher than the one set in Pr.13 . The inverter does not start if the frequency setting signal has a value lower than that of Pr.13 . | 238, 239 |
| | Zero is set in various running frequency settings (such as for multi-speed operation). Especially, Pr.1 Maximum frequency is zero. | Set the frequency command according to the application. Set Pr.1 higher than the actual frequency used. | 263, 287 |
| | Pr.15 Jog frequency is lower than Pr.13 Starting frequency for JOG operation. | The Pr.15 setting should be equal to or higher than the Pr.13 setting. | 238, 239, 261 |
| | Operation mode and a writing device do not correspond. | Check Pr.79 Operation mode selection, Pr.338 Communication operation command source, Pr.339 Communication speed command source, Pr.550 NET mode operation command source selection and Pr.551 PU mode operation command source selection, and select an operation mode suitable for the purpose. | 240, 251 |
| Parameter setting | The start signal operation selection is set by Pr.250 Stop selection | Check the Pr.250 setting and the connection of the STF and STR signals. | 563 |
| | The motor has decelerated to a stop when the power failure time deceleration-to-stop function is selected. | When power is restored, ensure the safety, and turn OFF the start signal once, then turn ON again to restart. When Pr.261 Power failure stop selection = "2 or 12", the motor automatically restarts after the power is restored. | 478 |
| | Auto tuning is being performed. | When offline auto tuning ends, press the operation panel for the PU operation. For the External operation, turn OFF the start signal (STF or STR). This operation resets the offline auto tuning, and the PU's monitor display returns to the normal indication. (Without this operation, next operation cannot be started.) | 383, 475 |
| | The automatic restart after instantaneous power failure function or power failure stop function has been activated. (Performing overload operation during input phase loss may cause voltage insufficiency, and that may result in detection of power failure.) | Set Pr.872 Input phase loss protection selection = "1" (input phase failure protection active). Disable the automatic restart after instantaneous power failure function and power failure stop function. Reduce the load. Increase the acceleration time if the function was activated during acceleration. | 276, 466, 472, 478 |
| | The motor test operation is selected under PM motor control. | Check the Pr.800 Control method selection setting. | 177 |
| | When the FR-HC2, FR-XC, FR-CV, or FR- CC2 is used, the input logic setting of the X10 signal is incorrect. | Set Pr.599 = "0" (initial value for standard models and IP55 compatible models) to use the X10 signal with the NO contact input specification, and Pr.599 = "1" (initial value for separated converter types) to use the X10 signal with the NC contact input specification. | 566 |
| Load | Load is too heavy. | Reduce the load. | <u> </u> |
| Luau | The shaft is locked. | Inspect the machine (motor). | _ |

6.6.2 Motor or machine is making abnormal acoustic noise

| Check point | Possible cause | Countermeasure | Refer to page |
|----------------------|---|--|---------------|
| Input signal | Disturbance due to EMI when the | Take countermeasures against EMI. | 90 |
| Parameter setting | frequency or torque command is given through analog input terminal 1, 2, or 4. | Increase the Pr.74 Input filter time constant setting if steady operation cannot be performed due to EMI. | 355 |
| | No carrier frequency noises (metallic noises) are generated. | In the initial setting, Pr.240 Soft-PWM operation selection is enabled to change motor noise to an unoffending complex tone. Therefore, no carrier frequency noises (metallic noises) are generated. Set Pr.240 = "0" to disable this function. | 218 |
| | The motor noise increases due to activation of the carrier frequency automatic reduction function when the motor is driven overloaded. | Reduce the load. Disable the automatic reduction function by setting Pr.260 PWM frequency automatic switchover = "0". (As the load remains excessive, overload may cause a protective function E.THT.) | 218 |
| Parameter setting | Resonance occurs. (output frequency) | Set Pr.31 to Pr.36, and Pr.552 (frequency jump) . When it is desired to avoid resonance attributable to the natural frequency of a mechanical system, these parameters allow resonant frequencies to be jumped. | 289 |
| | Resonance occurs. (carrier frequency) | Change the Pr.72 PWM frequency selection setting. Changing the PWM carrier frequency produces an effect on avoiding the resonance frequency of a mechanical system or a motor. | 218 |
| | Auto tuning is not performed under Advanced magnetic flux vector control. | Perform offline auto tuning | 383 |
| | Gain adjustment during PID control is insufficient. | To stabilize the measured value, change the proportional band (Pr.129) to a larger value, the integral time (Pr.130) to a slightly longer time, and the differential time (Pr.134) to a slightly shorter time. Check the calibration of set point and measured value. | 419 |
| | The gain is too high under PM motor control. | Check the settings of Pr.820 Speed control P gain 1 and Pr.824 Torque control P gain 1 (current loop proportional gain) . | 190 |
| Others | Mechanical looseness | Adjust machine/equipment so that there is no mechanical looseness. | — |
| Juleij | Contact the motor manufacturer. | | |
| Motor | Operating with output phase loss | Check the motor wiring. | — |

6.6.3 Inverter generates abnormal noise

| Check point | Possible cause | Countermeasure | Refer to page |
|----------------|--|----------------------------------|------------------|
| Fan | The fan cover was not correctly installed when a cooling fan was replaced. | Install the fan cover correctly. | 627 |

6.6.4 Motor generates heat abnormally

| Check point | Possible cause | Countermeasure | Refer to page |
|-------------------|---|---|---------------|
| Motor | The motor fan is not working. (Dust is accumulated.) | Clean the motor fan. Improve the environment. | — |
| WOLDI | Phase to phase insulation of the motor is insufficient. | Check the insulation of the motor. | _ |
| Main circuit | The inverter output voltage (U, V, W) are unbalanced. | Check the output voltage of the inverter. Check the insulation of the motor. | 632 |
| Parameter setting | The Pr.71 Applied motor setting is incorrect. | Check the Pr.71 Applied motor setting. | 379 |
| — | Motor current is too large | Refer to "6.6.11 Motor current is too large". | 618 |

6.6.5 Motor rotates in the opposite direction

| Check point | Possible cause | Countermeasure | Refer to page |
|-----------------|---|--|------------------|
| Main circuit | The phase sequence of output terminals U, V and W is incorrect. | Connect the output side terminals (terminals U, V, and W) correctly. | 50 |
| | The start signals (STF and STR signals) are connected improperly. | Check the connection. (STF: forward rotation, STR: reverse rotation) | 60, 563 |
| Input signal | The polarity of the frequency command is negative during the polarity reversible operation set by Pr.73 Analog input selection . | Check the polarity of the frequency command. | 349 |

6.6.6 Speed greatly differs from the setting

| Check point | Possible cause | Countermeasure | Refer to page |
|-------------------|---|---|------------------|
| Input | The frequency setting signal is incorrect. | Measure the input signal level. | — |
| signal | The input signal lines are affected by external EMI. | Take countermeasures against EMI, such as using shielded wires for input signal lines. | 93 |
| | Pr.1 Maximum frequency, Pr.2 Minimum | Check the settings of Pr.1, Pr.2 , and Pr.18 . | 287 |
| Parameter setting | frequency, Pr.18 High speed maximum frequency, and the calibration parameter C2 to C7 settings are not appropriate. | Check the calibration parameter C2 to C7 settings. | 357 |
| - | Pr.31 to Pr.36 , and Pr.552 (frequency jump) settings are not appropriate. | Narrow down the range of frequency jump. | 289 |
| Load | | Reduce the load weight. | — |
| Parameter setting | Stall prevention function is activated due to a heavy load. | Set Pr.22 Stall prevention operation level higher according to the load. (If Pr.22 is set too high, an overcurrent trip (E.OC[]) is likely to occur.) | 290 |
| Motor | | Check the capacities of the inverter and the motor. | — |

6.6.7 Acceleration/deceleration is not smooth

| Check point | Possible cause | Countermeasure | Refer to page |
|-------------------|---|---|------------------|
| | The acceleration/deceleration time is too short. | Increase the acceleration/deceleration time. | 228 |
| | | Increase/decrease the Pr.0 Torque boost setting value by 0.5% increments so that stall prevention does not occur. | 551 |
| Parameter setting | The base frequency does not match the | Under V/F control, set Pr.3 Base frequency and Pr.47 Second V / F (base frequency) . | 552 |
| | motor characteristics. | Under Advanced magnetic flux vector control or PM motor control, set Pr.84 Rated motor frequency . | 177 |
| | Regeneration avoidance operation is performed. | If the frequency becomes unstable during regeneration avoidance operation, decrease the setting of Pr.886 Regeneration avoidance voltage gain . | 572 |
| Load | | Reduce the load weight. | — |
| Parameter setting | Stall prevention function is activated due to a heavy load. | Set Pr.22 Stall prevention operation level higher according to the load. (If Pr.22 is set too high, an overcurrent trip (E.OC[]) is likely to occur.) | 290 |
| Motor | | Check the capacities of the inverter and the motor. | _ |

6.6.8 Speed varies during operation

Under Advanced magnetic flux vector control, the output frequency varies between 0 and 2 Hz as the load fluctuates. This is a normal operation and not a fault.

| Check point | Possible cause | Countermeasure | Refer to page |
|-------------------|--|---|------------------|
| Load | The load varies during an operation. | Select Advanced magnetic flux vector control. | 177 |
| | The frequency setting signal is varying. | Check the frequency setting signal. | — |
| | The frequency setting signal is affected by | Set filter to the analog input terminal using Pr.74 Input filter time constant, Pr.822 Speed setting filter 1 , etc. | 355 |
| Input | EMI. | Take countermeasures against EMI, such as using shielded wires for input signal lines. | 93 |
| signal | A malfunction is occurring due to the undesirable current generated when the transistor output unit is connected. | Use terminal PC (terminal SD when source logic) as a common terminal to prevent a malfunction caused by undesirable current. | 65 |
| | A multi-speed command signal is chattering. | Take countermeasures to suppress chattering. | _ |
| | Fluctuation of power supply voltage is too large. | Under V/F control, change the Pr.19 Base frequency voltage setting (approximately by 3%). | 552 |
| | The Pr.80 Motor capacity and Pr.81 Number of motor poles settings are not appropriate for the motor capacity under Advanced magnetic flux vector control or PM motor control. | Check the settings of Pr.80 and Pr.81 . | 177 |
| | Wiring length exceeds 30 m when Advanced magnetic flux vector control or PM motor control is performed. | Perform offline auto tuning | 383 |
| Parameter setting | Under V/F control, wiring is too long and a | In the low-speed range, adjust the Pr.0 Torque boost setting by 0.5% increments. | 551 |
| | voltage drop occurs. | Change the control method to Advanced magnetic flux vector control. | 177 |
| | Hunting occurs by the generated vibration, for example, when structural rigidity of the load is insufficient. | Disable automatic control functions, such as energy saving operation, fast-response current limit function, regeneration avoidance function, Advanced magnetic flux vector control, stall prevention, and online auto tuning. For PID control, set smaller values to Pr.129 PID proportional band and Pr.130 PID integral time . Lower the control gain to increase the stability. | _ |
| | | Change the Pr.72 PWM frequency selection setting. | 218 |

6.6.9 Operation mode is not changed properly

| Check point | Possible cause | Countermeasure | Refer to page |
|-----------------|---|--|------------------|
| Input signal | The start signal (STF or STR) is ON. | Check that the STF and STR signals are OFF. When either is ON, the operation mode cannot be changed. | 60, 563 |
| Parameter | The Pr.79 Operation mode selection setting is not appropriate. | When the Pr.79 is set to "0 (initial value)", the operation mode is the External operation mode at power ON. To switch to the PU operation mode, press the $\boxed{\frac{PU}{EXT}}$ key on the operation panel (press the $\boxed{\frac{PU}{EXT}}$ key on the parameter unit (FR-PU07)). At other settings (1 to 4, 6, 7), the operation mode is limited accordingly. | 240 |
| setting | Operation mode and a writing device do not correspond. | Check Pr.79 Operation mode selection, Pr.338 Communication operation command source, Pr.339 Communication speed command source, Pr.550 NET mode operation command source selection and Pr.551 PU mode operation command source selection, and select an operation mode suitable for the purpose. | 240, 251 |

6.6.10 Operation panel (FR-DU08) display is not operating

| Check point | Possible cause | Countermeasure | Refer to page |
|---------------------------------------|--|--|---------------|
| Main circuit Control circuit | The power is not input. | Input the power. | 45 |
| Front cover | The operation panel is not properly connected to the inverter. | Check if the inverter front cover is installed securely. | 32 |

6.6.11 The motor current is too large

| Check point | Possible cause | Countermeasure | Refer to page |
|----------------|--|---|------------------|
| | The torque boost (Pr.0 , Pr.46) setting is not appropriate under V/F control, so the stall prevention function is activated. | Increase/decrease the Pr.0 Torque boost setting value by 0.5% increments so that stall prevention does not occur. | 551 |
| | The V/F pattern is not appropriate when V/ F control is performed. | Set the rated frequency of the motor to Pr.3 Base frequency . Use Pr.19 Base frequency voltage to set the base voltage (for example, rated motor voltage). | 552 |
| | (Pr.3, Pr.14, Pr.19) | Change the Pr.14 Load pattern selection setting according to the load characteristic. | 554 |
| Parameter | | Reduce the load weight. | — |
| setting | Stall prevention function is activated due to a heavy load. | Set Pr.22 Stall prevention operation level higher according to the load. (If Pr.22 is set too high, an overcurrent trip (E.OC[]) is likely to occur.) | 290 |
| | | Check the capacities of the inverter and the motor. | — |
| | Offline auto tuning is not performed under Advanced magnetic flux vector control. | Perform offline auto tuning | 383 |
| | When PM motor control is selected for a PM motor other than the MM-EFS or MM-THE4, offline auto tuning is not performed. | Perform offline auto tuning for a PM motor. | 392 |

6.6.12 Speed does not accelerate

| Check point | Possible cause | Countermeasure | Refer to page | | | | | |
|----------------------|--|---|------------------|--|--|--|--|--|
| | The start command or frequency command is chattering. | Check if the start command and the frequency command are correct. | — | | | | | |
| Input signal | The wiring length is too long for the analog frequency command, causing a voltage (current) drop. | Perform the bias and gain calibration for the analog input. | 357 | | | | | |
| | The input signal lines are affected by external EMI. | Take countermeasures against EMI, such as using shielded wires for input signal lines. | 93 | | | | | |
| | Pr.1 Maximum frequency, Pr.2 Minimum frequency, Pr.18 High speed maximum | Check the Pr.1 and Pr.2 settings. To operate at 120 Hz or higher, set Pr.18 . | 287 | | | | | |
| | frequency, and the calibration parameter C2 to C7 settings are not appropriate. | Check the calibration parameter C2 to C7 settings. | 357 | | | | | |
| | The maximum voltage (current) input value is not set during the External operation. (Pr.125, Pr.126, Pr.18) | Check the settings of Pr.125 Terminal 2 frequency setting gain frequency and Pr.126 Terminal 4 frequency setting gain frequency. To operate at 120 Hz or higher, set Pr.18 High speed maximum frequency. | 287, 357 | | | | | |
| | The torque boost (Pr.0 , Pr.46) setting is not appropriate under V/F control, so the stall prevention function is activated. | Increase/decrease the Pr.0 Torque boost setting value by 0.5% increments so that stall prevention does not occur. | 551 | | | | | |
| | | Set the rated frequency of the motor to Pr.3 Base frequency. | | | | | | |
| | The V/F pattern is not appropriate when V/ F control is performed. (Pr.3, Pr.14, Pr.19) | | | | | | | |
| Parameter setting | r control is performed. (F1.3, F1.14, F1.13) | Change the Pr.14 Load pattern selection setting according to the load characteristic. | | | | | | |
| | | Reduce the load weight. | | | | | | |
| | Stall prevention function is activated due to a heavy load. | Set Pr.22 Stall prevention operation level higher according to the load. (If Pr.22 is set too high, an overcurrent trip (E.OC[]) is likely to occur.) | | | | | | |
| | | Check the capacities of the inverter and the motor. | — | | | | | |
| | Auto tuning is not performed under Advanced magnetic flux vector control. | Perform offline auto tuning | 383 | | | | | |
| | The setting of pulse train input is not appropriate. | Check the specification of the pulse generator (open collector output or complementary output) and check the adjustment of the pulse train and frequency (Pr.385 Frequency for zero input pulse and Pr.386 Frequency for maximum input pulse). | | | | | | |
| | During PID control, the output frequency is automatically controlled so that the measured value equals the set point. | | | | | | | |

6.6.13 Unable to write parameter setting

| Check point | Possible cause | Countermeasure | Refer to page |
|-------------------|---|---|------------------|
| Input signal | Operation is being performed (the STF or STR signal is ON). | Stop the operation. When Pr.77 Parameter write selection = "0 (initial value)", writing is enabled only during a stop. | 206 |
| Signal | Emergency drive operation is being performed (the X84 signal is ON). | Stop emergency drive operation. | 279 |
| | Decemptor patting was attempted in the | Choose the PU operation mode. | |
| | Parameter setting was attempted in the External operation mode. | Or, set Pr.77 Parameter write selection = "2" to enable parameter writing regardless of the operation mode. | 206, 240 |
| | Parameter write is disabled by the Pr.77 Parameter write selection setting. | Check the Pr.77 setting. | 206 |
| Parameter setting | The key lock mode is enabled by the Pr.161 Frequency setting/key lock operation selection setting. | Check the Pr.161 setting. | 202 |
| | Operation mode and a writing device do not correspond. | Check Pr.79, Pr.338, Pr.339, Pr.550 , and Pr.551 , and select an operation mode suitable for the purpose. | 240, 251 |
| | Under PM motor control, setting "25" in Pr.72 PWM frequency selection was attempted. Or, setting PM motor control was attempted while Pr.72 = "25". | Under PM motor control, "25" cannot be set in Pr.72 . (A sine wave filter (MT-BSL/BSC) cannot be used under PM motor control.) | 218 |

6.6.14 Power lamp is not lit

| Check point | Possible cause | Countermeasure | Refer to page | |
|---------------------------------------|---|--|------------------|--|
| Main circuit Control circuit | The wiring or installation is inadequate. | Check for secure wiring and installation. The power lamp is lit when power is supplied to the control circuit (R1/ L11, S1/L21). | 49 | |

CHAPTER 7 PRECAUTIONS FOR MAINTENANCE AND INSPECTION

| 7.1 | Inspection item | 622 |
|-----|--|-----|
| 7.2 | Measurement of main circuit voltages, currents, and powers | 632 |

7 PRECAUTIONS FOR MAINTENANCE AND INSPECTION

This chapter explains the precautions for maintenance and inspection of this product.

Always read the instructions before use.

For the precautions for maintenance and inspection of the separated converter type inverter, refer to the FR-F802 (Separated Converter Type) Instruction Manual (Hardware).

For the precautions for maintenance and inspection of the IP55 compatible model inverter, refer to the FR-F806 (IP55/UL Type 12 specification) Instruction Manual (Hardware).

7.1 Inspection item

The inverter is a static unit mainly consisting of semiconductor devices. Daily inspection must be performed to prevent any fault from occurring due to the adverse effects of the operating environment, such as temperature, humidity, dust, dirt and vibration, changes in the parts with time, service life, and other factors.

Precautions for maintenance and inspection

When accessing the inverter for inspection, wait for at least 10 minutes after the power supply has been switched OFF. Then, make sure that the voltage across the main circuit terminals P/+ and N/- on the inverter is not more than 30 VDC using a tester, etc.

7.1.1 Daily inspection

Basically, check for the following faults during operation.

- Motor operation fault
- · Improper installation environment
- · Cooling system fault
- · Abnormal vibration, abnormal noise
- · Abnormal overheat, discoloration

7.1.2 Periodic inspection

Check the areas inaccessible during operation and requiring periodic inspection. Consult us for periodic inspection.

Check and clean the cooling system: Check the tightening and retighten: Clean the air filter, etc. The screws and bolts may become loose due to vibration, temperature changes, etc. Check and tighten them. Tighten them according to the specified tightening torque. (Refer to page 53.)

Check the conductors and insulating materials for corrosion and damage.

Measure the insulation resistance.

Check and change the cooling fan and relay.

NOTE

 When using the safety stop function, periodic inspection is required to confirm that safety function of the safety system operates correctly. For more information on the safety stop function, refer to the FR-A800/F800 Safety Stop Function Instruction Manual.

7.1.3 Daily and periodic inspection

| Area of inspection | l | nspection item | Description | | pection nterval | Corrective action at fault | Check by use | |
|-----------------------|--|---------------------------|---|-------------------------------------|------------------------|--|---------------------------|--|
| Inspection | | item | | Daily | Periodic ^{*3} | occurrence | by user | |
| | | rounding vironment | Check the surrounding air temperature, humidity, dirt, corrosive gas, oil mist, etc. | 0 | | Improve the environment. | | |
| General | Ove | erall unit | Check for unusual vibration and noise. | 0 | | Check fault location and retighten. | | |
| | | | Check for dirt, oil, and other foreign material. ^{*1} | 0 | | Clean. | | |
| | | wer supply tage | Check that the main circuit voltage and control circuit voltage are normal. ^{*2} | 0 | | Inspect the power supply. | | |
| | | | Check with megger (between main circuit terminals and earth (ground) terminal). | | 0 | Contact the manufacturer. | | |
| | Go | neral | Check for loose screws and bolts. | | 0 | Retighten. | | |
| | Ge | nerai | Check for overheat traces on the parts. | | 0 | Contact the manufacturer. | | |
| | | | Check for stains. | | 0 | Clean. | | |
| | Со | nductors and | Check conductors for distortion. | | 0 | Contact the manufacturer. | | |
| | cab | bles | Check cable sheaths for breakage and deterioration (crack, discoloration, etc.). | | 0 | Contact the manufacturer. | | |
| Main circuit | | nsformer/ ctor | Check for unusual odor and abnormal increase of whining sound. | 0 | | Stop the equipment and contact the manufacturer. | | |
| | Terminal block | | Check for a damage. | | 0 | Stop the equipment and contact the manufacturer. | | |
| | Smoothing aluminum electrolytic capacitor | | Check for liquid leakage. | | 0 | Contact the manufacturer. | | |
| | | | Check for safety valve projection and bulge. | | 0 | Contact the manufacturer. | | |
| | | | Visual check and judge by the life check of the main circuit capacitor. (Refer to page 626.) | | 0 | | | |
| | Relay/contactor | | Check that the operation is normal and no chattering sound is heard. | | 0 | Contact the manufacturer. | | |
| | | | Check for an output voltage imbalance between | | 0 | Contact the | | |
| | Operation check | | phases while operating the inverter alone.Check that no fault is found in protective and display | | 0 | manufacturer. Contact the | | |
| | | | circuits in a sequence protective operation test. | | С С | manufacturer. Stop the equipment | | |
| Protection circuit | check | Overall | Check for unusual odor and discoloration. | | 0 | and contact the manufacturer. | | |
| Control circuit | nts ch | nts ch | ovorum | Check for serious rust development. | | 0 | Contact the manufacturer. | |
| | Components | Aluminum | Check for liquid leakage in a capacitor and deformation trace. | | 0 | Contact the manufacturer. | | |
| | Ö | electrolytic capacitor | Visual check and judge by the life check of the control circuit capacitor. (Refer to page 626.) | | 0 | | | |
| | | L | Check for unusual vibration and noise. | 0 | | Replace the fan. | | |
| Cooling | Co | oling fan | Check for loose screws and bolts. | | 0 | Fix with the fan cover fixing screws. | | |
| system | | | Check for stains. | | 0 | Clean. | | |
| | Her | at sink | Check for clogging. | | 0 | Clean. | | |
| | 1169 | | Check for stains. | | 0 | Clean. Contact the | | |
| | Ind | ication | Check that indications are correct.Check for stains. | 0 | 0 | manufacturer. Clean. | | |
| Display | Ме | ter/counter | Check that readouts are correct. | 0 | | Stop the equipment and contact the manufacturer. | | |
| Load motor | Op che | eration eck | Check for vibration and abnormal increase in operation noise. | 0 | | Stop the equipment and contact the manufacturer. | | |

- *1 Oil component of the heat dissipation grease used inside the inverter may leak out. The oil component, however, is not flammable, corrosive, nor conductive and is not harmful to humans. Wipe off such oil component.
- *2 It is recommended to install a voltage monitoring device for checking the voltage of the power supplied to the inverter.
- *3 One to two years of periodic inspection cycle is recommended. However, it differs according to the installation environment. Consult us for periodic inspection.

- NOTE

 Continuous use of a leaked, deformed, or degraded smoothing aluminum electrolytic capacitor (as shown in the table above) may lead to a burst, breakage, or fire. Replace such capacitor without delay.

7.1.4 Checking the inverter and converter modules

Preparation

- Disconnect the external power supply cables (R/L1, S/L2, T/L3) and motor cables (U, V, W).
- Prepare a continuity tester. (For the resistance measurement, use the 100 Ω range.)

Checking method

Change the polarity of the tester alternately at the inverter terminals R/L1, S/L2, T/L3, U, V, W, P/+, and N/- and check the electric continuity.

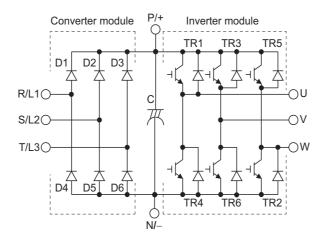
NOTE

- · Before measurement, check that the smoothing capacitor is discharged.
- At the time of electric discontinuity, the measured value is almost ∞. When there is an instantaneous electric continuity, due to the smoothing capacitor, the tester may not indicate ∞. At the time of electric continuity, the measured value is several Ω to several tens of Ω. When all measured values are almost the same (although values may not be constant depending on the tester type), it shows that there are no electrical paths with problems.

Module device numbers and terminals to be checked

| | | | polarity | Continuity | | Tester | polarity | Continuity |
|------------------|-----|------|----------|------------|------|--------|----------|------------|
| | | | | Continuity | | Ð | θ | Continuity |
| | D1 | R/L1 | P/+ | No | D4 | R/L1 | N/- | Yes |
| | | P/+ | R/L1 | Yes | 04 | N/- | R/L1 | No |
| Converter module | D2 | S/L2 | P/+ | No | D5 | S/L2 | N/- | Yes |
| | 02 | P/+ | S/L2 | Yes | 03 | N/- | S/L2 | No |
| | D3 | T/L3 | P/+ | No | D6 | T/L3 | N/- | Yes |
| | | P/+ | T/L3 | Yes | 00 | N/- | T/L3 | No |
| | TR1 | U | P/+ | No | TR4 | U | N/- | Yes |
| | | P/+ | U | Yes | 1114 | N/- | U | No |
| Inverter module | TR3 | V | P/+ | No | TR6 | V | N/- | Yes |
| | 113 | P/+ | V | Yes | | N/- | V | No |
| | TR5 | W | P/+ | No | TR2 | W | N/- | Yes |
| | 113 | P/+ | W | Yes | 1172 | N/- | W | No |

(Assuming that an analog meter is used.)



7.1.5 Cleaning

Always run the inverter in a clean status. When cleaning the inverter, gently wipe dirty areas with a soft cloth immersed in neutral detergent or ethanol.

- Do not use solvent, such as acetone, benzene, toluene and alcohol, as these will cause the inverter surface paint to peel off.
- The display, etc. of the operation panel (FR-DU08) and parameter unit (FR-PU07) are vulnerable to detergent and alcohol. Therefore, avoid using them for cleaning.

7

7.1.6 Replacement of parts

The inverter consists of many electronic parts such as semiconductor devices.

The following parts may deteriorate with age because of their structures or physical characteristics, leading to reduced performance or fault of the inverter. For preventive maintenance, the parts must be replaced periodically.

Use the life check function as a guidance of parts replacement.

| Part name | Estimated lifespan ^{*1} | Description | | | |
|---|----------------------------------|----------------------------------|--|--|--|
| Cooling fan | 10 years | Replace (as required) | | | |
| Main circuit smoothing capacitor | 10 years ^{*2} | Replace (as required) | | | |
| On-board smoothing capacitor | 10 years ^{*2} | Replace the board (as required). | | | |
| Relays | — | As required | | | |
| Main circuit fuse inside the inverter (FR-F840- 04320(185K) or higher) | 10 years | Replace (as required) | | | |

*1 Estimated lifespan for when the yearly average surrounding air temperature is 40°C.

- (without corrosive gas, flammable gas, oil mist, dust and dirt etc.)
- *2 Output current: 80% of the inverter rating

NOTE)

• For parts replacement, contact the nearest Mitsubishi FA center.

Inverter parts life display

The inverter diagnoses the main circuit capacitor, control circuit capacitor, cooling fan, and inrush current limit circuit by itself and estimates their lives.

The self-diagnostic warning is output when the life span of each part is near its end. It gives an indication of replacement time. **Guideline for life judgment using the life warning output**

| Part | Judgment level | | | | | | |
|------------------------------|---|--|--|--|--|--|--|
| Main circuit capacitor | 85% of the initial capacity | | | | | | |
| Control circuit capacitor | Estimated remaining life 10% | | | | | | |
| Inrush current limit circuit | Estimated remaining life 10% (Power ON: 100,000 times left) | | | | | | |
| Cooling fan | Not more than the specified speed | | | | | | |

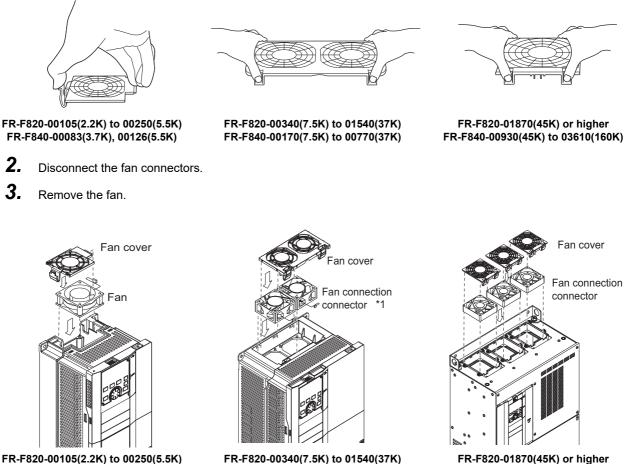
· Refer to page 220 to perform the life check of the inverter parts.

Replacement procedure of the cooling fan

The replacement interval of the cooling fan used for cooling the parts generating heat such as the main circuit semiconductor is greatly affected by the surrounding air temperature. When unusual noise and/or vibration are noticed during inspection, the cooling fan must be replaced immediately.

■ Removal (FR-F820-00105(2.2K) to 04750(110K), FR-F840-00083(3.7K) to 03610(160K))

1. Push the hooks from above and remove the fan cover.



FR-F840-00170(7.5K) to 00770(37K)

FR-F820-00105(2.2K) to 00250(5.5K) FR-F840-00083(3.7K), 00126(5.5K)

2.

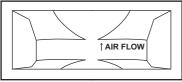
3.

*1 The number of cooling fans differs according to the inverter capacity.

FR-F820-01870(45K) or higher FR-F840-00930(45K) to 03610(160K)

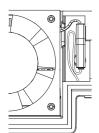
■ Installation (FR-F820-00105(2.2K) to 04750(110K), FR-F840-00083(3.7K) to 03610(160K))

1. After confirming the orientation of the fan, install the fan so that the "AIR FLOW" arrow faces up.

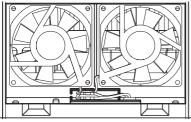


<Fan side face>

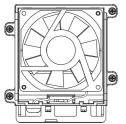
2. Connect the fan connectors.



FR-F820-00105(2.2K) to 00250(5.5K) FR-F840-00083(3.7K), 00126(5.5K)



FR-F820-00930(22K), 01250(30K) FR-F840-00470(22K), 00620(30K)

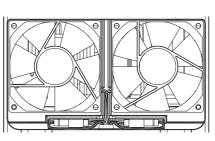


FR-F820-01870(45K), 02330(55K) FR-F840-00930(45K) to 01800(75K)

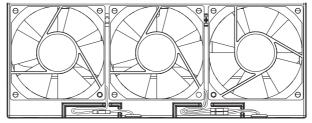
3. Install the fan cover.



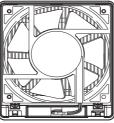
FR-F820-00105(2.2K) to 00250(5.5K) FR-F840-00083(3.7K), 00126(5.5K)



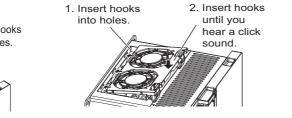
FR-F820-00340(7.5K) to 00770(18.5K) FR-F840-00170(7.5K) to 00380(18.5K)



FR-F820-01540(37K) FR-F840-00770(37K)



FR-F820-03160(75K) or higher FR-F840-02160(90K) to 03610(160K)



FR-F820-00340(7.5K) to 01540(37K) FR-F840-00170(7.5K) to 00770(37K)

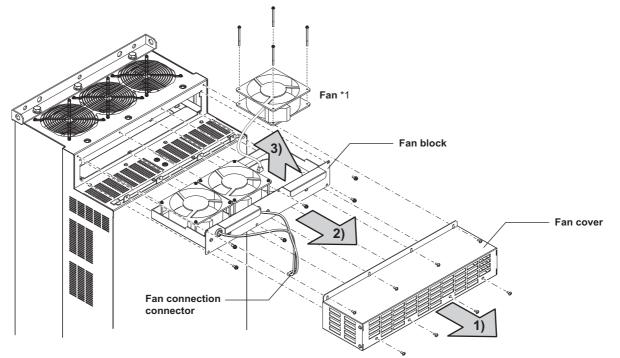


FR-F820-01870(45K) or higher FR-F840-00930(45K) to 03610(160K)

- · Installing the fan in the opposite direction of air flow may shorten the inverter life.
- Ensure that the cables are not caught when the fan is installed.
- Switch OFF the power before starting the fan replacement work. To prevent an electric shock accident, keep the inverter with its covers on during fans replacement since the inverter circuits are charged with voltage even after power OFF.

■ Removal (FR-F840-04320(185K) or higher)

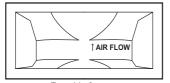
- **1.** Remove the screws attaching the fan cover, then remove the cover itself.
- **2.** Disconnect the fan connector, then remove the fan block itself.
- **3.** Remove the fan fixing screws, and remove the fan.



*1 The number of cooling fans differs according to the inverter capacity.

■ Installation (FR-F840-04320(185K) or higher)

1. After confirming the orientation of the fan, install the fan so that the "AIR FLOW" arrow faces up.



<Fan side face>

2. Install fans referring to the above figure. The tightening torque of the fan fixing screws is 0.73 N⋅m.

NOTE

- Installing the fan in the opposite direction of air flow may shorten the inverter life.
- Ensure that the cables are not caught when the fan is installed.
- Switch OFF the power before starting the fan replacement work. To prevent an electric shock accident, keep the inverter with its covers on during fans replacement since the inverter circuits are charged with voltage even after power OFF.

Smoothing capacitors

A large-capacity aluminum electrolytic capacitor is used for smoothing in the DC section of the main circuit, and an aluminum electrolytic capacitor is used for stabilizing the control power in the control circuit. Adverse effects from ripple currents deteriorate capacitors. Replacement intervals of capacitors vary greatly with surrounding temperatures and operating conditions. Replace them roughly every 10 years when used in normal air-conditioned environments.

Inspecting the product visually:

- Case: Check that the sides and bottom of the capacitor have not ruptured.
- Rubber seal: Check for any noticeable bulging or severe cracks.
- Check for external cracks, discoloration, leakage, etc. It is assumed that the capacitor has reached the end of its life when its capacity has dropped below 80% of its rated capacity.

NOTE

• The inverter diagnoses the main circuit capacitor and control circuit capacitor by itself and estimates its remaining life. (Refer to page 220.)

Relay output terminals

- The contacts of relays deteriorate over time. To prevent faults from occurring, relays must be replaced when they have reached the maximum of switching operations (switching life).
- The control terminal block must be replaced (refer to page 631) in case of failure of either relay between the relay output terminals C1 and B1 or A1, or terminals C2 and B2 or A2. After replacing the control terminal block, connect the jumper connector to the correct position in accordance with the control logic of input signals. (Refer to page 64.)

Main circuit fuse inside the inverter (FR-F840-04320(185K) or higher)

Fuses are used in some inverters. Replacement intervals of fuses vary greatly with surrounding temperatures and operating conditions. Replace them roughly every 10 years when used in normal air-conditioned environments.

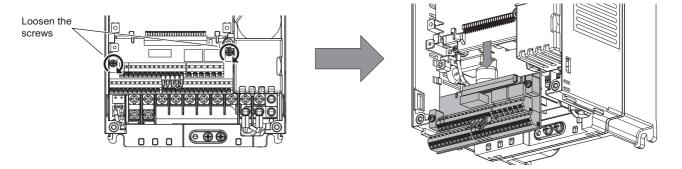
7.1.7 Removal and reinstallation of the control circuit terminal block

This product has a removable control circuit terminal block, which can be replaced with a new one or a control terminal option.

Removal and reinstallation

1. Loosen the two installation screws at the both side of the control circuit terminal block. (These screws cannot be removed.)

Slide down the control circuit terminal block to remove it.



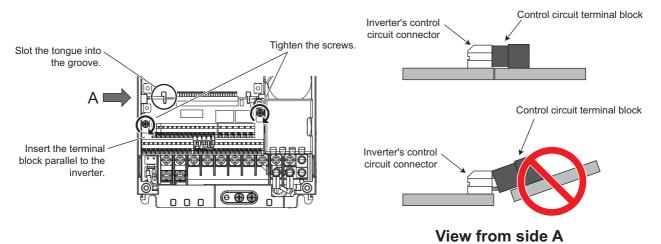
2. Be careful not to bend the pins of the inverter's control circuit connector, reinstall the control circuit terminal block and fix it with the mounting screws.

• Before starting the replacement, power OFF the inverter, wait for at least 10 minutes, and then check that the charge lamp is OFF to ensure safety.

Removal and reinstallation precautions

The following are the precautions to remove or reinstall the control circuit terminal block. Observe the following precautions and handle the inverter properly to avoid malfunctions or failures.

- To remove or reinstall the control circuit terminal block, keep it upright so that it is parallel with the inverter.
- To install the control circuit terminal block, slide it upward so that the tongues on the inverter slot into the grooves on the terminal block.
- Check that the terminal block is parallel to the inverter and the pins on the inverter control circuit connector are not bent. After checking proper connection, fix the terminal block in place with two screws.





- Do not tilt the terminal block while tightening the screws or removing it from the inverter. (Otherwise, a stress applied to the control circuit terminal block or the control circuit connector may cause damage to them.)
- After replacing the control terminal block, connect the jumper connector to the correct position in accordance with the control logic of input signals. (Refer to page 64.)

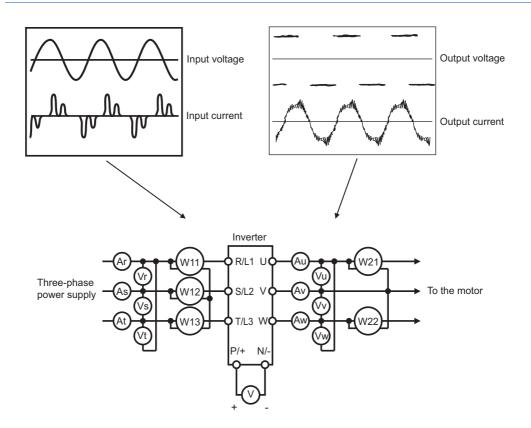
7.2 Measurement of main circuit voltages, currents, and powers

Since the voltages and currents on the inverter power supply and output sides include harmonics, measurement data depends on the instruments used and circuits measured. When instruments for commercial frequency are used for measurement, measure the following circuits with the instruments given on the next page.

• When installing meters etc. on the inverter output side

When the inverter-to-motor wiring length is long, especially in the 400 V class, small-capacity models, the meters and CTs may generate heat due to line-to-line leakage current. Therefore, choose the equipment which has enough allowance for the current rating.

To measure and display the output voltage and output current of the inverter, it is recommended to use the terminal AM and FM/CA output functions of the inverter.



Measuring points and instruments

| Item | Measuring point | Measuring instrument | Remarks (reference measure | d value) | | | |
|---|---|---|--|---|--|--|--|
| Input voltage V1 | Between R/L1 and S/L2, S/L2 and T/L3, or T/L3 and R/L1 | | Commercial power supply. Within pervoltage fluctuation. (Refer to page 63 | | | | |
| Input current I1 | Line current at R/L1, S/L2, and T/L3 | Digital power meter (designed for inverter) | | | | | |
| Input power P1 | At R/L1, S/L2, and T/L3, and between R/L1 and S/ L2, S/L2 and T/L3, and T/ L3 and R/L1 | inverter) | P1 = W11 + W12 + W13 (3-wattmete | er method) | | | |
| | Calculate after measuring i | nput voltage, input current and inp | ut power. | | | | |
| Input power factor Pf1 | $Pf_1 = \frac{P_1}{\sqrt{3}V_{1 \times I_1}}$ | x 100% | | | | | |
| Output voltage V2 | Between U and V, V and W, or W and U | Digital power meter (designed for inverter) ^{*1} | Difference between the phases is with maximum output voltage. | thin 1% of the | | | |
| Output current I2 | Line current at U, V, and W | Digital power meter (designed for | Difference between the phases is 10 the rated inverter current. | % or lower of | | | |
| Output power P2 | At U, V, and W, and between U and V, and V and W | inverter) | P2 = W21 + W22 2-wattmeter method (or 3-wattmeter | method) | | | |
| Output power factor Pf2 | Calculate in similar manner $Pf_2 = \frac{P_2}{\sqrt{3}V_2 x}$ factor. | | | | | | |
| Converter output | Between P/+ and N/- | Digital multimeter or other tester | Inverter LED indication 1.35 × V1 | | | | |
| Frequency setting | 2, and between 4(+) and 5 | | 0 to 10 VDC, 4 to 20 mA | | | | |
| signal | Between 1(+) and 5 | | 0 to ±5 VDC and 0 to ±10 VDC | 1 | | | |
| Power supply for a | Between 10(+) and 5 | | 5.2 VDC | | | | |
| frequency setting potentiometer | Between 10E(+) and 5 | | 10 VDC | Terminal 5 is a common | | | |
| | Between AM(+) and 5 | | Approximately 10 VDC at maximum frequency (without frequency meter) | terminal. | | | |
| | Between CA(+) and 5 | | Approximately 20 mADC at maximum frequency | | | | |
| Frequency meter signal | Between FM(+) and SD | Digital multimeter or other tester, or moving-coil type instrument (internal resistance 50 kΩ or more) | Approximately 5 VDC at maximum frequency (without frequency meter) T1 8VDC T2 Pulse width T1: Adjust with C0 (Pr.900). Pulse cycle T2: Set with Pr.55 (for frequency monitor only). | Terminal SD is a common terminal. | | | |
| Start signal, selection signal, reset signal, output stop signal | Between STF, STR, RH, RM, RL, JOG, RT, AU, STP (STOP), CS, RES, or MRS(+) and SD (for sink logic) | | Voltage when terminal is open: 20 to 30 VDC ON voltage: 1 V or less | | | | |
| Fault signal | Between A1 and C1 Between B1 and C1 | Digital multimeter or other tester | Continuity check ^{*2} Normal: discontinuity across A1 and C1 (continu across B1 and C1) Fault: continuity across A1 and C1 (discontinuit across B1 and C1) | | | | |

*1 Use an FFT to measure the output voltage accurately. A tester or general measuring instrument cannot measure accurately.

*2 When the setting of **Pr.195 ABC1 terminal function selection** is the positive logic.

7.2.1 Measurement of powers

Use digital power meters (for inverter) both on the inverter's input and output sides.

7.2.2 Measurement of voltages

♦ Inverter input side

Use digital power meters (for inverters) for the input side voltage.

Inverter output side

When using a measuring instrument, use a digital power meter for inverters as the inverter outputs PWM-controlled square wave voltage. The value monitored on the operation panel is the inverter-controlled voltage itself. Monitoring values via the operation panel or by outputting the analog signal is recommended as these values are accurate.

7.2.3 Measurement of currents

Use digital power meters (for inverter) both on the inverter's input and output sides.

Since the inverter input current tends to be unbalanced, measurement of three phases is recommended. The correct value cannot be obtained by measuring only one or two phases. On the other hand, the unbalanced ratio of each phase of the output current should be within 10%.

The inverter output current can be monitored on the operation panel. The value displayed on the operation panel is accurate even if the output frequency varies. Hence, it is recommended to monitor values on the operation panel.

7.2.4 Measurement of inverter input power factor

Calculate the factor from the effective power and the apparent power. A power-factor meter cannot indicate an exact value.

 $\sqrt{3}$ ×V (power supply voltage) × I (input current effective value)

7.2.5 Measurement of converter output voltage (between terminals P and N)

The output voltage of the converter is output across terminals P and N, and can be measured with a voltmeter such as a digital multimeter. The voltage varies according to the power supply voltage. Approximately 270 to 300 VDC (540 to 600 VDC for the 400 V class) is output when no load is connected. The voltage decreases when a load is applied.

When energy is regenerated from the motor during deceleration, for example, the converter output voltage rises to nearly 400 to 450 VDC (800 to 900 VDC for the 400 V class) maximum.

7.2.6 Measurement of inverter output frequency

In the initial setting of the FM type inverter, a pulse train proportional to the output frequency is output across the pulse train output terminals FM and SD on the inverter. This pulse train output can be counted by a frequency counter, or a digital multimeter can be used to read the mean value of the pulse train output voltage. When a meter is used to measure the output frequency, approximately 5 VDC is indicated at the maximum frequency.

For detailed specifications of the pulse train output terminal FM, refer to page 320.

In the initial setting of the CA type inverter, a pulse train proportional to the output frequency is output across the analog current output terminals CA and 5 on the inverter. Measure the current using a digital multimeter.

For detailed specifications of the analog current output terminal CA, refer to page 322.

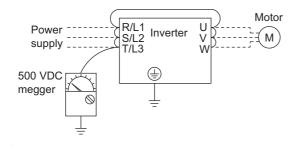
7.2.7 Insulation resistance test using megger

• For the inverter, conduct the insulation resistance test on the main circuit only as follows and do not perform the test on the control circuit.

(Use a 500 VDC megger.)

- NOTE

- Before performing the insulation resistance test on the external circuit, disconnect the cables from all terminals of the inverter so that the test voltage is not applied to the inverter.
- For the continuity test of the control circuit, use a tester (high resistance range) and do not use the megger or buzzer.



7.2.8 Pressure test

Do not conduct a pressure test. Deterioration may occur.

MEMO

CHAPTER 8 SPECIFICATIONS

| 8.1 | Inverter rating | 638 |
|-----|----------------------------|-----|
| 8.2 | Motor rating | 641 |
| 8.3 | Common specifications | 646 |
| 8.4 | Outline dimension drawings | 648 |
| | | |

8 SPECIFICATIONS

This chapter explains the specifications of this product.

Always read the instructions before use.

For the separated converter type inverter, refer to "SPECIFICATIONS" in the FR-F802 (Separated Converter Type) Instruction Manual (Hardware).

For the IP55 compatible model inverter, refer to "SPECIFICATIONS" in the FR-F806 (IP55/UL Type12 specification) Instruction Manual (Hardware).

8.1 Inverter rating

♦ 200 V class

| | Madal | ED E020 II | | 00046 | 00077 | 00105 | 00167 | 00250 | 00340 | 00490 | 00630 | 00770 | 00930 | 01250 | 01540 | 01870 | 02330 | 03160 | 03800 | 04750 |
|--------|--|---------------------|------------------------------------|--------------------------|----------|---------|----------|---------|---------|-----------|----------|---------|----------|--------|---------|----------|-------|-------|------------|-------|
| | Model FR-F820-[] | | 0.75K | 1.5K | 2.2K | 3.7K | 5.5K | 7.5K | 11K | 15K | 18.5K | 22K | 30K | 37K | 45K | 55K | 75K | 90K | 110K | |
| | plicable motor | SLD | | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | | 90/ 110 | 132 |
| cap | pacity (kW) ^{*1} | LD | | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 | 90 | 110 |
| | Rated | SLD | | 1.8 | 2.9 | 4 | 6.4 | 10 | 13 | 19 | 24 | 29 | 35 | 48 | 59 | 71 | 89 | 120 | 145 | 181 |
| | capacity (kVA) ^{*2} | LD | | 1.6 | 2.7 | 3.7 | 5.8 | 8.8 | 12 | 17 | 22 | 27 | 32 | 43 | 53 | 65 | 81 | 110 | 132 | 165 |
| ŧ | Rated current | SLD | | 4.6 | 7.7 | 10.5 | 16.7 | 25 | 34 | 49 | 63 | 77 | 93 | 125 | 154 | 187 | 233 | 316 | 380 | 475 |
| Output | (A) | LD | | 4.2 | 7 | 9.6 | 15.2 | 23 | 31 | 45 | 58 | 70.5 | 85 | 114 | 140 | 170 | 212 | 288 | 346 | 432 |
| | | SLD | | 110% | 60 s, 12 | 20% 3 : | s (inver | se-time | chara | cteristic | cs) at s | urround | ling air | temper | ature o | f 40°C | | | | |
| | current rating ^{*3} | LD | | 120% | 60 s, 1 | 50% 3 : | s (inver | se-time | e chara | cteristic | cs) at s | urround | ling air | temper | ature o | f 50°C | | | | |
| | Rated voltage | age ^{*4} | | Three-phase 200 to 240 V | | | | | | | | | | | | | | | | |
| | Rated input A | quency | Three-phase 200 to 240 V, 50/60 Hz | | | | | | | | | | | | | | | | | |
| | Permissible A | C voltage flu | ctuation | 170 to 264 V, 50/60 Hz | | | | | | | | | | | | | | | | |
| | Permissible fre | equency fluctuation | | ±5% | | | | | | | | | | | | | | | | |
| ≥ | | Without DC | SLD | 5.3 | 8.9 | 13.2 | 19.7 | 31.3 | 45.1 | 62.8 | 80.6 | 96.7 | 115 | 151 | 185 | 221 | 269 | _ | — | — |
| supply | Rated input | reactor | LD | 5 | 8.3 | 12.2 | 18.3 | 28.5 | | 58.2 | 74.8 | 90.9 | 106 | 139 | 178 | 207 | 255 | — | — | — |
| er s | current (A) ^{*5} | Wildi DO | SLD | 4.6 | 7.7 | 10.5 | | 25 | | 49 | 63 | | 93 | 125 | 154 | | | 316 | 380 | 475 |
| Power | | reactor | LD | 4.2 | 7 | 9.6 | 15.2 | 23 | | 45 | | | 85 | 114 | 140 | | 212 | 288 | 346 | 432 |
| õ | Power supply | Without DC | SLD | 2 | 3.4 | - | 7.5 | 12 | | 24 | | - | | 58 | | 84 | 103 | _ | — | — |
| | capacity | reactor | LD | | - | | | 11 | | 22 | | | | | 68 | | 97 | _ | — | — |
| | (kVA) ^{*6} | | SLD | | 2.9 | | 6.4 | 10 | 13 | 19 | 24 | | | 48 | 59 | | 89 | 120 | 145 | 181 |
| | · , | reactor | LD | 1.6 | 2.7 | 3.7 | 5.8 | 8.8 | 12 | 17 | 22 | 27 | 32 | 43 | 53 | 65 | 81 | 110 | 132 | 165 |
| | Protection rating of structure (IEC 60529) ^{*7} | | | Enclos | e type | (IP20) | | | | | | | | | Open t | type (IP | 00) | | | |
| Co | oling system | | | Natura | | Forced | l air | | | | | | | | | | | | | |
| Ap | prox. mass (kg) | | | 1.9 | 2.1 | 3.1 | 3.1 | 3.1 | 6.3 | 6.3 | 8.3 | 15.5 | 15.5 | 15.5 | 22 | 42 | 42 | 54 | 74 | 74 |

*1 The applicable motor capacity indicated is the maximum capacity applicable for use of the Mitsubishi Electric standard 4-pole motor.

*2 The rated output capacity is the value with respect to 220 V output voltage.

*3 The percentage of the overload current rating is the ratio of the overload current to the inverter's rated output current. For repeated duty, allow time for the inverter and motor to return to or below the temperatures under 100% load.

*4 The maximum output voltage does not exceed the power supply voltage. The maximum output voltage can be changed within the setting range.

However, the maximum point of the voltage waveform at the inverter output side is the power supply voltage multiplied by about $\sqrt{2}$.

*5 The rated input current is the value at a rated output voltage. The input power impedances (including those of the input reactor and cables) affect the value.

*6 The power supply capacity is the value at the rated output current. The input power impedances (including those of the input reactor and cables) affect the value.

*7 FR-DU08: IP40 (except for the PU connector)

♦ 400 V class

■ 00023 to 01160

| | Mode | | | 00023 | 00038 | 00052 | 00083 | 00126 | 00170 | 00250 | 00310 | 00380 | 00470 | 00620 | 00770 | 00930 | 01160 |
|-----------------|--|------------------------------------|---------|---------|---|-----------|------------|-----------|------------|------------|-----------|-----------|-----------|--------|---------|-----------|-------|
| | Model FR-F840-[] | | | 0.75K | 1.5K | 2.2K | 3.7K | 5.5K | 7.5K | 11K | 15K | 18.5K | 22K | 30K | 37K | 45K | 55K |
| Ap [,] | plicable motor | SLD | | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | | | - | | 55 |
| car | , , | LD | | | | | - | 5.5 | | 11 | 15 | | | | - | | 55 |
| | | SLD | | 1.8 | 2.9 | 4 | 6.3 | 10 | 13 | 19 | 24 | 29 | 36 | 47 | 59 | 71 | 88 |
| | capacity (kVA) ^{*2} | LD | LD | | | - | | 8.8 | 12 | | | | | 43 | | | 81 |
| Ħ | Rated current | SLD | | - | | - | 8.3 | 12.6 | | | - | | | 62 | | | 116 |
| Output | - (A) | LD | | 2.1 | 3.5 | 4.8 | 7.6 | 11.5 | 16 | 23 | 29 | 35 | 43 | 57 | 70 | 85 | 106 |
| õ | - | SLD | | 110% 6′ | 110% 60 s, 120% 3 s (inverse-time characteristics) at surrounding air temperature of 40°C | | | | | | | | | | | | |
| | current rating ^{*3} | LD | | 120% 6' | 0 s, 150º | % 3 s (in | iverse-tim | ne charac | cteristics |) at surrc | ounding a | air tempe | rature of | f 50°C | | | |
| | Rated voltage* | '4 | | Three-p | Three-phase 380 to 500 V | | | | | | | | | | | | |
| | Rated input AC | | equency | Three-p | Three-phase 380 to 500 V, 50/60 Hz ^{*8} | | | | | | | | | | | | |
| | Permissible A ^r | Permissible AC voltage fluctuation | | | | 0/60 Hz | | | | | | | | | - | - | |
| | | Permissible frequency fluctuation | | | | | | | | | | | | | | | |
| l≥ | | Without DC | , SLD | 3.2 | 5.4 | 7.8 | 10.9 | 16.4 | 22.5 | 31.7 | 40.3 | 48.2 | 58.4 | 76.8 | 97.6 | 115 | 141 |
| ddn | Rated input | | LD | - | | 7.3 | 10.1 | | | | | | | | 89.7 | 106 | 130 |
| Power supply | current (A) ^{*5} | | SLD | - | | | 8.3 | | | | - | | | 62 | | | 116 |
| MO | | | LD | | | - | 7.6 | - | | | | | | 57 | | | 106 |
| ٩ | Dowor oupply | Without DC | | - | | | 8.3 | | | | - | - | | 59 | | | 107 |
| | capacity | reactor | LD | | - | | 7.7 | . – | | | | ÷ . | | ÷. | | - · | 99 |
| | (kVA) ^{*6} | | SLD | - | | | 6.3 | 10 | 13 | | | | | 47 | | | 88 |
| | | | LD | 1.6 | 2.7 | 3.7 | 5.8 | 8.8 | 12 | 18 | 22 | 27 | 33 | 43 | 53 | 65 | 81 |
| | otection rating of 529) ^{*7} | f structure (l | IEC | Enclose | e type (IP: | 20) | | | | | | | | | Open ty | /pe (IP00 |) |
| Co | oling system | | | Natural | | | Forced a | air | | | | | | | | | |
| Ap | prox. mass (kg) |) | | 2.7 | 2.7 | 2.7 | 3.1 | 3.1 | 6.3 | 6.3 | 8.3 | 8.3 | 15 | 15 | 23 | 41 | 41 |

*1 The applicable motor capacity indicated is the maximum capacity applicable for use of the Mitsubishi Electric standard 4-pole motor.

*2 The rated output capacity is the value with respect to 440 V output voltage.

*3 The percentage of the overload current rating is the ratio of the overload current to the inverter's rated output current. For repeated duty, allow time for the inverter and motor to return to or below the temperatures under 100% load.

*4 The maximum output voltage does not exceed the power supply voltage. The maximum output voltage can be changed within the setting range.

However, the maximum point of the voltage waveform at the inverter output side is the power supply voltage multiplied by about $\sqrt{2}$.

*5 The rated input current is the value at a rated output voltage. The input power impedances (including those of the input reactor and cables) affect the value.

*6 The power supply capacity is the value at the rated output current. The input power impedances (including those of the input reactor and cables) affect the value.

*7 FR-DU08: IP40 (except for the PU connector)

*8 For the power voltage exceeding 480 V, set Pr.977 Input voltage mode selection. (For details, refer to page 205.)

■ 01800 to 06830

| | Medal | | • | 01800 | 02160 | 02600 | 03250 | 03610 | 04320 | 04810 | 05470 | 06100 | 06830 | |
|-----------|--|-----------------------------------|-----|---|---------------|--------------|-------------|----------------|---------------|------------|---------|-------|-------|--|
| | woder | FR-F840-[| 1 | 75K | 90K | 110K | 132K | 160K | 185K | 220K | 250K | 280K | 315K | |
| Ap | plicable motor | SLD | | 75/90 | 110 | 132 | 160 | 185 | 220 | 250 | 280 | 315 | 355 | |
| ca | pacity (kW) ^{*1} | LD | | 75 | 90 | 110 | 132 | 160 | 185 | 220 | 250 | 280 | 315 | |
| | Rated | SLD | | 137 | 165 | 198 | 248 | 275 | 329 | 367 | 417 | 465 | 521 | |
| | capacity (kVA) ^{*2} | LD | | 110 | 137 | 165 | 198 | 248 | 275 | 329 | 367 | 417 | 465 | |
| ÷ | Rated current | SLD | | 180 | 216 | 260 | 325 | 361 | 432 | 481 | 547 | 610 | 683 | |
| Output | - (A) | LD | | 144 | 180 | 216 | 260 | 325 | 361 | 432 | 481 | 547 | 610 | |
| õ | Overload | SLD | | 110% 60 s | s, 120% 3 s (| inverse-time | characteris | tics) at surro | ounding air t | emperature | of 40°C | | | |
| | current rating ^{*3} | LD | | 120% 60 s, 150% 3 s (inverse-time characteristics) at surrounding air temperature of 50°C | | | | | | | | | | |
| | Rated voltage | *4 | | Three-phase 380 to 500 V | | | | | | | | | | |
| | Rated input AC voltage/frequency | | | Three-phase 380 to 500 V, 50/60 Hz ^{*8} | | | | | | | | | | |
| | Permissible AC voltage fluctuation | | | 323 to 550 V, 50/60 Hz | | | | | | | | | | |
| vlddns | Permissible fre | Permissible frequency fluctuation | | | | | | | | | | | | |
| | | With DC | SLD | 180 | 216 | 260 | 325 | 361 | 432 | 481 | 547 | 610 | 683 | |
| Power | current (A) ^{*5} | reactor | LD | 144 | 180 | 216 | 260 | 325 | 361 | 432 | 481 | 547 | 610 | |
| 5 | Power supply | | SLD | 137 | 165 | 198 | 248 | 275 | 329 | 367 | 417 | 465 | 521 | |
| ď | Fower suppry | Mith DC | | | | | | | | | | | | |
| ď | capacity (kVA) ^{*6} | With DC reactor | LD | 110 | 137 | 165 | 198 | 248 | 275 | 329 | 367 | 417 | 465 | |
| Pre | capacity | reactor | | 110 Open type | - | 165 | 198 | 248 | 275 | 329 | 367 | 417 | 465 | |
| Pre 60 | capacity (kVA) ^{*6} otection rating o | reactor | | - | (IP00) | 165 | 198 | 248 | 275 | 329 | 367 | 417 | 465 | |

8

- *1 The applicable motor capacity indicated is the maximum capacity applicable for use of the Mitsubishi Electric standard 4-pole motor.
- *2 The rated output capacity is the value with respect to 440 V output voltage.
- *3 The percentage of the overload current rating is the ratio of the overload current to the inverter's rated output current. For repeated duty, allow time for the inverter and motor to return to or below the temperatures under 100% load.
- *4 The maximum output voltage does not exceed the power supply voltage. The maximum output voltage can be changed within the setting range.
 - However, the maximum point of the voltage waveform at the inverter output side is the power supply voltage multiplied by about $\sqrt{2}$.
- *5 The rated input current is the value at a rated output voltage. The input power impedances (including those of the input reactor and cables) affect the value.
- *6 The power supply capacity is the value at the rated output current. The input power impedances (including those of the input reactor and cables) affect the value.
- *7 FR-DU08: IP40 (except for the PU connector)
- *8 For the power voltage exceeding 480 V, set Pr.977 Input voltage mode selection. (For details, refer to page 205.)

8.2.1 Premium high-efficiency IPM motor [MM-EFS (1500 r/min specification)]

♦ Motor specifications

| Motor model | 200 V class MM-EFS[]1M(-S10) ^{*4} | 7 | 15 | 22 | 37 | 55 | 75 | 11K | 15K | 18K | 22K | 30K | 37K | 45K | 55K |
|------------------------|--|---|-----------------|-----------------|-----------------|-----------------|-----------------|----------------|----------------|------------------|----------------|----------------|----------------|----------------|----------------|
| | 400 V class MM-EFS[]1M4(-S10) ^{*4} | | | | | | | | ion | ioix | | | | | oon |
| Compatible | 200 V class FR-F820-[] | 00046 (0.75K) | 00077 (1.5K) | 00105 (2.2K) | 00167 (3.7K) | 00250 (5.5K) | 00340 (7.5K) | 00490 (11K) | 00630 (15K) | 00770 (18.5K) | 00930 (22K) | 01250 (30K) | 01540 (37K) | 01870 (45K) | 02330 (55K) |
| inverter ^{*3} | 400 V class FR-F840-[] | 00023 (0.75K) | | 00052 (2.2K) | 00083 (3.7K) | 00126 (5.5K) | 00170 (7.5K) | 00250 (11K) | 00310 (15K) | 00380 (18.5K) | 00470 (22K) | 00620 (30K) | 00770 (37K) | 00930 (45K) | 01160 (55K) |
| Continuous | Rated output power (kW) | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 |
| characteristics*1 | Rated torque (N·m) | 4.77 | 9.55 | 14 | 23.6 | 35 | 47.7 | 70 | 95.5 | 118 | 140 | 191 | 236 | 286 | 350 |
| Rated speed (r/m | iin) | 1500 | | | | | | | | | | | | | |
| Maximum speed | (r/min) | 2250 | 2250 | | | | | | | | | | | | |
| Number of poles | | 6 | 8 | | | | | | | | | | | | |
| Maximum torque | | 120% 60 s | | | | | | | | | | | | | |
| Frame number | | 80M | 90L | 100L | 112M | 132S | 132M | 160M | 160L | 180M | | 180L | 200L | | 225S |
| Inertia moment J | (×10 ⁻⁴ kg⋅m²) | 20 | 40 | 55 | 110 | 275 | 280 | 760 | 770 | 1700 | 1700 | 1900 | 3400 | 3850 | 6500 |
| Rated current (A) | 200 V class | 3 | 6.0 | 8.2 | 13.4 | 20 | 27 | 40 | 54 | 66 | 79 | 110 | 128 | 157 | 194 |
| Rated current (A) | 400 V class | 1.5 | 3.0 | 4.1 | 6.7 | 10 | 13.5 | 20 | 27 | 33 | 39.5 | 55 | 64 | 78.5 | 97 |
| Structure | | Totally-enclosed fan-cooled type with steel framed legs (protective structure IP44*2) | | | | | | | | | | | | | |
| Insulation class | | F | | | | | | | | | | | | | |
| Vibration rank | | V15 | | | | | | | | | | | | | |
| | Surrounding air temperature and humidity | -10°C to +40°C (non-freezing), 90% RH or less (non-condensing) | | | | | | | | | | | | | |
| Environment | Storage temperature and humidity | -20°C to +70°C (non-freezing), 90% RH or less (non-condensing) | | | | | | | | | | | | | |
| | Atmosphere | Indoors | (no dire | ct sun lig | ht) and | without co | orrosive | gas, flam | mable ga | as, oil mi | st, dust a | and dirt, | etc. | | |
| | Altitude | Maximu | m 1000 | m | | | | | | | | | | | |
| | Vibration | 4.9 m/s ² | 2 | | | | | | | | | | | | |
| Mass (kg) | | 11 | 15 | 22 | 31 | 50 | 53 | 95 | 100 | 135 | | 155 | 220 | 230 | 290 |

*1 The above characteristics apply when the rated AC voltage is input from the inverter (refer to page 638). The rated output power or speed is not guaranteed at low supply voltages.

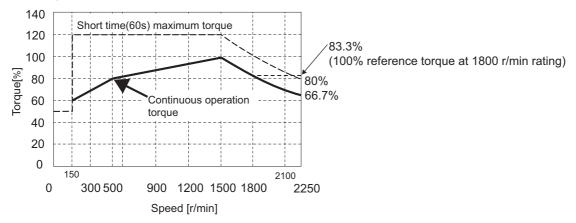
*2 This does not apply to the shaft through portion.

*3 For the LD rating.

*4 The belt drive models (MM-EFS[]1M-S10 and MM-EFS[]1M4-S10) are available for the capacity of 11 kW or higher.

◆ Motor torque characteristic

The torque characteristics of the premium high-efficiency IPM motor MM-EFS (1500 r/min) series driven by the inverter are shown in graph form as follows.



NOTE

- The motor can also be used for applications which require the rated speed of 1800 r/min.
- The torque characteristic is when the armature winding temperature is 20°C, and the input voltage to the inverter is 200 VAC or 400 VAC.
- Constant-speed operation cannot be performed for the speed of 150 r/min or less.
- The standard models (MM-EFS[]1M and MM-EFS[]1M4) of 11 kW capacity or higher are designed for a direct connection only.

8.2.2 Premium high-efficiency IPM motor [MM-EFS (3000 r/min specification)]

Motor specifications

| Motor model | 200 V class MM-EFS[]3 | 7 | 15 | 22 | 37 | 55 | 75 | 11K | 15K | | | |
|---|--|--|-----------------|-----------------|-----------------|-----------------|-----------------|----------------|----------------|--|--|--|
| | 400 V class MM-EFS[]34 | | | | | | | | | | | |
| Compatible | 200 V class FR-F820-[] | 00046 (0.75K) | 00077 (1.5K) | 00105 (2.2K) | 00167 (3.7K) | 00250 (5.5K) | 00340 (7.5K) | 00490 (11K) | 00630 (15K) | | | |
| inverter ^{*3} | 400 V class FR-F840-[] | 00023 (0.75K) | 00038 (1.5K) | 00052 (2.2K) | 00083 (3.7K) | 00126 (5.5K) | 00170 (7.5K) | 00250 (11K) | 00310 (15K) | | | |
| Continuous characteristics ^{*1} | Rated output power (kW) | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | | | |
| characteristics | Rated torque (N·m) | 2.39 | 4.77 | 7.0 | 11.8 | 17.5 | 23.9 | 35.0 | 47.7 | | | |
| Rated speed (r/m | nin) | 3000 | | | | | | | | | | |
| Maximum speed | (r/min) | 4000 | | | | | | | | | | |
| Number of poles | | 6 | | | | | | | | | | |
| Maximum torque | | 120% 60 s | | | | | | | | | | |
| Frame number | | 80M 90L 112M 132S 160M | | | | | | 160M | | | | |
| Inertia moment J | (×10 ⁻⁴ kg⋅m²) | 10.7 22.4 29.8 68.3 198 | | | | 534 | | | | | | |
| Rated current | 200 V class | 3.2 | 6.1 | 8.4 | 14.3 | 21.4 | 28.7 | 37.6 | 51.4 | | | |
| (A) | 400 V class | 1.6 | 3.1 | 4.2 | 7.2 | 10.7 | 14.4 | 18.8 | 25.7 | | | |
| Structure | | Totally-enclosed fan-cooled type with steel framed legs (protective structure IP44 ^{*2}) | | | | | | | | | | |
| Insulation class | | F | | | | | | | | | | |
| Vibration rank | | V15 | | | | | | | | | | |
| | Surrounding air temperature and humidity | -10°C to +40°C (non-freezing), 90% RH or less (non-condensing) | | | | | | | | | | |
| Environment | Storage temperature and humidity | -20°C to +7 | ′0°C (non-fre | ezing), 90% | RH or less (| non-condens | sing) | | | | | |
| | Atmosphere | Indoors (no | direct sun lig | ght) and with | out corrosive | e gas, flamm | able gas, oil | mist, dust a | nd dirt, etc. | | | |
| | Altitude | Maximum 1 | 000 m | | | | | | | | | |
| | Vibration | 4.9 m/s2 | | | | | | | | | | |
| Mass (kg) | Mass (kg) | | 12 | 14 | 25 | 41 | | 75 | | | | |

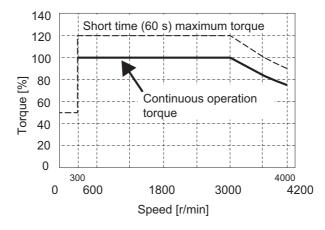
*1 The above characteristics apply when the rated AC voltage is input from the inverter (refer to page 638). The rated output power or speed is not guaranteed at low supply voltages.

*2 This does not apply to the shaft through portion.

*3 For the LD rating.

♦ Motor torque characteristic

The torque characteristics of the premium high-efficiency IPM motor MM-EFS (3000 r/min) series driven by the inverter are shown in graph form as follows.





- The torque characteristic is when the armature winding temperature is 20°C, and the input voltage to the inverter is 200 VAC or 400 VAC.
- Constant-speed operation cannot be performed for the speed of 300 r/min or less.
- The MM-EFS[]3 or MM-EFS[]34 motor with an 11 kW or higher capacity is designed for a direct connection only.

8.2.3 Premium high-efficiency IPM motor [MM-THE4]

Motor specifications

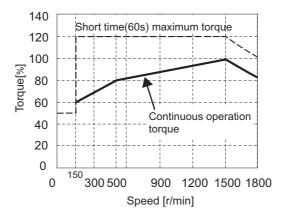
| I | Notor model | MM-THE4 | | | | | | | | | |
|-----------------------|--|---|------------|------------|-------------|-------------|-------------|--|--|--|--|
| ۱. ۱ | /oltage class | 200 V | | | 400 V | | | | | | |
| Com | patible Inverter ^{*2} | FR-F820-[] FR-F840-[] | | | | | | | | | |
| Com | | 03160(75K) | 01800(75K) | 02160(90K) | 02600(110K) | 03250(132K) | 03610(160K) | | | | |
| Continuous | Rated output power (kW) | 75 | 75 | 90 | 110 | 132 | 160 | | | | |
| characteristics *1 | Rated torque (N⋅m) | 477 | 477 | 573 | 700 | 840 | 1018 | | | | |
| Rated speed (r | /min) | 1500 | | | | | | | | | |
| Maximum spee | ed (r/min) | 1800 | | | | | | | | | |
| Number of pole | es | 6 | | | | | | | | | |
| Maximum torqu | le | 120% 60 s | | | | | | | | | |
| Frame number | | 250MA | 250MA | 250MD | 280MD | | | | | | |
| Inertia moment | t J (×10 ⁻⁴ kg·m²) | 6000 | 6000 | 10000 | 17500 | 20500 | 23250 | | | | |
| Rated current (| (A) | 270 | 135 | 170 | 195 | 230 | 280 | | | | |
| Structure | | Totally-enclosed fan-cooled type with casting framed legs (protective structure IP44) | | | | | | | | | |
| Insulation class | 6 | F | | | | | | | | | |
| Vibration rank | | V25 | | | | | | | | | |
| | Surrounding air temperature and humidity | -10°C to +40°C (non-freezing), 90% RH or less (non-condensing) | | | | | | | | | |
| | Storage temperature and humidity | -20°C to +70°C (non-freezing), 90% RH or less (non-condensing) | | | | | | | | | |
| Environment | Atmosphere | Indoors (no direct sun light) and free from corrosive gas, flammable gas, oil mist, dust and dirt, etc. | | | | | | | | | |
| | Altitude | Maximum 100 | 0 m | | | | | | | | |
| | Vibration | 4.9 m/s ² | | | | | | | | | |
| Mass (kg) | | 470 | 470 | 610 | 780 | 810 | 860 | | | | |

*1 The rated output power or speed is not guaranteed at low supply voltages.

*2 For the LD rating.

Motor torque characteristic

The torque characteristics of the premium high-efficiency IPM motor MM-THE4 driven by the inverter are shown in graph form as follows.





- The motor can also be used for applications which require the rated speed of 1800 r/min.
- The torque characteristic is when the armature winding temperature is 20°C, and the input voltage to the inverter is 200 VAC or 400 VAC.
- Constant-speed operation cannot be performed for the speed of 150 r/min or less.

8.3 Common specifications

| | Соі | ntrol metho | od or function | Soft-PWM control / high carrier frequency PWM control (selectable among V/F control (Optimum excitation control), Advanced magnetic flux vector control (Advanced optimum excitation control), and PM motor control) | | | | | |
|-----------|---|----------------------------|---|--|--|--|--|--|--|
| | Out | tout freque | ency range | 0.2 to 590 Hz (400 Hz or less under Advanced magnetic flux vector control and PM motor control.) | | | | | |
| | Fre set | quency ting olution | Analog input | 0.015 Hz/60 Hz at 0 to 10 V/12 bits (terminals 2 and 4) 0.03 Hz/60 Hz at 0 to 5 V/11 bits or 0 to 20 mA/approx. 11 bits (terminals 2 and 4), at 0 to \pm 10 V/12 bits (terminal 1) 0.06 Hz/60 Hz at 0 to \pm 5 V/11 bits (terminal 1) | | | | | |
| | | | Digital input | 0.01 Hz | | | | | |
| | Fre | quency | Analog input | Within ±0.2% of the maximum output frequency (25°C ± 10°C) | | | | | |
| _ | accuracy Digital input | | Digital input | 0.01% or less of the set output frequency | | | | | |
| Control | | tage/frequ tracteristic | | The base frequency can be set from 0 to 590 Hz. The constant-torque/variable-torque pattern or adjustable 5 points V/F can be selected. | | | | | |
| U | Sta tore | rting | Induction motor | 120% 0.5 Hz (Advanced magnetic flux vector control) | | | | | |
| | ton | que | IPM motor | 50% | | | | | |
| | Tor | que boost | | Manual torque boost | | | | | |
| | Acceleration/deceleration time setting | | | 0 to 3600 s (acceleration and deceleration can be set individually), linear or S-pattern acceleration/ deceleration mode, backlash countermeasures acceleration/deceleration can be selected. | | | | | |
| | DC injection brake (induction motor) | | orake (induction | Operation frequency (0 to 120 Hz), operation time (0 to 10 s), operation voltage (0% to 30%) vari | | | | | |
| | Stall prevention operation level | | | Activation range of stall prevention operation (SLD rating: 0% to 120%, LD rating: 0% to 150%). Whether to use the stall prevention or not can be selected (V/F control, Advanced magnetic flux vector control). | | | | | |
| | Frequency setting | | Analog input | Terminals 2 and 4: 0 to 10 V / 0 to 5 V / 4 to 20 mA (0 to 20 mA) Terminal 1: -10 to +10 V / -5 to +5 V | | | | | |
| | signal | Digital input | Input using the setting dial of the operation panel or parameter unit. Input of four-digit BCD (Binary-coded decimal) or 16-bit binary when the option FR-A8AX is installed. | | | | | | |
| | Start signal | | | Forward and reverse rotation or start signal automatic self-holding input (3-wire input) can be selected. | | | | | |
| | Input signal (12) | | | Low-speed operation command, Middle-speed operation command, High-speed operation command, Second function selection, Terminal 4 input selection, Jog operation selection, Output stop, Start self- holding selection, Forward rotation command, Reverse rotation command, Inverter reset | | | | | |
| | | | | The signal to be input can be changed using Pr.178 to Pr.189 (Input terminal function selection). | | | | | |
| | | Pulse trai | n input | 100k pulses/s | | | | | |
| Operation | Operational function | | | Maximum frequency, minimum frequency, multi-speed operation, acceleration/deceleration pattern, thermal protection, DC injection brake, starting frequency, JOG operation, output stop (MRS), stall prevention, regeneration avoidance, increased magnetic excitation deceleration, DC feeding ^{*1} , frequency jump, rotation display, automatic restart after instantaneous power failure, electronic bypass sequence, remote setting, retry function, carrier frequency selection, fast-response current limit, forward/reverse rotation prevention, operation mode selection, slip compensation, speed smoothing control, traverse, auto tuning, applied motor selection, stop selection (deceleration stop/ coasting), power failure time deceleration-to-stop function, PLC function, life diagnosis, maintenance timer, current average monitor, multiple rating, test run, 24 V power supply input for control circuit, safety stop function, self power management, BACnet communication, PID gain tuning, cleaning, load characteristics storage, emergency drive | | | | | |
| | Open collector output (5) Relay output (2) | | | Inverter running, Up to frequency, Instantaneous power failure/undervoltage ^{*1} , Overload warning, Output frequency detection, Fault The signal to be output can be changed using Pr.190 to Pr.196 (Output terminal function selection) . Fault codes (4 bits) of the inverter can be output from the open collector. | | | | | |
| | Ö Pulse train output (FM type inverter) | | | 50k pulses/s | | | | | |

| | | Pulse train | Max. 2.4 kHz via one terminal (for the indication of inverter output frequency). | | | | | | |
|-------------|-----------------------|------------------------------|--|--|--|--|--|--|--|
| | For | output (FM type inverter) | The item for monitoring can be changed using Pr.54 FM/CA terminal function selection . | | | | | | |
| | indication | Current output | Max. 20 mADC via one terminal (for the indication of inverter output frequency). | | | | | | |
| Indication | on external meters | (CA type inverter) | The item for monitoring can be changed using Pr.54 FM/CA terminal function selection . | | | | | | |
| cati | | Voltage output | Max. 10 VDC via one terminal (for the indication of inverter output frequency). | | | | | | |
| ndi | | Voltage output | The item for monitoring can be changed using Pr.158 AM terminal function selection. | | | | | | |
| - | | Status | Output frequency, output current, output voltage, and frequency setting value are monitored. | | | | | | |
| | Operation | monitoring | The item for monitoring can be changed using Pr.52 Operation panel main monitor selection . | | | | | | |
| | panel (FR- DU08) | Fault type | When a protective function is activated, a fault indication is displayed and the output voltage, output current, output frequency, cumulative energization time, date (year, month, day) and time at the occurrence of the fault are stored. Each fault is recorded and the last 8 records can be displayed. | | | | | | |
| | | | Overcurrent trip during acceleration, Overcurrent trip during constant speed, Overcurrent trip during deceleration or stop, Regenerative overvoltage trip during acceleration, Regenerative overvoltage trip during constant speed, Regenerative overvoltage trip during deceleration or stop, Inverter overload trip (electronic thermal relay function), Motor overload trip (electronic thermal relay function), Heat | | | | | | |
| | | | sink overheat, Instantaneous power failure ^{*1} , Undervoltage ^{*1} , Input phase loss ^{*1*2} , Stall prevention | | | | | | |
| | | Fault | stop, Loss of synchronism detection ^{*2} , Upper limit fault detection, Lower limit fault detection, Output side earth (ground) fault overcurrent, Output short circuit, Output phase loss, External thermal relay operation ^{*2} , PTC thermistor operation ^{*2} , Option fault, Communication option fault, Parameter storage | | | | | | |
| Prot | tective | | device fault (control circuit board), PU disconnection, Retry count excess ^{*2} , CPU fault, Operation panel power supply short circuit/RS-485 terminals power supply short circuit, 24 VDC power fault, | | | | | | |
| func | ction | | Abnormal output current detection ^{*2} , Inrush current limit circuit fault ^{*1} , Communication fault (inverter), | | | | | | |
| | | | Analog input fault, USB communication fault, Safety circuit fault, Overspeed occurrence*2, 4 mA | | | | | | |
| | | | fault, Pre-charge fault, PID signal fault ^{*2} , Internal circuit fault, User definition error by the PLC function, | | | | | | |
| | | | Abnormal internal temperature ^{*3} , Internal storage device fault | | | | | | |
| | | | Fan alarm, Stall prevention (overcurrent), Stall prevention (overvoltage), Electronic thermal relay | | | | | | |
| | | Alarm, | function pre-alarm, PU stop, Parameter copy, Safety stop, Maintenance signal output ^{*2} , USB host | | | | | | |
| | | Warning, Error | error, Operation panel lock ^{*2} , Password locked ^{*2} , Parameter write error, Copy operation error, 24 V | | | | | | |
| | | message | external power supply operation, Load fault warning, Emergency drive in operation ^{*1} , Continuous | | | | | | |
| | | | operation during communication fault ^{*2} , Internal fan alarm ^{*3} | | | | | | |
| | Surrounding | air temperature | -10°C to +50°C (non-freezing) (LD rating) -10°C to +40°C (non-freezing) (SLD rating, IP55 compatible models) | | | | | | |
| Environment | Surrounding | air humidity | 95% RH or less (non-condensing) (With circuit board coating (conforming to class 3C2/3S2 in IEC 60721-3-3:1994), IP55 compatible models). 90% RH or less (non-condensing) (Without circuit board coating). | | | | | | |
| vire | Storage temp | erature ^{*4} | -20°C to +65°C | | | | | | |
| Ш | Ambience | | Indoors (free from corrosive gas, flammable gas, oil mist, dust and dirt) | | | | | | |
| | Altitude/uibm | tion | 2500 m or less (For the installation at an altitude above 1000 m, consider a 3% reduction in the rated | | | | | | |
| | Altitude/vibra | luon | current per 500 m increase in altitude.) 5.9 m/s ² or less ^{*5} at 10 to 55 Hz (directions of X, Y, Z axes) | | | | | | |
| - | | | | | | | | | |

*1 The function is available for standard structure models and IP55 compatible models.

*2 Not activated in the inverter in the initial state.

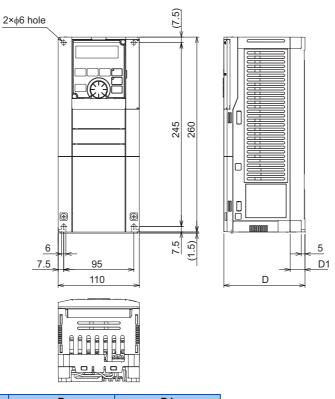
*3 Available only for the IP55 compatible model.

*4 Applicable to conditions for a short time, for example, in transit.

*5 2.9 m/s² or less for the FR-F840-04320(185K) or higher.

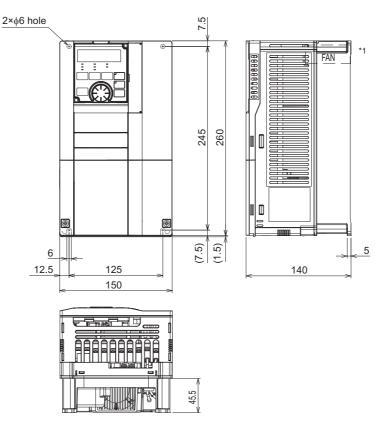
8.4.1 Inverter outline dimension drawings

FR-F820-00046(0.75K), FR-F820-00077(1.5K)



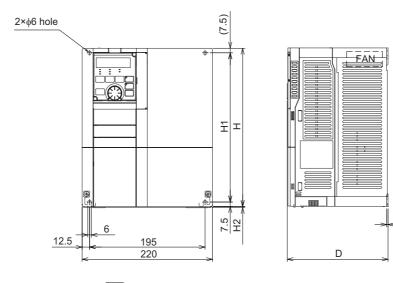
| Inverter model | D | D1 |
|----------------------|-----|----|
| FR-F820-00046(0.75K) | 110 | 20 |
| FR-F820-00077(1.5K) | 125 | 35 |

FR-F820-00105(2.2K), 00167(3.7K), 00250(5.5K) FR-F840-00023(0.75K), 00038(1.5K), 00052(2.2K), 00083(3.7K), 00126(5.5K)

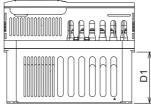


*1 FR-F840-00023(0.75K) to 00052(2.2K) are not provided with a cooling fan.

FR-F820-00340(7.5K), 00490(11K), 00630(15K) FR-F840-00170(7.5K), 00250(11K), 00310(15K), 00380(18.5K)

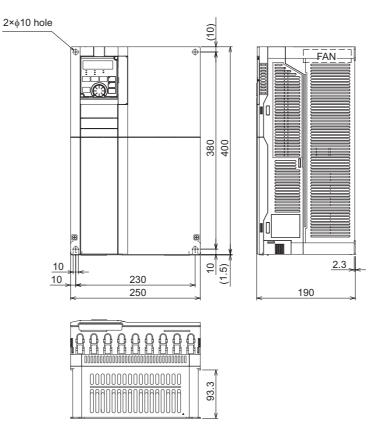


2.3

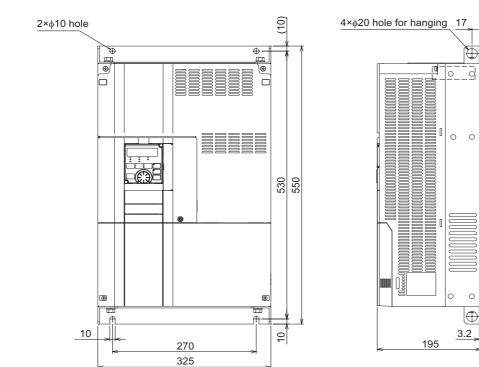


| Inverter model | Н | H1 | H2 | D | D1 |
|--|-----|-----|-----|-----|-------|
| FR-F820-00340(7.5K), 00490(11K) FR-F840-00170(7.5K), 00250(11K) | 260 | 245 | 1.5 | 170 | 84 |
| FR-F820-00630(15K) FR-F840-00310(15K), 00380(18.5K) | 300 | 285 | 3 | 190 | 101.5 |

FR-F820-00770(18.5K), 00930(22K), 01250(30K) FR-F840-00470(22K), 00620(30K)



FR-F820-01540(37K) FR-F840-00770(37K)

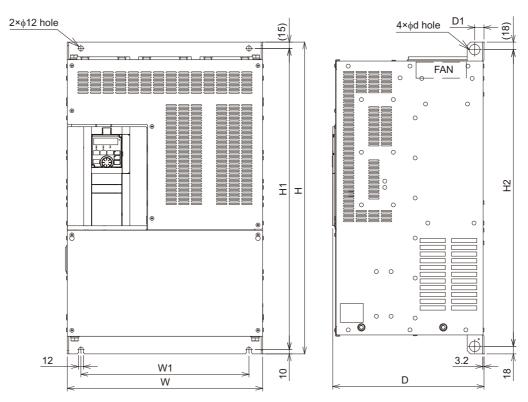


(15)

520

15

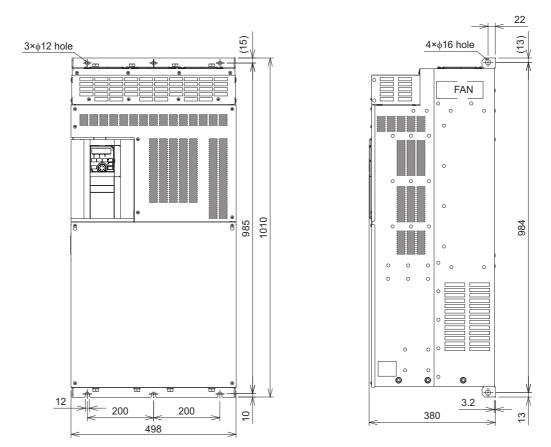
FR-F820-01870(45K), 02330(55K), 03160(75K), 03800(90K), 04750(110K) FR-F840-00930(45K), 01160(55K), 01800(75K), 02160(90K), 02600(110K), 03250(132K), 03610(160K)



| Inverter model | w | W1 | Н | H1 | H2 | d | D | D1 |
|---|-----|-----|-----|-----|-----|----|-----|----|
| FR-F820-01870(45K), 02330(55K) | 435 | 380 | 550 | 525 | 514 | 25 | 250 | 24 |
| FR-F840-00930(45K), 01160(55K), 01800(75K) ^{*1} | 433 | 300 | 550 | 525 | 514 | 23 | 230 | 24 |
| FR-F820-03160(75K) ^{*1} | 465 | 410 | 700 | 675 | 664 | 25 | 250 | 22 |
| FR-F820-03800(90K) ^{*1} , 04750(110K) ^{*1} | 465 | 400 | 740 | 715 | 704 | 24 | 360 | 22 |
| FR-F840-02160(90K) ^{*1} , 02600(110K) ^{*1} | 465 | 400 | 620 | 595 | 584 | 24 | 300 | 22 |
| FR-F840-03250(132K) ^{*1} , 03610(160K) ^{*1} | 465 | 400 | 740 | 715 | 704 | 25 | 360 | 22 |

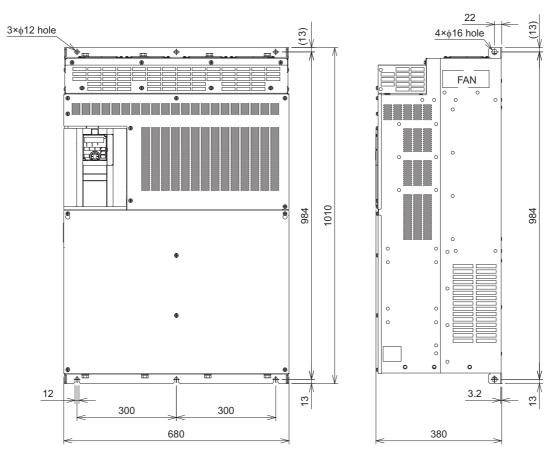
*1 Always connect a DC reactor (FR-HEL), which is available as an option.

FR-F840-04320(185K), 04810(220K)



Always connect a DC reactor (FR-HEL), which is available as an option. (Unit: mm)

FR-F840-05470(250K), 06100(280K), 06830(315K)

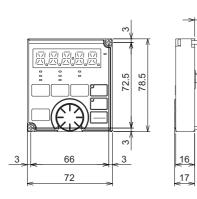


Always connect a DC reactor (FR-HEL), which is available as an option. (Unit: mm)

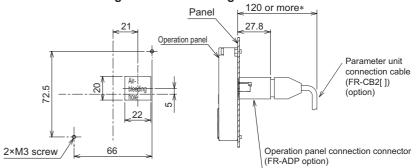
3.2max

Operation panel (FR-DU08, FR-LU08)

Outline drawing



Panel cutting dimension drawing

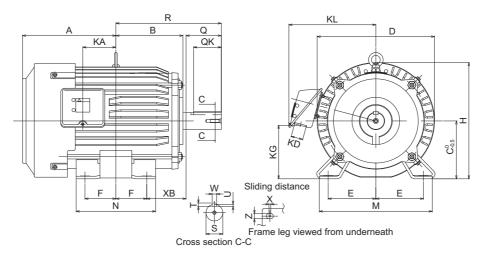


* Denotes the space required to connect an optional parameter unit connection cable (FR-CB2[]). When using another cable, leave the space required for the cable specification.

8.4.2 Dedicated motor outline dimension drawings

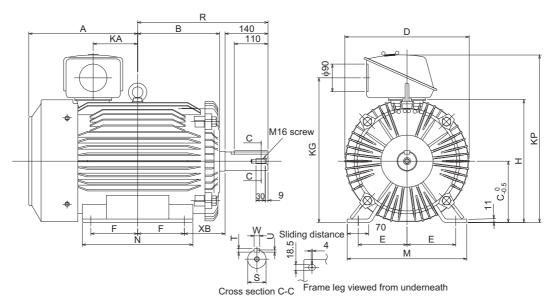
Premium high-efficiency IPM motor [MM-EFS (1500 r/min specification)]

• 30K or lower



| Model | | Output | Frame | | | | | | | | | Out | line | dime | nsioı | n (mn | n) | | | | | | | | | |
|---------------------------|-----|--------|--------|-------|-------|-----|-----|-------|-------|-------|------|-----|------|------|-------|-------|-----|-----|----|-------|-------|----|-----|----|----|------|
| Woder | | (kW) | number | Α | В | С | D | E | F | н | KA | KD | KG | KL | М | Ν | ХВ | Q | QK | R | S | Т | U | W | Х | Z |
| | 7 | 0.75 | 80M | 122 | 93 | 80 | 162 | 62.5 | 50 | 166 | 39.5 | 27 | 63 | 145 | 160 | 125 | 50 | 40 | 32 | 140 | φ19j6 | 6 | 3.5 | 6 | 15 | 9 |
| | 15 | 1.5 | 90L | 143 | 111.5 | 90 | 184 | 70 | 62.5 | 191 | 53 | 27 | 76 | 158 | 175 | 150 | 56 | 50 | 40 | 168.5 | φ24j6 | 7 | 4 | 8 | 15 | 9 |
| | 22 | 2.2 | 100L | 173 | 128 | 100 | 207 | 80 | 70 | 203.5 | 65 | 27 | 88 | 169 | 200 | 180 | 63 | 60 | 45 | 193 | φ28j6 | 7 | 4 | 8 | 4 | 12 |
| | 37 | 3.7 | 112M | 181 | 135 | 112 | 228 | 95 | 70 | 226 | 69 | 27 | 103 | 180 | 230 | 180 | 70 | 60 | 45 | 200 | φ28j6 | 7 | 4 | 8 | 4 | 12 |
| 200 V class | 55 | | 132S | 211.5 | 152 | 132 | 266 | 108 | 70 | 265 | 75 | 27 | 120 | 197 | 256 | 180 | 89 | 80 | 63 | 239 | φ38k6 | 8 | 5 | 10 | 4 | 12 |
| MM-EFS[]1M 400 V class | 75 | 7.5 | 132M | 230.5 | 171 | 132 | 266 | 108 | 89 | 265 | 94 | 27 | 120 | 197 | 256 | 218 | 89 | 80 | 63 | 258 | φ38k6 | 8 | 5 | 10 | 4 | 12 |
| MM-EFS[]1M4 | 11K | 11 | 160M | 252 | 198 | 160 | 318 | 127 | 105 | 316 | 105 | 56 | 142 | 266 | 310 | 254 | 108 | 110 | 90 | 323 | φ42k6 | 8 | 5 | 12 | 4 | 14.5 |
| _ | 15K | 15 | 160L | 274 | 220 | 160 | 318 | 127 | 127 | 316 | 127 | 56 | 142 | 266 | 310 | 298 | 108 | 110 | 90 | 345 | φ42k6 | 8 | 5 | 12 | 4 | 14.5 |
| | 18K | 18.5 | 180M | 292.5 | 225 5 | 180 | 363 | 139.5 | 120 5 | 350 | 127 | 56 | 168 | 280 | 335 | 285 | 101 | 110 | 00 | 351 5 | φ48k6 | o | 5.5 | 14 | ٨ | 14.5 |
| | 22K | 22 | 100101 | 292.5 | 225.5 | 100 | 303 | 159.5 | 120.5 | 559 | 121 | 50 | 100 | 209 | 333 | 205 | 121 | 110 | 90 | 551.5 | φ40κυ | 9 | 5.5 | 14 | 4 | 14.5 |
| | 30K | 30 | 180L | 311.5 | 242.5 | 180 | 363 | 139.5 | 139.5 | 359 | 146 | 56 | 168 | 289 | 335 | 323 | 121 | 110 | 90 | 370.5 | φ55m6 | 10 | 6 | 16 | 4 | 14.5 |

• 37K to 55K

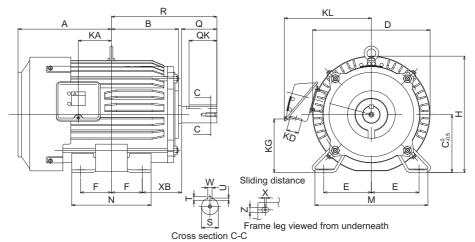


| Model | | Output | Frame | | | | | | | 0 | utline | dimen | sion | (mm) | | | | | | | |
|---------------------------|-----|--------|--------|-----|-------|-----|-----|-----|-------|-----|--------|-------|------|------|-----|-----|-------|-------|----|---|----|
| Woder | | (kW) | number | Α | В | С | D | E | F | н | KA | KG | KP | М | Ν | ХВ | R | S | Т | U | W |
| 200 V class | 37K | 37 | 200L | 355 | 267.5 | 200 | 406 | 159 | 152.5 | 401 | 145 | 472 | 548 | 390 | 361 | 133 | 425.5 | φ60m6 | 11 | 7 | 18 |
| MM-EFS[]1M 400 V class | 45K | 45 | 2002 | 555 | 207.5 | 200 | 400 | 155 | 152.5 | 401 | 140 | 472 | 540 | 550 | 501 | 100 | 420.0 | φυυπο | •• | ' | 10 |
| MM-EFS[]1M4 | 55K | 55 | 225S | 365 | 277 | 225 | 446 | 178 | 143 | 446 | 145 | 517 | 593 | 428 | 342 | 149 | 432 | φ65m6 | 11 | 7 | 18 |



• The drawings shown above are sample outline dimension drawings. The outer appearance may differ depending on the frame number.

Premium high-efficiency IPM motor [MM-EFS (3000 r/min specification)]

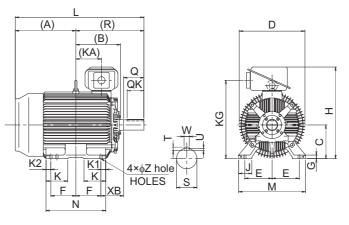


| Model | | Output | Frame | | | | | | | | | C | Dutlir | e din | nensi | ion (r | nm) | | | | | | | | | |
|-------------|-----|--------|--------|-------|-------|-----|-----|------|------|-----|------|----|--------|-------|-------|--------|-----|-----|----|-------|---------------------|---|-----|----|----|------|
| Woder | | (kW) | number | Α | В | С | D | Е | F | н | KA | KD | KG | KL | М | Ν | ХВ | Q | QK | R | S | Т | U | w | X | Z |
| | 7 | 0.75 | 80M | 122 | 93 | 80 | 162 | 62.5 | 50 | 166 | 39.5 | 27 | 63 | 145 | 160 | 125 | 50 | 40 | 32 | 140 | φ19j6 | 6 | 3.5 | 6 | 15 | 9 |
| 200 V class | 15 | 1.5 | 90L | 143 | 111.5 | an | 184 | 70 | 62.5 | 101 | 53 | 27 | 76 | 158 | 175 | 150 | 56 | 50 | 40 | 168 5 | φ24j6 | 7 | 4 | 8 | 15 | 9 |
| MM-EFS[]3 | 22 | 2.2 | 90L | 145 | 111.5 | 90 | 104 | 10 | 02.5 | 191 | 55 | 21 | 10 | 150 | 175 | 150 | 50 | 50 | 40 | 100.5 | φ24j0 | ŕ | 4 | 0 | 15 | 9 |
| | 37 | 3.7 | 112M | 181 | 135 | 112 | 228 | 95 | 70 | 226 | 69 | 27 | 103 | 180 | 230 | 180 | 70 | 60 | 45 | 200 | φ28j6 | 7 | 4 | 8 | 4 | 12 |
| 400 V class | 55 | 5.5 | 132S | 211.5 | 152 | 132 | 266 | 108 | 70 | 265 | 75 | 27 | 120 | 197 | 256 | 180 | 80 | 80 | 63 | 239 | φ38k6 | g | 5 | 10 | л | 12 |
| MM-EFS[]34 | 75 | 7.5 | 1020 | 211.5 | 152 | 152 | 200 | 100 | 10 | 200 | 15 | 21 | 120 | 137 | 200 | 100 | 03 | 00 | 00 | 203 | φυσκο | Ŭ | 9 | 10 | 7 | 12 |
| | 11K | 11 | 160M | 252 | 198 | 160 | 318 | 127 | 105 | 316 | 105 | 56 | 142 | 266 | 310 | 254 | 108 | 110 | 00 | 323 | φ42k6 | Q | 5 | 12 | 1 | 14.5 |
| | 15K | 15 | 100101 | 202 | 190 | 100 | 510 | 121 | 105 | 510 | 105 | 50 | 172 | 200 | 510 | 204 | 100 | 110 | 30 | 525 | ψ -1 2K0 | U | 9 | 12 | 7 | 14.5 |

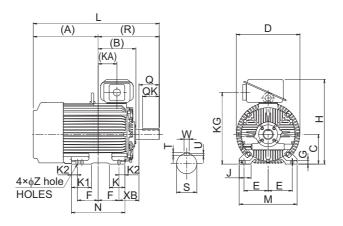
• The drawings shown above are sample outline dimension drawings. The outer appearance may differ depending on the frame number.

Premium high-efficiency IPM motor [MM-THE4]

• 75 kW

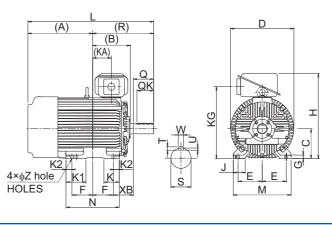


| Frame | | | | | | | | | | | Out | line d | imens | sion (| mm) | | | | | | | | | | | |
|--------|-------|-----|-----|-----|-----|-------|----|-----|-----|-------|-----|--------|-------|--------|-----|-----|-----|----|-----|-----|-----|-------|------|----|-----|----|
| number | Α | В | С | D | Е | F | G | н | J | KA | KG | ĸ | K1 | K2 | L | М | Ν | Z | ХВ | Q | QK | R | S | Т | U | W |
| 250MA | 449.5 | 317 | 250 | 490 | 203 | 174.5 | 30 | 692 | 100 | 157.5 | 583 | 168 | 50 | 50 | 932 | 486 | 449 | 24 | 168 | 140 | 110 | 482.5 | 75m6 | 12 | 7.5 | 20 |



| Frame | | | | | | | | | | | Out | line d | imen | sion | (mm) | | | | | | | | | | | |
|--------|-------|-----|-----|-----|-----|-------|----|-----|-----|-------|-----|--------|------|------|------|-----|-----|----|-----|-----|-----|-------|------|----|-----|----|
| number | A | В | С | D | E | F | G | н | J | KA | KG | κ | K1 | K2 | L | М | Ν | Z | ХВ | Q | QK | R | S | Т | U | W |
| 250MD | 545.5 | 317 | 250 | 535 | 203 | 174.5 | 30 | 712 | 100 | 157.5 | 603 | 130 | 168 | 50 | 1028 | 486 | 449 | 24 | 168 | 140 | 110 | 482.5 | 75m6 | 12 | 7.5 | 20 |

• 110 kW, 132 kW, 160 kW



| Frame | | | | | | | | | | | Out | line d | imens | sion (| (mm) | | | | | | | | | | | |
|--------|-------|-----|-----|-----|-------|-------|----|-----|-----|-------|-----|--------|-------|--------|------|-----|-----|----|-----|-----|-----|-------|------|----|---|----|
| number | Α | В | С | D | E | F | G | н | J | KA | KG | ĸ | K1 | K2 | L | М | Ν | Z | ΧВ | Q | QK | R | S | Т | U | W |
| 280MD | 596.5 | 374 | 280 | 587 | 228.5 | 209.5 | 30 | 782 | 110 | 210.5 | 673 | 130 | 181 | 40 | 1166 | 560 | 499 | 24 | 190 | 170 | 140 | 569.5 | 85m6 | 14 | 9 | 22 |

- NOTE

- The drawings shown above are sample outline dimension drawings. The outer appearance may differ depending on the frame number.
- For the 200 V class, models with capacities up to 75 kW are available.

CHAPTER 9 APPENDIX

| 9.1 | For customers replacing the conventional model with this inverter | 660 |
|-----|---|-----|
| 9.2 | International standards | 661 |
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| 9.7 | Ready bit status selection (Pr.349, N240) | |

APPENDIX provides the reference information for use of this product. Refer to APPENDIX as required.

9.1 For customers replacing the conventional model with this inverter

9.1.1 Replacement of the FR-F700(P) series

♦ Differences and compatibility with the FR-F700(P) series

| Item | FR-F700(P) | FR-F800 |
|---|---|--|
| Control method | V/F control Simple magnetic flux vector control IPM motor control | V/F control, Advanced magnetic flux vector control PM motor control (IPM motor / SPM motor) |
| Added functions | _ | USB host function Safety stop function etc. |
| Maximum output frequency V/F control | 400 Hz | 590 Hz |
| PID control | Turn the X14 signal ON to enable PID control. | When the X14 signal is not assigned, just set a value in Pr.128 to enable PID control. When the X14 signal is assigned, turn the X14 signal ON while Pr.128 \neq "0" to enable PID control. |
| Automatic restart after instantaneous power failure | Turn the CS signal ON to enable restart. Pr.186 CS terminal function selection initial value: "6" | The CS signal does not need to be assigned. (Restart is enabled with the Pr.57 setting only.) Pr.186 CS terminal function selection initial value: "9999" |
| PTC thermistor input | Input from the terminal AU (The function of terminal AU is switched by a switch.) | Input through terminal 2 (The function of terminal 2 is switched by the Pr.561 setting.) |
| USB connector | None | USB host: A connector USB device: mini B connector |
| Main circuit terminal screw size | Terminals R/L1, S/L2, T/L3, U, V, and W: Same for all Terminals P/+, N/-, and P1: Same except for the 400 V FRF840-01800(75K): M8) Screws for earthing (grounding): Same except for the 2 FR-F820-03160(75K): M8) | • |
| Control circuit terminal block | Removable terminal block (screw type) | Removable terminal block (spring clamp type) |
| Terminal response level | The FR-F800's I/O terminals have better response leve Inverter output terminal filter and Pr.699 Input term with that of FR-F700(P). Set to approximately 5 to 8 m | inal filter, the terminal response level can be compatible |
| PU | FR-DU07 (4-digit LED) FR-PU07 | FR-DU08 (5-digit LED) FR-LU08 (LCD) FR-PU07 (Some functions are unavailable.) The FR-DU07 is not supported. |
| Plug-in option | Dedicated plug-in options (not interchangeable) | |
| Plug-in option connector | One connector (FR-F700P, FR-F700-CHT) Two connectors (FR-F700-NA/EC) | Three connectors |
| Communication option | Connected to the connector 1. (FR-F700P, FR-F700- CHT) Connected to the connector 2. (FR-F700-NA/EC) | Connected to the connector 1 |
| Installation size | For standard models, installation size is compatible. (Re new mounting holes. However, for the 200 V class 031 F8AT) is required.) For separated converter types, installation size is not c | |

| Item | FR-F700(P) | FR-F800 |
|---------------------------------|---|---|
| Converter | Built-in for all capacities | An optional converter unit (FR-CC2) is required for separated converter types. |
| DC reactor | The 75K or higher comes with a DC reactor (FR-HEL). | For the FR-F820-03160(75K) or higher or FR-F840- 01800(75K) or higher, select a DC reactor suitable for the applicable motor capacity. (A DC reactor is not included.) Separated converter types (converter unit FR-CC2) and IP55 compatible models have a built-in DC reactor. |
| Brake unit (75 kW or higher) | FR-BU2, MT-BU5 | FR-BU2 |

Installation precautions

- Removal procedure of the front cover is different. (Refer to page 32.)
- · Plug-in options of the FR-A700 series are not compatible.
- Operation panel (FR-DU07) cannot be used.

Wiring instructions

• The spring clamp type terminal block has changed to the screw type. Use of blade terminals is recommended.

Instructions for continuous use of the PU07 (parameter unit) manufactured in September 2015 or earlier

- For the FR-F800 series, many functions (parameters) have been added. When setting these parameters, the parameter names and setting ranges are not displayed.
- Only the parameter with the numbers up to "999" can be read and set. The parameters with the numbers after "999" cannot be read or set.
- Many protective functions have been added for the FR-F800 series. These functions are available, but all faults are displayed as "Fault". When the fault history is checked, "ERR" appears. Added faults will not appear on the parameter unit. (However, MT1 to MT3 are displayed as MT.)
- · Parameter copy/verification function are not available.

Copying parameter settings

 The FR-F700(P) series' parameter setting can be easily copied to the FR-F800 series by using the setup software (FR Configurator2). (Not supported by the setup software FR-SW3-SETUP or older.)

9.1.2 Replacement of the FR-F500(L) series

Installation precautions

Installation size is compatible for replacing the FR-F520(L)-0.75K, 2.2K, 3.7K, 7.5K, 18.5K, 22K, 37K, 45K, 90K, or 110K, or FR-A540(L)-0.75K to 3.7K, 7.5K, 11K, 22K, 37K to 55K, or 132K to 280K. New mounting holes or the installation interchange attachment are required for replacing models with other capacities. (For the 55K or lower, the installation interchange attachment can be used.)

- NOTE

• For the installation size and the outline dimensions of the separated converter type, refer to the FR-F802 (Separated Converter Type) Instruction Manual (Hardware).

9.2 International standards

• For information on compliance with EU Directives or standards including UL or cUL standards, refer to both the Startup and Hardware versions of the Instruction Manual.

9.3 Acquisition of type certification for ship classification standards (400 V class)

9.3.1 Applicable models

| Structure/functionality | Applicable inverter |
|--------------------------|---|
| Standard model | FR-F840-00023(0.75K) to 06830(315K) |
| Separated converter type | FR-F842-07700(355K) to 12120(560K) FR-CC2-H355K to H630K |
| IP55 compatible model | FR-F846-00023(0.75K) to 03610(160K)-C2 |

*1 FR-F846-00023(0.75K) to 03610(160K)-C3 inverters are not applicable.

9.3.2 Details of type certification for standard model / Separated converter type

The inverters can be used in ships, except on the bridge and open deck areas.

Details of certification

| Certification body | Certificate number | Compatible from (Manufacture year and month) |
|-----------------------------------|---|---|
| NK (Nippon Kaiji Kyokai) | 14A020 | August 2019 |
| ABS (American Bureau of Shipping) | 19-YO1938937-PDA (Made in Japan) 19-YO1938937-PDA-DUP (Made in Japan) | December 2019 |
| DNV GL (DNV GL AS) | TAE00000H2 | January 2020 |

NOTE

The inverters approved for the ship classification standards are manufactured after the date shown in the table above. For the manufacture date of the inverter, check the SERIAL number indicated on the inverter rating plate.

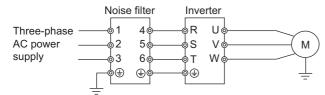
Precautions

The following are precautions for the system as a whole to be compliant with ship classification standards.

- To use the FR-F840-01160(55K) or lower, set AC voltage/frequency to three-phase 380 to 480 V, 50/60 Hz.
- The applicable inverters have been approved as products for use in enclosure. Install the inverters in enclosures.
- Use the inverters in an environment without corrosive gas or the like. (Inverters with circuit board coating are available for improved environmental resistance. Consult our sales office for more details.)
- For electromagnetic compatibility (EMC), install the recommended EMC filter shown in the following page (manufactured by Soshin Electric Co., Ltd.) or an equivalent at the input side of the inverter.
- Set the built-in EMC filter in the inverter to "enabled" (ON).
- Ensure that the finalized system which includes an inverter complies with the ship classification standards.

Noise filter wiring

Install a recommended noise filter (manufactured by Soshin Electric Co., Ltd.) at the input side of the inverter as shown in the following diagram.



♦ Recommended EMC filter (manufactured by Soshin Electric Co., Ltd.)

The following section shows the specifications of recommended EMC filters to be used in combination with inverters.

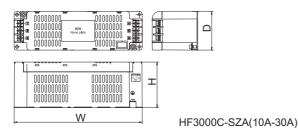
Standard model

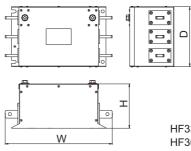
| Inverter model | Noise filt | ter model | | | | | | |
|----------------|--------------|-------------|--|--|--|--|--|--|
| FR-F840-[] | SLD | LD | | | | | | |
| 00023(0.75K) | | | | | | | | |
| 00038(1.5K) | HF3010C-SZA | | | | | | | |
| 00052(2.2K) | | | | | | | | |
| 00083(3.7K) | HF3020C-SZA | | | | | | | |
| 00126(5.5K) | HF3020C-32A | | | | | | | |
| 00170(7.5K) | HF3030C-SZA | | | | | | | |
| 00250(11K) | HF3030C-SZA | | | | | | | |
| 00310(15K) | HF3040C-SZA | | | | | | | |
| 00380(18.5K) | HF3050C-SZA | | | | | | | |
| 00470(22K) | HF3060C-SZA | | | | | | | |
| 00620(30K) | HF3080C-SZA | | | | | | | |
| 00770(37K) | HF3100C-SZA | | | | | | | |
| 00930(45K) | HF3150C-SZA | HF3100C-SZA | | | | | | |
| 01160(55K) | HF3150C-SZA | | | | | | | |
| 01800(75K) | HF3200C-SZA | | | | | | | |
| 02160(90K) | HF3250C-SZA | | | | | | | |
| 02600(110K) | HF32300-32A | | | | | | | |
| 03250(132K) | HF3600C-SJB | HF3300C-SJB | | | | | | |
| 03610(160K) | HF3600C-SJB | | | | | | | |
| 04320(185K) | | | | | | | | |
| 04810(220K) | | | | | | | | |
| 05470(250K) | HF3600C-SJB | | | | | | | |
| 06100(280K) | | | | | | | | |
| 06830(315K) | HF31000C-SJB | | | | | | | |

Separated converter type

| Inverter model | Noise filter model | | | | | |
|----------------|--------------------|----|--|--|--|--|
| FR-F842-[] | SLD | LD | | | | |
| 07700(355K) | | | | | | |
| 08660(400K) | HF31000C-SJB | | | | | |
| 09620(450K) | | | | | | |
| 10940(500K) | HF31200C-SJB | | | | | |
| 12120(560K) | HF31600C-SJB | | | | | |

■ Appearance examples and outline dimensions





HF3300C-SJB HF3600C-SJB

| Noise filter model | W | D | Н | | |
|--------------------|-------|-----|-----|--|--|
| HF3010C-SZA | | | | | |
| HF3020C-SZA | 220 | 66 | 78 | | |
| HF3030C-SZA | | | | | |
| HF3040C-SZA | | | | | |
| HF3050C-SZA | 270 | 80 | 84 | | |
| HF3060C-SZA | | | | | |
| HF3080C-SZA | - 310 | 100 | 210 | | |
| HF3100C-SZA | - 310 | 100 | 210 | | |
| HF3150C-SZA | 395 | 110 | 230 | | |
| HF3200C-SZA | 400 | 120 | 260 | | |
| HF3250C-SZA | 400 | 120 | 200 | | |
| HF3300C-SJB | - 340 | 190 | 140 | | |
| HF3600C-SJB | - 340 | 190 | 140 | | |
| HF31000C-SJB | 390 | 190 | 160 | | |
| HF31200C-SJB | 480 | 200 | 190 | | |
| HF31600C-SJB | 400 | 200 | 190 | | |

(Unit: mm)

For details on this filter, contact Soshin Electric Co., Ltd.

9.3.3 Details of type certification for IP55 compatible model

The inverters can be used in ships, except on the bridge and open deck areas.

Details of certification

| Certification body | Certificate number | Compatible from (Manufacture year and month) |
|-----------------------------------|--|--|
| NK (Nippon Kaiji Kyokai) | 14A020 | August 2019 |
| ABS (American Bureau of Shipping) | 19-YO1938937-PDA (Made in Japan) 19-YO1938937-PDA-DUP (Made in Japan) | December 2019 |
| DNV GL (DNV GL AS) | TAE00000H2 | January 2020 |

♦ Precautions

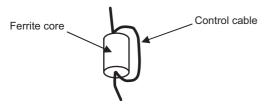
The following are precautions for the system as a whole to be compliant with ship classification standards.

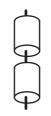
- To use the FR-F846-01160(55K)-C2 or lower, set AC voltage/frequency to three-phase 380 to 480 V, 50/60 Hz.
- Set the built-in EMC filter in the inverter to "enabled" (ON).
- Ensure that the finalized system which includes an inverter complies with the ship classification standards.
- For electromagnetic compatibility (EMC), install the recommended ferrite core (shown in the following page) or an equivalent by two turns (passing the cable twice through the core) for wiring of control circuit terminals.

• When the inverter is used in an environment with the surrounding air temperature exceeding 40°C, the rated output current must not exceed the value shown in the following table.

| Inverter model | Rated ou | tput current |
|----------------|--------------------------------------|--------------------------------------|
| FR-F846-[]-C2 | Surrounding air temperature: 45°C | Surrounding air temperature: 50°C |
| 00023(0.75K) | 2.0 A | 1.9 A |
| 00038(1.5K) | 3.3 A | 3.2 A |
| 00052(2.2K) | 4.6 A | 4.3 A |
| 00083(3.7K) | 7.2 A | 6.8 A |
| 00126(5.5K) | 10.9 A | 9.2 A |
| 00170(7.5K) | 13.6 A | 11.2 A |
| 00250(11K) | 22 A | 21 A |
| 00310(15K) | 28 A | 26 A |
| 00380(18.5K) | 33 A | 28 A |
| 00470(22K) | 37 A | 30.1 A |
| 00620(30K) | 54 A | 51 A |
| 00770(37K) | 67 A | 63 A |
| 00930(45K) | 81 A | 77 A |
| 01160(55K) | 101 A | 95 A |
| 01800(75K) | 137 A | 130 A |
| 02160(90K) | 171 A | 162 A |
| 02600(110K) | 205 A | 178 A |
| 03250(132K) | 247 A | 234 A |
| 03610(160K) | 284 A | 244 A |

Example of installing ferrite cores





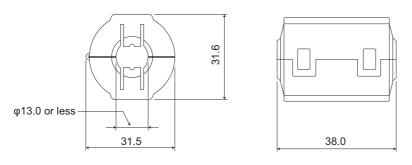
For using two ferrite cores

For using one ferrite core

- The wiring must be contained in the casing.
- When there is more than one bundle of control signal lines, install ferrite cores to each bundle.

Recommended ferrite core

Manufacturer: TOKIN Corporation Model: ESD-SR-250

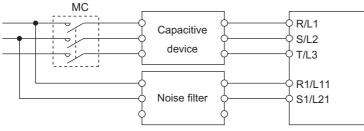


(Unit: mm)

For details on this ferrite core, contact TOKIN Corporation.

9.3.4 Wiring for compliance with EMC standards

• When a power supply is provided for the control circuit separately from the main circuit and a capacitive device (such as an EMC filter or a radio noise filter) is connected, connect a noise filter (example: RTMN5006 manufactured by TDK-Lambda Corporation) to the control circuit power supply.



Connect two of the three phases.

- Connect the inverter, noise filter, and motor to the enclosure earth (ground). (It is assumed that the enclosure earth (ground) is connected to the ship hull earth (ground).)
- When the wiring is different from the recommended one, the noise suppression effect may be insufficient (inadequate earthing (grounding)).

9.4 Specification comparison between PM motor control and induction motor control

| Item | PM motor control | Induction motor control | | |
|------------------------------|---|---|--|--|
| Applicable motor | Premium high-efficiency IPM motor MM-EFS or MM-THE4 series (the same capacity as the inverter capacity) | General-purpose motor SF-JR, SF-PR series, etc. ^{*1} | | |
| Number of connectable motors | 1: 1 | Several motors can be driven under V/F control. | | |
| Number of motor poles | MM-EFS (1500 r/min specification) 15 kW or lower: 6 poles MM-EFS (1500 r/min specification) 18.5 kW or higher: 8 poles MM-EFS (3000 r/min specification): 6 poles MM-THE4: 6 poles | Normally 2, 4, or 6 poles. | | |
| Rated motor frequency | MM-EFS (1500 r/min specification) 15 kW or lower: 75 Hz MM-EFS (1500 r/min specification) 18.5 kW or higher: 100 Hz MM-EFS (3000 r/min specification): 150 Hz MM-THE4: 75 Hz | Normally 50 Hz or 60 Hz | | |
| Maximum output frequency | MM-EFS (1500 r/min specification) 15 kW or lower: 112.5 Hz MM-EFS (1500 r/min specification) 18.5 kW or higher: 150 Hz MM-EFS (3000 r/min specification): 200 Hz MM-THE4: 90 Hz | 590 Hz (17700 r/min with 4P) (Set the upper limit frequency (Pr.1, Pr.18) according to the motor and machine specifications.) | | |
| Permissible load | 120% 60 s, 150% 3 s (inverse-time characteristics) (The % value is a ratio to the rated motor current.) | 120% 60 s, 150% 3 s (inverse-time characteristics) (The % value is a ratio to the inverter rated current.) | | |
| Maximum starting torque | 50% | 120% (Advanced magnetic flux vector control) | | |

| | Item | PM motor control | Induction motor control | | | |
|--|--|--|--|--|--|--|
| | Terminals 2 and 4 (0 to 10 V / 12 bits) | MM-EFS (1500 r/min specification) 15 kW or lower ^{*2} and MM-THE4: 0.018 Hz MM-EFS (1500 r/min specification) 18.5 kW or higher ^{*2} : 0.025 Hz MM-EFS (3000 r/min specification): 0.036 Hz | 0.015 Hz (60 Hz rating) | | | |
| Frequency setting and resolution (based on the motor rating) | Terminals 2 and 4 (0 to 5 V / 11 bits or 0 to 20 mA / 11 bits) Terminal 1 (0 to ±10 V / 12 bits) | MM-EFS (1500 r/min specification) 15 kW or lower ^{*2} and MM-THE4: 0.036 Hz MM-EFS (1500 r/min specification) 18.5 kW or higher ^{*2} : 0.050 Hz MM-EFS (3000 r/min specification): 0.072 Hz | 0.03 Hz (60 Hz rating) | | | |
| | Terminal 1 (0 to ±5 V / 11 bits) | MM-EFS (1500 r/min specification) 15 kW or lower ^{*2} and MM-THE4: 0.072 Hz MM-EFS (1500 r/min specification) 18.5 kW or higher ^{*2} : 0.100 Hz MM-EFS (3000 r/min specification): 0.144 Hz | 0.06 Hz (60 Hz rating) | | | |
| Output signal | Pulse output for meter | In the initial setting, 1 mA is output at the rated motor frequency from across terminals FM and SD. (SD is a common terminal.) The permissible frequency load current is 2 mA. Pulse specification: 1440 pulses/s at the rated motor frequency | | | | |
| Carrier | frequency | Four patterns of 2 kHz, 6 kHz, 10 kHz, and 14 kHz* ³ | Selectable between 0.75 kHz to 14.5 kHz ^{*3} | | | |
| | c restart after us power failure | Two patterns of 2 kHz and 6 kHz ^{*4} No startup delay time. Using the regeneration avoidance function together is recommended. | 0.75 kHz to 6 kHz ^{*4} Startup waiting time exists. | | | |
| Start | tup delay | Startup delay of about 0.1 s for initial tuning. | No startup delay. | | | |
| Driving by the commercial power supply | | Not available. Never connect an IPM motor to the commercial power supply. | Can be driven by the commercial power supply. | | | |
| Operation o | during coasting | While the motor is coasting, an electrical potential is generated across motor terminals. Before wiring, make sure that the motor is stopped. | While the motor is coasting, no potential is generated across motor terminals. | | | |
| Maximum mo | otor wiring length | 100 m or shorter | Overall length: 500 m or shorter | | | |

*1 Select a motor with the rated current equal to or less than the inverter rated current. (It must be 0.4 kW or higher.)

If a motor with substantially low rated current compared with the inverter rated current is used, speed and torque accuracies may deteriorate due to torque ripples, etc. Set the rated motor current to about 40% or higher of the inverter rated current.

*2 For the MM-EFS (1500 r/min specification), the number of motor poles differs between the 15 kW or lower motor (6 poles) and the 18.5 kW or higher motor (8 poles). For this reason, the frequency setting resolution also differs between them.

*3 For the FR-F820-02330(55K) or lower and FR-F840-01160(55K) or lower.

*4 For the FR-F820-03160(75K) or higher and FR-F840-01800(75K) or higher.

• NOTE

• Before wiring, make sure that the motor is stopped. Otherwise you may get an electric shock.

• Never connect an IPM motor to the commercial power supply.

• No slippage occurs with an IPM motor because of its characteristic. If an IPM motor, which took over an induction motor, is driven at the same speed as for the general-purpose motor, the running speed of the IPM motor becomes faster by the amount of the general-purpose motor's slippage. Adjust the speed command to run the IPM motor at the same speed as the induction motor, as required.

9.5 Parameters (functions) and instruction codes under different control methods

- *1 Instruction codes are used to read and write parameters in accordance with the Mitsubishi inverter protocol of RS-485 communication. (For RS-485 communication, refer to page 505.)
- *2 Function availability under each control method is shown as follows: o: Available
 - ×: Not available
- *3 For Parameter copy, Parameter clear, and All parameter clear, o indicates the function is available, and × indicates the function is not available.
- *4 Communication parameters that are not cleared by parameter clear or all clear (H5A5A or H55AA) via communication. (For RS-485 communication, refer to page 505.)
- *5 When a communication option is installed, parameter clear (lock release) during password lock (**Pr.297 Password lock/unlock** ≠ "9999") can be performed only from the communication option.
- *6 Reading and writing via the PU connector are available.

Symbols in the table indicate parameters that operate when the options are connected.

AR FR-A8AR, AX FR-A8AX, AY FR-A8AY, AVP FR-A8AVP, NC FR-A8NC, NC FR-A8NCE, NC FR-A8NCG, ND FR-A8ND, NP FR-A8NP, NF FR-A8NF, NF FR-A8NL

| | | | Instruction code ^{*1} | | | Control method ^{*2} | | | Parameter | | |
|-----|--|------|--------------------------------|----------|-----|------------------------------|----|--------------------|---------------------|----------------------------|--|
| Pr. | Name | Read | Write | Extended | V/F | Magnetic flux | PM | Copy ^{*3} | Clear ^{*3} | All clear ^{*3} | |
| 0 | Torque boost | 00 | 80 | 0 | 0 | × | × | 0 | 0 | 0 | |
| 1 | Maximum frequency | 01 | 81 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 2 | Minimum frequency | 02 | 82 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 3 | Base frequency | 03 | 83 | 0 | 0 | × | × | 0 | 0 | 0 | |
| 4 | Multi-speed setting (high speed) | 04 | 84 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 5 | Multi-speed setting (middle speed) | 05 | 85 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 6 | Multi-speed setting (low speed) | 06 | 86 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 7 | Acceleration time | 07 | 87 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 8 | Deceleration time | 08 | 88 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 9 | Electronic thermal O/L relay | 09 | 89 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 10 | DC injection brake operation frequency | 0A | 8A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 11 | DC injection brake operation time | 0B | 8B | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 12 | DC injection brake operation voltage | 0C | 8C | 0 | 0 | 0 | × | 0 | 0 | 0 | |
| 13 | Starting frequency | 0D | 8D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 14 | Load pattern selection | 0E | 8E | 0 | 0 | × | × | 0 | 0 | 0 | |
| 15 | Jog frequency | 0F | 8F | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 16 | Jog acceleration/deceleration time | 10 | 90 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 17 | MRS input selection | 11 | 91 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 18 | High speed maximum frequency | 12 | 92 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 19 | Base frequency voltage | 13 | 93 | 0 | 0 | × | × | 0 | 0 | 0 | |
| 20 | Acceleration/deceleration reference frequency | 14 | 94 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 21 | Acceleration/deceleration time increments | 15 | 95 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 22 | Stall prevention operation level | 16 | 96 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 23 | Stall prevention operation level compensation factor at double speed | 17 | 97 | 0 | 0 | 0 | × | 0 | 0 | 0 | |
| 24 | Multi-speed setting (speed 4) | 18 | 98 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 25 | Multi-speed setting (speed 5) | 19 | 99 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 26 | Multi-speed setting (speed 6) | 1A | 9A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 27 | Multi-speed setting (speed 7) | 1B | 9B | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 28 | Multi-speed input compensation selection | 1C | 9C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 29 | Acceleration/deceleration pattern selection | 1D | 9D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 30 | Regenerative function selection | 1E | 9E | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 31 | Frequency jump 1A | 1F | 9F | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |

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9.5 Parameters (functions) and instruction codes under different control methods

| | | Ins | tructio | n code ^{*1} | de ^{*1} Control method ^{*2} | | | | Parameter | | | |
|------------------|--|----------|---------|----------------------|---|---------------|----|--------------------|---------------------|----------------------------|--|--|
| Pr. | Name | Read | Write | Extended | | Magnetic flux | PM | Copy ^{*3} | Clear ^{*3} | All clear ^{*3} | | |
| 32 | Frequency jump 1B | 20 | A0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 33 | Frequency jump 2A | 21 | A1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 34 | Frequency jump 2B | 22 | A2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 35 | Frequency jump 3A | 23 | A3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 36 | Frequency jump 3B | 24 | A4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 37 | Speed display | 25 | A5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 41 | Up-to-frequency sensitivity | 29 | A9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 42 | Output frequency detection | 2A | AA | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 43 | Output frequency detection for reverse rotation | 2B | AB | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 44 | Second acceleration/deceleration time | 2C | AC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 45 | Second deceleration time | 2D | AD | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 46 | Second torque boost | 2E | AE | 0 | 0 | × | × | 0 | 0 | 0 | | |
| 47 | Second V/F (base frequency) | 2F | AF | 0 | 0 | × | × | 0 | 0 | 0 | | |
| 48 | Second stall prevention operation level | 30 | В0 | 0 | 0 | 0 | × | 0 | 0 | 0 | | |
| 49 | Second stall prevention operation frequency | 31 | B1 | 0 | 0 | 0 | × | 0 | 0 | 0 | | |
| 50 | Second output frequency detection | 32 | B2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 51 | Second electronic thermal O/L relay | 33 | B3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 52 | Operation panel main monitor selection | 34 | B4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 54 | FM/CA terminal function selection | 36 | B6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 55 | Frequency monitoring reference | 37 | B7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 56 | Current monitoring reference | 38 | B8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 57 | Restart coasting time | 39 | B9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 58 | Restart cushion time | 3A | BA | 0 | 0 | 0 | × | 0 | 0 | 0 | | |
| 59 | Remote function selection | 3B | BB | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 60 | Energy saving control selection | 3C | BC | 0 | 0 | 0 | × | 0 | 0 | 0 | | |
| 65 | Retry selection | 41 | C1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 66 | Stall prevention operation reduction starting frequency | 42 | C2 | 0 | 0 | 0 | × | 0 | 0 | 0 | | |
| 67 | Number of retries at fault occurrence | 43 | C3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 68 | Retry waiting time | 44 | C4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 69 | Retry count display erase | 45 | C5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 70 | Parameter for manufacturer setting. Do | not set. | | | | | | | | | | |
| 71 | Applied motor | 47 | C7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 72 | PWM frequency selection | 48 | C8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 73 | Analog input selection | 49 | C9 | 0 | 0 | 0 | 0 | 0 | × | 0 | | |
| 74 | Input filter time constant | 4A | CA | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 75 | Reset selection/disconnected PU detection/PU stop selection | 4B | СВ | 0 | 0 | 0 | 0 | 0 | × | × | | |
| 76 | Fault code output selection | 4C | СС | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 77 ^{*6} | Parameter write selection | 4D | CD | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 78 | Reverse rotation prevention selection | 4E | CE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 79 ^{*6} | Operation mode selection | 4F | CF | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 80 | Motor capacity | 50 | D0 | 0 | × | 0 | 0 | 0 | 0 | 0 | | |
| 81 | Number of motor poles | 51 | D1 | 0 | × | 0 | 0 | 0 | 0 | 0 | | |
| 82 | Motor excitation current | 52 | D2 | 0 | × | 0 | × | 0 | × | 0 | | |
| 83 | Rated motor voltage | 53 | D3 | 0 | × | 0 | 0 | 0 | 0 | 0 | | |
| 84 | Rated motor frequency | 54 | D4 | 0 | × | 0 | 0 | 0 | 0 | 0 | | |
| 85 | Excitation current break point | 55 | D5 | 0 | × | 0 | × | 0 | × | 0 | | |
| 86 | Excitation current low-speed scaling factor | 56 | D6 | 0 | × | 0 | × | 0 | × | 0 | | |
| 89 | Speed control gain (Advanced magnetic flux vector) | 59 | D9 | 0 | × | 0 | × | 0 | × | 0 | | |
| 90 | Motor constant (R1) | 5A | DA | 0 | × | 0 | 0 | 0 | × | 0 | | |



| | Instruction code ^{*1} Control method ^{*2} | | | | F | r | | | | |
|------------|---|----------|----------|----------|-----|---------------|----|--------------------|---------------------|----------------------------|
| Pr. | Name | Read | Write | Extended | V/F | Magnetic flux | PM | Copy ^{*3} | Clear ^{*3} | All clear ^{*3} |
| 91 | Motor constant (R2) | 5B | DB | 0 | × | 0 | × | 0 | × | 0 |
| 92 | Motor constant (L1)/d-axis inductance (Ld) | 5C | DC | 0 | × | 0 | 0 | 0 | × | 0 |
| 93 | Motor constant (L2)/q-axis inductance (Lq) | 5D | DD | 0 | × | 0 | 0 | 0 | × | 0 |
| 94 | Motor constant (X) | 5E | DE | 0 | × | 0 | × | 0 | × | 0 |
| 95 | Online auto tuning selection | 5F | DF | 0 | × | 0 | × | 0 | 0 | 0 |
| 96 | Auto tuning setting/status | 60 | E0 | 0 | × | 0 | 0 | 0 | × | 0 |
| 100 | V/F1 (first frequency) | 00 | 80 | 1 | 0 | × | × | 0 | 0 | 0 |
| 101 | V/F1 (first frequency voltage) | 01 | 81 | 1 | 0 | × | × | 0 | 0 | 0 |
| 102 103 | V/F2 (second frequency) V/F2 (second frequency voltage) | 02 03 | 82 83 | 1 | 0 | × | × | 0 | 0 0 | 0 |
| 103 | V/F3 (third frequency) | 03 | 03 84 | 1 | 0 | × | × | 0 0 | 0 | 0 |
| 104 | V/F3 (third frequency voltage) | 04 | 85 | 1 | 0 | × | × | 0 | 0 | 0 |
| 106 | V/F4 (fourth frequency) | 06 | 86 | 1 | 0 | × | × | 0 | 0 | 0 |
| 107 | V/F4 (fourth frequency voltage) | 07 | 87 | 1 | 0 | × | × | 0 | 0 | 0 |
| 108 | V/F5 (fifth frequency) | 08 | 88 | 1 | 0 | × | × | 0 | 0 | 0 |
| 109 | V/F5 (fifth frequency voltage) | 09 | 89 | 1 | 0 | × | × | 0 | 0 | 0 |
| 111 | Check valve deceleration time | 0B | 8B | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 117 | PU communication station number | 11 | 91 | 1 | 0 | 0 | 0 | 0 | ° ^{*4} | ° *4 |
| 118 | PU communication speed | 12 | 92 | 1 | 0 | 0 | 0 | 0 | ° ^{*4} | ° *4 |
| 119 | PU communication stop bit length / data length | 13 | 93 | 1 | 0 | 0 | 0 | 0 | o ^{*4} | °*4 |
| 120 | PU communication parity check | 14 | 94 | 1 | 0 | 0 | 0 | 0 | ° ^{*4} | ° ^{*4} |
| 121 | PU communication retry count | 15 | 95 | 1 | 0 | 0 | 0 | 0 | ° ^{*4} | °*4 |
| 122 | PU communication check time interval | 16 | 96 | 1 | 0 | 0 | 0 | 0 | o ^{*4} | ° *4 |
| 123 | PU communication waiting time setting | 17 | 97 | 1 | 0 | 0 | 0 | 0 | ° ^{*4} | ° ^{*4} |
| 124 | PU communication CR/LF selection | 18 | 98 | 1 | 0 | 0 | 0 | 0 | ° ^{*4} | ° ^{*4} |
| 125 | Terminal 2 frequency setting gain frequency | 19 | 99 | 1 | 0 | 0 | 0 | 0 | × | 0 |
| 126 | Terminal 4 frequency setting gain frequency | 1A | 9A | 1 | 0 | 0 | 0 | 0 | × | 0 |
| 127 | PID control automatic switchover frequency | 1B | 9B | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 128 | PID action selection | 1C | 9C | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 129 | PID proportional band | 1D | 9D | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 130 | PID integral time | 1E | 9E | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 131 | PID upper limit | 1F | 9F | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 132 133 | PID lower limit PID action set point | 20 21 | A0 A1 | 1 | 0 | 0 | 0 | 0 | 0 0 | 0 |
| 133 | PID differential time | 21 | A1 A2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 135 | Electronic bypass sequence selection | 23 | A3 | 1 | 0 | 0 | × | 0 | 0 | 0 |
| 136 | MC switchover interlock time | 24 | A4 | 1 | 0 | 0 | × | 0 | 0 | 0 |
| 137 | Start waiting time | 25 | A5 | 1 | 0 | 0 | × | 0 | 0 | 0 |
| 138 | Bypass selection at a fault | 26 | A6 | 1 | 0 | 0 | × | 0 | 0 | 0 |
| 139 | Automatic switchover frequency from inverter to bypass operation | 27 | A7 | 1 | 0 | 0 | × | 0 | 0 | 0 |
| 140 | Backlash acceleration stopping frequency | 28 | A8 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 141 | Backlash acceleration stopping time | 29 | A9 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 142 | Backlash deceleration stopping frequency | 2A | AA | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 143 | Backlash deceleration stopping time | 2B | AB | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 144 | Speed setting switchover | 2C | AC | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 145 | PU display language selection | 2D | AD | 1 | 0 | 0 | 0 | 0 | × | × |

| | | Ins | tructio | n code ^{*1} | Co | ontrol metho | d ^{*2} | I | Paramete | r |
|------------|---|----------|----------|----------------------|-----|---------------|-----------------|--------------------|----------|----------------------------|
| Pr. | Name | Read | Write | Extended | V/F | Magnetic flux | PM | Copy ^{*3} | Clear*3 | All clear ^{*3} |
| 147 | Acceleration/deceleration time switching frequency | 2F | AF | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 148 | Stall prevention level at 0 V input | 30 | B0 | 1 | 0 | 0 | × | 0 | 0 | 0 |
| 149 | Stall prevention level at 10 V input | 31 | B1 | 1 | 0 | 0 | × | 0 | 0 | 0 |
| 150 | Output current detection level | 32 | B2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 151 | Output current detection signal delay time | 33 | В3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 152 | Zero current detection level | 34 | B4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 153 | Zero current detection time | 35 | B5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 154 | Voltage reduction selection during stall prevention operation | 36 | B6 | 1 | 0 | 0 | × | 0 | 0 | 0 |
| 155 | RT signal function validity condition selection | 37 | B7 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 156 | Stall prevention operation selection | 38 | B8 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 157 | OL signal output timer | 39 | B9 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 158 | AM terminal function selection | 3A | BA | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Automatic switchover frequency | | | | | | | | | |
| 159 | range from bypass to inverter operation | 3B | BB | 1 | 0 | 0 | × | 0 | 0 | 0 |
| 160 | User group read selection | 00 | 80 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 161 | Frequency setting/key lock operation selection | 01 | 81 | 2 | 0 | 0 | 0 | 0 | × | 0 |
| 162 | Automatic restart after instantaneous power failure selection | 02 | 82 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 163 | First cushion time for restart | 03 | 83 | 2 | 0 | 0 | × | 0 | 0 | 0 |
| 164 | First cushion voltage for restart | 04 | 84 | 2 | 0 | 0 | × | 0 | 0 | 0 |
| 165 | Stall prevention operation level for restart | 05 | 85 | 2 | 0 | 0 | × | 0 | 0 | 0 |
| 166 | Output current detection signal retention time | 06 | 86 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 167 | Output current detection operation selection | 07 | 87 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 168 169 | Parameter for manufacturer setting. Do | not set. | | | | | | | | |
| 170 | Watt-hour meter clear | 0A | 8A | 2 | 0 | 0 | 0 | 0 | × | 0 |
| 171 | Operation hour meter clear | 0B | 8B | 2 | 0 | 0 | 0 | × | × | × |
| 172 | User group registered display/batch clear | 0C | 8C | 2 | 0 | 0 | 0 | × | × | × |
| 173 | User group registration | 0D | 8D | 2 | 0 | 0 | 0 | × | × | × |
| 174 | User group clear | 0E | 8E | 2 | 0 | 0 | 0 | × | × | × |
| 178 | STF terminal function selection | 12 | 92 | 2 | 0 | 0 | 0 | 0 | × | 0 |
| 179 | STR terminal function selection | 13 | 93 | 2 | 0 | 0 | 0 | 0 | × | 0 |
| 180 | RL terminal function selection | 14 | 94 | 2 | 0 | 0 | 0 | 0 | × | 0 |
| 181 | RM terminal function selection | 15 | 95 | 2 | 0 | 0 | 0 | 0 | × | 0 |
| 182 | RH terminal function selection | 16 | 96 | 2 | 0 | 0 | 0 | 0 | × | 0 |
| 183 | RT terminal function selection | 17 | 97 | 2 | 0 | 0 | 0 | 0 | × | 0 |
| 184 | AU terminal function selection | 18 | 98 | 2 | 0 | 0 | 0 | 0 | × | 0 |
| 185 | JOG terminal function selection | 19 | 99 | 2 | 0 | 0 | 0 | 0 | × | 0 |
| 186 | CS terminal function selection | 1A | 9A | 2 | 0 | 0 | 0 | 0 | × | 0 |
| 187 | MRS terminal function selection | 1B | 9B | 2 | 0 | 0 | 0 | 0 | × | 0 |
| 188 | STOP terminal function selection RES terminal function selection | 1C 1D | 9C 9D | 2 | 0 | 0 | 0 | 0 | × | 0 |
| 189 190 | RES terminal function selection RUN terminal function selection | 1D 1E | 9D 9E | 2 | 0 | 0 | 0 | 0 | × | 0 0 |
| 190 191 | SU terminal function selection | 1E 1F | 9E 9F | 2 | 0 | 0 | 0 | 0 | × | 0 |
| 191 | IPF terminal function selection | 20 | A0 | 2 | 0 | 0 | 0 | 0 | × | 0 |
| 192 | OL terminal function selection | 20 | AU A1 | 2 | 0 | 0 | 0 | 0 | × | 0 |
| 194 | FU terminal function selection | 22 | A2 | 2 | 0 | 0 | 0 | 0 | × | 0 |
| 195 | ABC1 terminal function selection | 23 | A3 | 2 | 0 | 0 | 0 | 0 | × | 0 |
| 196 | ABC2 terminal function selection | 24 | A4 | 2 | 0 | 0 | 0 | 0 | × | 0 |
| | | - ' | | - | Ť | - | Ť | Ŭ, | L | Ť |

9. APPENDIX 671 9.5 Parameters (functions) and instruction codes under different control methods

| | | Ins | tructio | n code ^{*1} | Co | ntrol metho | d ^{*2} | F | Paramete | r |
|------------|---|----------|----------|----------------------|----------|---------------|-----------------|--------------------|---------------------|----------------------------|
| Pr. | Name | Read | Write | Extended | V/F | Magnetic flux | PM | Copy ^{*3} | Clear ^{*3} | All clear ^{*3} |
| 232 | Multi-speed setting (speed 8) | 28 | A8 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 233 | Multi-speed setting (speed 9) | 29 | A9 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 234 | Multi-speed setting (speed 10) | 2A | AA | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 235 | Multi-speed setting (speed 11) | 2B | AB | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 236 | Multi-speed setting (speed 12) | 2C | AC | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 237 | Multi-speed setting (speed 13) | 2D | AD | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 238 | Multi-speed setting (speed 14) | 2E | AE | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 239 | Multi-speed setting (speed 15) | 2F | AF | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 240 | Soft-PWM operation selection | 30 | B0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 241 242 | Analog input display unit switchover Terminal 1 added compensation | 31 32 | B1 B2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 0 |
| | amount (terminal 2) Terminal 1 added compensation | - | | | | | | | | |
| 243 | amount (terminal 4) | 33 | B3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 244 | Cooling fan operation selection | 34 | B4 | 2 | 0 | 0 ¥ | 0 ¥ | 0 | 0 | 0 |
| 245 | Rated slip | 35 | B5 B6 | 2 | 0 | × | × | 0 | 0 | 0 |
| 246 | Slip compensation time constant | 36 | B6 | 2 | 0 | × | × | 0 | 0 | 0 |
| 247 | Constant output range slip compensation selection | 37 | B7 | 2 | 0 | × | × | 0 | 0 | 0 |
| 248 | Self power management selection | 38 | B8 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 249 | Earth (ground) fault detection at start | 39 | B9 | 2 | 0 | 0 | × | 0 | 0 | 0 |
| 250 | Stop selection | 3A | BA | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 251 | Output phase loss protection selection | 3B | BB | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 252 | Override bias | 3C | BC | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 253 | Override gain | 3D | BD | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 254 | Main circuit power OFF waiting time | 3E | BE | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 255 | Life alarm status display | 3F | BF | 2 | 0 | 0 | 0 | × | × | × |
| 256 | Inrush current limit circuit life display | 40 | C0 | 2 | 0 | 0 | 0 | × | × | × |
| 257 | Control circuit capacitor life display | 41 | C1 | 2 | 0 | 0 | 0 | × | × | × |
| 258 | Main circuit capacitor life display | 42 | C2 | 2 | 0 | 0 | 0 | × | × | × |
| 259 | Main circuit capacitor life measuring | 43 | C3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 260 | PWM frequency automatic switchover | 44 | C4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 261 | Power failure stop selection | 45 | C5 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 262 | Subtracted frequency at deceleration start | 46 | C6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 263 | Subtraction starting frequency | 47 | C7 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 264 | Power-failure deceleration time 1 | 48 | C8 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 265 | Power-failure deceleration time 2 | 49 | C9 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 266 | Power failure deceleration time switchover frequency | 4A | СА | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 267 | Terminal 4 input selection | 4B | СВ | 2 | 0 | 0 | 0 | 0 | × | 0 |
| 268 | Monitor decimal digits selection | 4C | CC | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 269 | Parameter for manufacturer setting. Do | | | - | | | | | | |
| 289 | Inverter output terminal filter | 61 | E1 | 2 | 0 | 0 | 0 | 0 | × | 0 |
| 290 | Monitor negative output selection | 62 | E2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 291 | Pulse train I/O selection | 63 | E3 | 2 | 0 | 0 | 0 | 0 | × | 0 |
| 294 | UV avoidance voltage gain | 66 | E6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 295 | Frequency change increment amount setting | 67 | E7 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 296 | Password lock level | 68 | E8 | 2 | 0 | 0 | 0 | 0 | × | 0 |
| 297 | Password lock/unlock | 69 | E9 | 2 | 0 | 0 | 0 | 0 | °*5 | 0 |
| 298 | Frequency search gain | 6A | EA | 2 | 0 | 0 | × | 0 | × | 0 |
| 299 | Rotation direction detection selection at restarting | 6B | EB | 2 | 0 | 0 | × | 0 | 0 | 0 |
| 300 | BCD input bias AX | 00 | 80 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 301 | BCD input gain AX | 01 | 81 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| L | | | 1 | 1 | <u> </u> | 1 | | I | I | |

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| | | Ins | tructio | n code ^{*1} | Co | ntrol metho | d ^{*2} | F | Paramete | r |
|------------|--|----------|----------|----------------------|-----|---------------|-----------------|--------------------|---------------------|----------------------------|
| Pr. | Name | Read | Write | Extended | V/F | Magnetic flux | PM | Copy ^{*3} | Clear ^{*3} | All clear ^{*3} |
| 302 | BIN input bias AX | 02 | 82 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 303 | BIN input gain AX | 03 | 83 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 304 | Digital input and analog input compensation enable/disable selection | 04 | 84 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 305 | Read timing operation selection AX | 05 | 85 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 306 | Analog output signal selection AY | 06 | 86 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 307 | Setting for zero analog output AY | 07 | 87 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 308 | Setting for maximum analog output | 08 | 88 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 309 | Analog output signal voltage/current switchover AY | 09 | 89 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 310 | Analog meter voltage output selection AY | 0A | 8A | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 311 | Setting for zero analog meter voltage output AY | 0B | 8B | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 312 | Setting for maximum analog meter voltage output | 0C | 8C | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 313 | DO0 output selection AY NC NCE NCG | 0D | 8D | 3 | 0 | 0 | 0 | 0 | × | 0 |
| 314 | DO1 output selection AY NC NCE NCG | 0E | 8E | 3 | 0 | 0 | 0 | 0 | × | 0 |
| 315 | DO2 output selection AY NC NCE NCG | 0F | 8F | 3 | 0 | 0 | 0 | 0 | × | 0 |
| 316 | DO3 output selection AY | 10 | 90 | 3 | 0 | 0 | 0 | 0 | × | 0 |
| 317 | DO4 output selection AY | 11 | 91 | 3 | 0 | 0 | 0 | 0 | × | 0 |
| 318 | DO5 output selection AY | 12 | 92 | 3 | 0 | 0 | 0 | 0 | × | 0 |
| 319 | DO6 output selection AY | 13 | 93 | 3 | 0 | 0 | 0 | 0 | × | 0 |
| 320 | RA1 output selection AR | 14 | 94 | 3 | 0 | 0 | 0 | 0 | × | 0 |
| 321 | RA2 output selection AR | 15 | 95 | 3 | 0 | 0 | 0 | 0 | × | 0 |
| 322 | RA3 output selection AR | 16 | 96 | 3 | 0 | 0 | 0 | 0 | × | 0 |
| 323 | AM0 0V adjustment AY | 17 | 97 | 3 | 0 | 0 | 0 | 0 | × | 0 |
| 324 | AM1 0mA adjustment AY | 18 | 98 | 3 | 0 | 0 | 0 | 0 | × | 0 |
| 329 | Digital input unit selection AX | 1D | 9D | 3 | 0 | 0 | 0 | 0 | × | 0 |
| 331 | RS-485 communication station number | 1F | 9F | 3 | 0 | 0 | 0 | 0 | o ^{*4} | °*4 |
| 332 | RS-485 communication speed | 20 | A0 | 3 | 0 | 0 | 0 | 0 | ° ^{*4} | ° ^{*4} |
| 333 | RS-485 communication stop bit length / data length | 21 | A1 | 3 | 0 | 0 | 0 | 0 | ° *4 | °*4 |
| 334 | RS-485 communication parity check selection | 22 | A2 | 3 | 0 | 0 | 0 | 0 | °*4 | °*4 |
| 335 | RS-485 communication retry count | 23 | A3 | 3 | 0 | 0 | 0 | 0 | ° ^{*4} | ° *4 |
| 336 | RS-485 communication check time interval | 24 | A4 | 3 | 0 | 0 | 0 | 0 | ° ^{*4} | ° ^{*4} |
| 337 | RS-485 communication waiting time setting | 25 | A5 | 3 | 0 | 0 | 0 | 0 | ° ^{*4} | o ^{*4} |
| 338 | Communication operation command source Communication speed command | 26 | A6 | 3 | 0 | 0 | 0 | 0 | ° ^{*4} | °*4 |
| 339 | Source Communication startup mode | 27 | A7 | 3 | 0 | 0 | 0 | 0 | °*4 | ° ^{*4} |
| 340 | selection RS-485 communication CR/LF | 28 | A8 | 3 | 0 | 0 | 0 | 0 | ° ^{*4} | o ^{*4} |
| 341 | selection Communication EEPROM write | 29 | A9 | 3 | 0 | 0 | 0 | 0 | o ^{*4} | o ^{*4} |
| 342 343 | selection Communication error count | 2A 2B | AA AB | 3 | 0 | 0 | 0 | 0 × | 0 × | 0 × |
| 345 | | 2D | AD | 3 | 0 | 0 | 0 | ^ | ^ _^*4 | ^ _*4 |
| | DeviceNet address | | | | | | | | | |
| 346 | DeviceNet baud rate ND | 2E | AE | 3 | 0 | 0 | 0 | 0 | ° ^{*4} | ° *4 |

| | | Inst | tructio | n code ^{*1} | Co | ntrol metho | d ^{*2} | F | Paramete | r |
|------------|---|----------|----------|----------------------|--------|---------------|-----------------|--------------------|---------------------|----------------------------|
| Pr. | Name | Read | Write | Extended | V/F | Magnetic flux | PM | Copy ^{*3} | Clear ^{*3} | All clear ^{*3} |
| | Communication reset selection/ | | | | | | | | | |
| | Ready bit status selection/Reset selection after inverter faults are | | | | | | | | | |
| 349 | cleared/DriveControl writing | 31 | B1 | 3 | 0 | 0 | 0 | 0 | ° ^{*4} | ° ^{*4} |
| | restriction | | | | | | | | | |
| 074 | selection NC NCE NCG ND NP NF NL | 4.0 | <u> </u> | 2 | | | | | | |
| 374 384 | Overspeed detection level Input pulse division scaling factor | 4A 54 | CA D4 | 3 | × 0 | × | 0 | 0 0 | 0 0 | 0 |
| 385 | Frequency for zero input pulse | 55 | D4 D5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 386 | Frequency for maximum input pulse | 56 | D6 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 387 | Initial communication delay time NL | 57 | D7 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 388 | Send time interval at heart beat NL | 58 | D8 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 389 | Minimum sending time at heart beat | 59 | D9 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 390 | % setting reference frequency | 5A | DA | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Receive time interval at heart | | | | | | | | | |
| 391 | beat | 5B | DB | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 392 | Event driven detection width NL | 5C | DC | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 414 | PLC function operation selection | 0E | 8E | 4 | 0 | 0 | 0 | 0 | × | × |
| 415 | Inverter operation lock mode setting | 0F | 8F | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 416 417 | Pre-scale function selection Pre-scale setting value | 10 11 | 90 91 | 4 | 0 | 0 | 0 | 0 0 | 0 0 | 0 |
| 417 | Extension output terminal | 12 | 92 | 4 | 0 | 0 | 0 | 0 | × | 0 |
| | filter AY AR | | | | | | | | | |
| 434 | Network number (CC-Link IE) NCE | 22 | A2 | 4 | 0 | 0 | 0 | 0 | ° ^{*4} | ° *4 |
| | Station number (CC-Link IE) | | | | | | | | | |
| 435 | | 23 | A3 | 4 | 0 | 0 | 0 | 0 | ° *4 | ° ^{*4} |
| 436 | IP address 3 NCG | 24 | A4 | 4 | 0 | 0 | 0 | 0 | °*4 | °*4 |
| 437 | IP address 4 _{NCG} | 25 | A5 | 4 | 0 | 0 | 0 | 0 | ° ^{*4} | ° ^{*4} |
| 438 | Subnet mask 1 _{NCG} | 26 | A6 | 4 | 0 | 0 | 0 | 0 | ° ^{*4} | ° ^{*4} |
| 439 | Subnet mask 2NCG | 27 | A7 | 4 | 0 | 0 | 0 | 0 | ° ^{*4} | ° ^{*4} |
| 440 | | 28 | A8 | 4 | 0 | 0 | 0 | 0 | ° ^{*4} | ° ^{*4} |
| | Subnet mask 3NCG | 29 | A9 | 4 | 0 | 0 | 0 | 0 | | |
| 441 450 | Subnet mask 4 _{NCG} Second applied motor | 32 | B2 | 4 | 0 | 0 | 0 | 0 | °*4 | °*4 |
| 450 | Second motor capacity | 35 | B2 B5 | 4 | × | 0 | 0 | 0 | 0 | 0 |
| 454 | Number of second motor poles | 36 | B6 | 4 | × | 0 | 0 | 0 | 0 | 0 |
| 455 | Second motor excitation current | 37 | B7 | 4 | × | 0 | × | 0 | × | 0 |
| 456 | Rated second motor voltage | 38 | B8 | 4 | × | 0 | 0 | 0 | 0 | 0 |
| 457 | Rated second motor frequency | 39 | B9 | 4 | × | 0 | 0 | 0 | 0 | 0 |
| 458 | Second motor constant (R1) | 3A | BA | 4 | × | 0 | 0 | 0 | × | 0 |
| 459 | Second motor constant (R2) | 3B | BB | 4 | × | 0 | × | 0 | × | 0 |
| 460 | Second motor constant (L1) / d-axis inductance (Ld) | 3C | BC | 4 | × | 0 | 0 | 0 | × | 0 |
| 461 | Second motor constant (L2) / q-axis inductance (Lq) | 3D | BD | 4 | × | 0 | 0 | 0 | × | 0 |
| 462 | Second motor constant (X) | 3E | BE | 4 | × | 0 | × | 0 | × | 0 |
| 463 | Second motor auto tuning setting/ status | 3F | BF | 4 | × | 0 | 0 | 0 | × | 0 |
| 495 | Remote output selection | 5F | DF | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 496 | Remote output data 1 | 60 | E0 | 4 | 0 | 0 | 0 | × | × | × |
| 497 498 | Remote output data 2 PLC function flash memory clear | 61 62 | E1 E2 | 4 | 0 | 0 | 0 | × | × | × |
| +30 | Communication error execution | 02 | E2 | | 0 | U | 0 | ^ | ^ | ^ |
| 500 | waiting time NC NCE NCG ND NP NF NL | 00 | 80 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |

| | | Ins | tructior | n code ^{*1} | Co | ntrol metho | d ^{*2} | F | Paramete | r |
|------------|---|----------|----------|----------------------|--------|---------------|-----------------|--------------------|---------------------|----------------------------|
| Pr. | Name | Read | Write | Extended | | Magnetic flux | PM | Copy ^{*3} | Clear ^{*3} | All clear ^{*3} |
| | Communication error occurrence | | | | | | | | | |
| 501 | count display_NC_NCE_NCG_ND_NP_NF_NL_ | 01 | 81 | 5 | 0 | 0 | 0 | × | 0 | 0 |
| | Stop mode selection at | | | | | | | | | |
| 502 | communication error | 02 | 82 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 503 | Maintenance timer 1 | 03 | 83 | 5 | 0 | 0 | 0 | × | × | × |
| 504 | Maintenance timer 1 warning output set time | 04 | 84 | 5 | 0 | 0 | 0 | 0 | × | 0 |
| 505 | Speed setting reference | 05 | 85 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 506 | Display estimated main circuit capacitor residual life | 06 | 86 | 5 | 0 | 0 | 0 | × | × | × |
| 507 | Display/reset ABC1 relay contact life | 07 | 87 | 5 | 0 | 0 | 0 | × | × | × |
| 508 | Display/reset ABC2 relay contact life | 08 | 88 | 5 | 0 | 0 | 0 | × | × | × |
| 514 | Emergency drive dedicated retry waiting time | 0E | 8E | 5 | 0 | 0 | 0 | 0 | × | 0 |
| 515 | Emergency drive dedicated retry count | 0F | 8F | 5 | 0 | 0 | 0 | 0 | × | 0 |
| 522 | Output stop frequency | 16 | 96 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 523 | Emergency drive mode selection | 17 | 97 | 5 | 0 | 0 | 0 | 0 | × | 0 |
| 524 | Emergency drive running speed | 18 | 98 | 5 | 0 | 0 | 0 | 0 | × | 0 |
| 539 | MODBUS RTU communication check time interval | 27 | A7 | 5 | 0 | 0 | 0 | 0 | ° ^{*4} | ° *4 |
| 541 | Frequency command sign selection NC INCEINCG NP | 29 | A9 | 5 | 0 | 0 | 0 | 0 | °*4 | ° *4 |
| 542 | Communication station number (CC-Link) NC | 2A | AA | 5 | 0 | 0 | 0 | 0 | ° *4 | ° *4 |
| 543 | Baud rate selection (CC-Link) NC | 2B | AB | 5 | 0 | 0 | 0 | 0 | ° ^{*4} | ° ^{*4} |
| 544 | CC-Link extended setting NC | 2C | AC | 5 | 0 | 0 | 0 | 0 | ° ^{*4} | °*4 |
| 547 | USB communication station number | 2F | AF | 5 | 0 | 0 | 0 | 0 | ° ^{*4} | ° ^{*4} |
| 548 | USB communication check time interval | 30 | В0 | 5 | 0 | 0 | 0 | 0 | °*4 | ° ^{*4} |
| 549 | Protocol selection | 31 | B1 | 5 | 0 | 0 | 0 | 0 | ° ^{*4} | ° ^{*4} |
| 550 | NET mode operation command source selection | 32 | B2 | 5 | 0 | 0 | 0 | 0 | ° *4 | °*4 |
| 551 | PU mode operation command source selection | 33 | В3 | 5 | 0 | 0 | 0 | 0 | °*4 | ° ^{*4} |
| 552 | Frequency jump range | 34 | B4 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 553 | PID deviation limit | 35 | B5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 554 | PID signal operation selection | 36 | B6 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 555 | Current average time | 37 | B7 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 556 | Data output mask time | 38 | B8 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 557 | Current average value monitor signal output reference current | 39 | В9 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 560 | Second frequency search gain | 3C | BC | 5 | 0 | 0 | × | 0 | × | 0 |
| 561 563 | PTC thermistor protection level Energization time carrying-over | 3D 3F | BD BF | 5 5 | 0 | 0 | 0 | ہ × | × | 0 × |
| | times | - | | | | | | | | |
| 564 | Operating time carrying-over times Second motor excitation current | 40 | C0 | 5 | 0 | 0 | 0 | × | × | × |
| 565 | break point Second motor excitation current | 41 | C1 | 5 | × | 0 | × | 0 | × | 0 |
| 566 | low-speed scaling factor | 42 | C2 | 5 | × | 0 | × | 0 | × | 0 |
| 569 | Second motor speed control gain | 45 | C5 | 5 | × | 0 | × | 0 | × | 0 |
| 570 | Multiple rating setting | 46 | C6 | 5 | 0 | 0 | 0 | 0 | × | × |
| 571 | Holding time at a start | 47 | C7 | 5 | 0 | 0 | × | 0 | 0 | 0 |
| 573 | 4 mA input check selection | 49 | C9 | 5 | 0 ¥ | 0 | 0 | 0 | 0 | 0 |
| 574 | Second motor online auto tuning Output interruption detection time | 4A 4B | CA CB | 5 5 | × 0 | 0 | 0 | 0 | 0 | 0 |
| 575 | Output interruption detection times | | · · · D | | () | 0 | | () | | |

| | | Ins | tructio | n code ^{*1} | Co | ontrol metho | d ^{*2} | Ĩ | Paramete | r |
|------------|---|----------|----------|----------------------|-----|---------------|-----------------|--------------------|---------------------|----------------------------|
| Pr. | Name | Read | Write | Extended | V/F | Magnetic flux | PM | Copy ^{*3} | Clear ^{*3} | All clear ^{*3} |
| 577 | Output interruption cancel level | 4D | CD | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 578 | Auxiliary motor operation selection | 4E | CE | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 579 | Motor connection function selection | 4F | CF | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 580 | MC switchover interlock time (multi- pump) | 50 | D0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 581 | Start waiting time (multi-pump) | 51 | D1 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 582 | Auxiliary motor connection-time deceleration time | 52 | D2 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 583 | Auxiliary motor disconnection-time acceleration time | 53 | D3 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 584 | Auxiliary motor 1 starting frequency | 54 | D4 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 585 | Auxiliary motor 2 starting frequency | 55 | D5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 586 | Auxiliary motor 3 starting frequency | 56 | D6 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 587 | Auxiliary motor 1 stopping frequency | 57 | D7 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 588 | Auxiliary motor 2 stopping frequency | 58 | D8 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 589 | Auxiliary motor 3 stopping frequency | 59 | D9 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 590 | Auxiliary motor start detection time | 5A | DA | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 591 | Auxiliary motor stop detection time | 5B | DB | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 592 | Traverse function selection | 5C | DC | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 593 | Maximum amplitude amount | 5D | DD | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 594 | Amplitude compensation amount during deceleration | 5E | DE | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 595 | Amplitude compensation amount during acceleration | 5F | DF | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 596 | Amplitude acceleration time | 60 | E0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 597 | Amplitude deceleration time | 61 | E1 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 598 | Undervoltage level | 62 | E2 | 5 | 0 | 0 | × | 0 | 0 | 0 |
| 599 | X10 terminal input selection | 63 | E3 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 600 | First free thermal reduction frequency 1 | 00 | 80 | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 601 | First free thermal reduction ratio 1 | 01 | 81 | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 602 | First free thermal reduction frequency 2 | 02 | 82 | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 603 | First free thermal reduction ratio 2 | 03 | 83 | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 604 | First free thermal reduction frequency 3 | 04 | 84 | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 606 | Power failure stop external signal input selection | 06 | 86 | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 607 | Motor permissible load level | 07 | 87 | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 608 | Second motor permissible load level | 08 | 88 | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 609 | PID set point/deviation input selection | 09 | 89 | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 610 | PID measured value input selection | 0A | 8A | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 611 | Acceleration time at a restart | 0B | 8B | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 617 | Reverse rotation excitation current low-speed scaling factor | 11 | 91 | 6 | × | 0 | × | 0 | × | 0 |
| 653 | Speed smoothing control | 35 | B5 | 6 | 0 | × | × | 0 | 0 | 0 |
| 654 | Speed smoothing cutoff frequency | 36 | B6 | 6 | 0 | × | × | 0 | 0 | 0 |
| 655 | Analog remote output selection | 37 | B7 | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 656 | Analog remote output 1 | 38 | B8 | 6 | 0 | 0 | 0 | × | × | × |
| 657 | Analog remote output 2 | 39 | B9 | 6 | 0 | 0 | 0 | × | × | × |
| 658 | Analog remote output 3 Analog remote output 4 | 3A 3B | BA | 6 6 | 0 | 0 | 0 | × | × | × × |
| 659 660 | Increased magnetic excitation | 3B 3C | BB BC | 6 | 0 | 0 | 0 × | × 0 | × 0 | × 0 |
| 661 | deceleration operation selection Magnetic excitation increase rate | 3D | BD | 6 | 0 | 0 | × | 0 | 0 | 0 |
| 001 | magnetic excitation increase rate | 50 | | 0 | Ų | U | <u> </u> | ÿ | U | Ų |

| | | Ins | tructio | n code ^{*1} | Co | ntrol metho | d ^{*2} | | Paramete | r |
|------------|---|----------|----------|----------------------|--------|---------------|-----------------|--------------------|---------------------|----------------------------|
| Pr. | Name | Read | Write | Extended | V/F | Magnetic flux | PM | Copy ^{*3} | Clear ^{*3} | All clear ^{*3} |
| 662 | Increased magnetic excitation current level | 3E | BE | 6 | 0 | 0 | × | 0 | 0 | 0 |
| 663 | Control circuit temperature signal output level | 3F | BF | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 665 | Regeneration avoidance frequency gain | 41 | C1 | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 668 | Power failure stop frequency gain | 44 | C4 | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 673 | SF-PR slip amount adjustment operation selection | 49 | C9 | 6 | 0 | × | × | 0 | 0 | 0 |
| 674 | SF-PR slip amount adjustment gain | 4A | CA | 6 | 0 | × | × | 0 | 0 | 0 |
| 675 | User parameter auto storage function selection | 4B | СВ | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 684 | Tuning data unit switchover | 54 | D4 | 6 | × | 0 | 0 | 0 | 0 | 0 |
| 686 | Maintenance timer 2 | 56 | D6 | 6 | 0 | 0 | 0 | × | × | × |
| 687 | Maintenance timer 2 warning output set time | 57 | D7 | 6 | 0 | 0 | 0 | 0 | × | 0 |
| 688 | Maintenance timer 3 | 58 | D8 | 6 | 0 | 0 | 0 | × | × | × |
| 689 | Maintenance timer 3 warning output set time | 59 | D9 | 6 | 0 | 0 | 0 | 0 | × | 0 |
| 692 | Second free thermal reduction frequency 1 | 5C | DC | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 693 | Second free thermal reduction ratio | 5D | DD | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 694 | Second free thermal reduction frequency 2 | 5E | DE | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 695 | Second free thermal reduction ratio | 5F | DF | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 696 | Second free thermal reduction frequency 3 | 60 | E0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 699 702 | Input terminal filter Maximum motor frequency | 63 02 | E3 82 | 6 7 | ۰ × | ہ × | 0 | 0 | × | 0 |
| 702 | Induced voltage constant (phi f) | 02 | o∠ 86 | 7 | × | × | 0 | 0 | • × | 0 |
| 707 | Motor inertia (integer) | 07 | 87 | 7 | × | × | 0 | 0 | 0 | 0 |
| 711 | Motor Ld decay ratio | 0B | 8B | 7 | × | × | 0 | 0 | × | 0 |
| 712 | Motor Lq decay ratio | 0C | 8C | 7 | × | × | 0 | 0 | × | 0 |
| 717 | Starting resistance tuning compensation | 11 | 91 | 7 | × | × | 0 | 0 | × | 0 |
| 721 | Starting magnetic pole position detection pulse width | 15 | 95 | 7 | × | × | 0 | 0 | × | 0 |
| 724 | Motor inertia (exponent) | 18 | 98 | 7 | × | × | 0 | 0 | 0 | 0 |
| 725 | Motor protection current level | 19 | 99 | 7 | × | × | 0 | 0 | 0 | 0 |
| 726 | Auto Baudrate/Max Master | 1A | 9A | 7 | 0 | 0 | 0 | 0 | ° ^{*4} | ° ^{*4} |
| 727 | Max Info Frames Device instance number (Upper 3 | 1B | 9B | 7 | 0 | 0 | 0 | 0 | °*4 | °*4 *4 |
| 728 | digits) Device instance number (Lower 4 | 1C | 9C | 7 | 0 | 0 | 0 | 0 | °*4 *4 | °*4 *4 |
| 729 | digits) Second motor induced voltage | 1D | 9D | | 0 | 0 | 0 | 0 | °*4 | °*4 |
| 738 739 | constant (phi f) Second motor Ld decay ratio | 26 27 | A6 A7 | 7 | × | × | 0 | 0 | × | 0 |
| 740 | Second motor Lq decay ratio | 28 | A8 | 7 | × | × | 0 | 0 | × | 0 |
| 741 | Second starting resistance tuning compensation | 29 | A9 | 7 | × | × | 0 | 0 | × | 0 |
| 742 | Second motor magnetic pole detection pulse width | 2A | AA | 7 | × | × | 0 | 0 | × | 0 |
| 743 | Second motor maximum frequency | 2B | AB | 7 | × | × | 0 | 0 | 0 | 0 |
| 744 | Second motor inertia (integer) | 2C | AC | 7 | × | × | 0 | 0 | 0 | 0 |
| 745 | Second motor inertia (exponent) | 2D | AD | 7 | × | × | 0 | 0 | 0 | 0 |
| 746 | Second motor protection current level | 2E | AE | 7 | × | × | 0 | 0 | 0 | 0 |

| | | Ins | tructior | n code ^{*1} | Co | ontrol metho | d ^{*2} | Ĩ | Paramete | r |
|-----|--|----------|----------|----------------------|-----|---------------|-----------------|--------------------|---------------------|----------------------------|
| Pr. | Name | Read | Write | Extended | V/F | Magnetic flux | PM | Copy ^{*3} | Clear ^{*3} | All clear ^{*3} |
| 753 | Second PID action selection | 35 | B5 | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 754 | Second PID control automatic switchover frequency | 36 | B6 | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 755 | Second PID action set point | 37 | B7 | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 756 | Second PID proportional band | 38 | B8 | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 757 | Second PID integral time | 39 | B9 | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 758 | Second PID differential time | 3A | BA | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 759 | PID unit selection | 3B | BB | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 760 | Pre-charge fault selection | 3C | BC | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 761 | Pre-charge ending level | 3D | BD | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 762 | Pre-charge ending time | 3E | BE | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 763 | Pre-charge upper detection level | 3F | BF | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 764 | Pre-charge time limit | 40 | C0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 765 | Second pre-charge fault selection | 41 | C1 | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 766 | Second pre-charge ending level | 42 | C2 | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 767 | Second pre-charge ending time | 43 | C3 | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 768 | Second pre-charge upper detection level | 44 | C4 | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 769 | Second pre-charge time limit | 45 | C5 | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 774 | Operation panel monitor selection 1 | 4A | CA | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 775 | Operation panel monitor selection 2 | 4B | СВ | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 776 | Operation panel monitor selection 3 | 4C | CC | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 777 | 4 mA input fault operation frequency | 4D | CD | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 778 | 4 mA input check filter | 4E | CE | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 779 | Operation frequency during communication error | 4F | CF | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 791 | Acceleration time in low-speed range | 5B | DB | 7 | × | × | 0 | 0 | 0 | 0 |
| 792 | Deceleration time in low-speed range | 5C | DC | 7 | × | × | 0 | 0 | 0 | 0 |
| 799 | Pulse increment setting for output power | 63 | E3 | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 800 | Control method selection | 00 | 80 | 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| 820 | Speed control P gain 1 | 14 | 94 | 8 | × | × | 0 | 0 | 0 | 0 |
| 821 | Speed control integral time 1 | 15 | 95 | 8 | × | × | 0 | 0 | 0 | 0 |
| 822 | Speed setting filter 1 | 16 | 96 | 8 | × | × | 0 | 0 | 0 | 0 |
| 824 | Torque control P gain 1 (current loop proportional gain) | 18 | 98 | 8 | × | × | 0 | 0 | 0 | 0 |
| 825 | Torque control integral time 1 (current loop integral time) | 19 | 99 | 8 | × | × | 0 | 0 | 0 | 0 |
| 827 | Torque detection filter 1 | 1B | 9B | 8 | × | × | 0 | 0 | 0 | 0 |
| 828 | Parameter for manufacturer setting. Do | not set. | | | | | | | | |
| 830 | Speed control P gain 2 | 1E | 9E | 8 | × | × | 0 | 0 | 0 | 0 |
| 831 | Speed control integral time 2 | 1F | 9F | 8 | × | × | 0 | 0 | 0 | 0 |
| 832 | Speed setting filter 2 | 20 | A0 | 8 | × | × | 0 | 0 | 0 | 0 |
| 834 | Torque control P gain 2 (current loop proportional gain) | 22 | A2 | 8 | × | × | 0 | 0 | 0 | 0 |
| 835 | Torque control integral time 2 (current loop integral time) | 23 | A3 | 8 | × | × | 0 | 0 | 0 | 0 |
| 837 | Torque detection filter 2 | 25 | A5 | 8 | × | × | 0 | 0 | 0 | 0 |
| 849 | Analog input offset adjustment | 31 | B1 | 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| 858 | Terminal 4 function assignment | ЗA | BA | 8 | 0 | 0 | 0 | 0 | × | 0 |
| 859 | Torque current/Rated PM motor current | 3B | BB | 8 | × | 0 | 0 | 0 | × | 0 |
| 860 | Second motor torque current/Rated PM motor current | 3C | вс | 8 | × | 0 | 0 | 0 | × | 0 |
| 864 | Torque detection | 40 | C0 | 8 | × | × | 0 | 0 | 0 | 0 |
| 866 | Torque monitoring reference | 42 | C2 | 8 | × | 0 | 0 | 0 | 0 | 0 |
| 867 | AM output filter | 43 | C3 | 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| 307 | · output intoi | 70 | - 55 | U | Ŭ | Ŭ Ŭ | Ŭ | Ļ | Ŭ | ÿ |

^{678 9.} APPENDIX 9.5 Parameters (functions) and instruction codes under different control methods

| | | Ins | tructio | n code ^{*1} | Co | ntrol metho | d ^{*2} | F | Paramete | r |
|--------------|--|----------|----------|----------------------|-----|---------------|-----------------|--------------------|---------------------|----------------------------|
| Pr. | Name | Read | Write | Extended | V/F | Magnetic flux | PM | Copy ^{*3} | Clear ^{*3} | All clear ^{*3} |
| 868 | Terminal 1 function assignment | 44 | C4 | 8 | 0 | 0 | 0 | 0 | × | 0 |
| 869 | Current output filter | 45 | C5 | 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| 870 | Speed detection hysteresis Input phase loss protection | 46 | C6 | 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| 872 | selection | 48 | C8 | 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| 874 | OLT level setting | 4A | CA | 8 | × | × | 0 | 0 | 0 | 0 |
| 882 | Regeneration avoidance operation selection | 52 | D2 | 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| 883 | Regeneration avoidance operation level | 53 | D3 | 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| 884 | Regeneration avoidance at deceleration detection sensitivity | 54 | D4 | 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| 885 | Regeneration avoidance compensation frequency limit value | 55 | D5 | 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| 886 | Regeneration avoidance voltage gain | 56 | D6 | 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| 888 | Free parameter 1 | 58 | D8 | 8 | 0 | 0 | 0 | 0 | × | × |
| 889 | Free parameter 2 | 59 | D9 | 8 | 0 | 0 | 0 | 0 | × | × |
| 890 | Internal storage device status indication | 5A | DA | 8 | 0 | 0 | 0 | × | × | × |
| 891 | Cumulative power monitor digit shifted times | 5B | DB | 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| 892 | Load factor | 5C | DC | 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| 893 | Energy saving monitor reference (motor capacity) | 5D | DD | 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| 894 | Control selection during commercial power-supply operation | 5E | DE | 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| 895 | Power saving rate reference value | 5F | DF | 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| 896 897 | Power unit cost | 60 61 | E0 E1 | 8 8 | 0 | 0 | 0 | 0 0 | 0 0 | 0 |
| 898 | Power saving monitor average time Power saving cumulative monitor | - | E1 | | | | 0 | | | |
| 899 | clear Operation time rate (estimated | 62 63 | E2 | 8 | 0 | 0 | 0 | 0 | × 0 | 0 |
| C0 | value) | | | | | | | | | |
| (900) C1 | FM/CA terminal calibration | 5C | DC | 1 | 0 | 0 | 0 | 0 | × | 0 |
| (901) C2 | AM terminal calibration | 5D | DD | 1 | 0 | 0 | 0 | 0 | × | 0 |
| (902) | Terminal 2 frequency setting bias frequency | 5E | DE | 1 | 0 | 0 | 0 | 0 | × | 0 |
| C3 (902) | Terminal 2 frequency setting bias | 5E | DE | 1 | 0 | 0 | 0 | 0 | × | 0 |
| 125 (903) | Terminal 2 frequency setting gain frequency | 5F | DF | 1 | 0 | 0 | 0 | 0 | × | 0 |
| C4 (903) | Terminal 2 frequency setting gain | 5F | DF | 1 | 0 | 0 | 0 | 0 | × | 0 |
| C5 (904) | Terminal 4 frequency setting bias frequency | 60 | E0 | 1 | 0 | 0 | 0 | 0 | × | 0 |
| C6 (904) | Terminal 4 frequency setting bias | 60 | E0 | 1 | 0 | 0 | 0 | 0 | × | 0 |
| 126 (905) | Terminal 4 frequency setting gain frequency | 61 | E1 | 1 | 0 | 0 | 0 | 0 | × | 0 |
| C7 (905) | Terminal 4 frequency setting gain | 61 | E1 | 1 | 0 | 0 | 0 | 0 | × | 0 |
| C12 (917) | Terminal 1 bias frequency (speed) | 11 | 91 | 9 | × | × | 0 | 0 | × | 0 |
| C13 (917) | Terminal 1 bias (speed) | 11 | 91 | 9 | × | × | 0 | 0 | × | 0 |
| C14 (918) | Terminal 1 gain frequency (speed) | 12 | 92 | 9 | × | × | 0 | 0 | × | 0 |
| C15 (918) | Terminal 1 gain (speed) | 12 | 92 | 9 | × | × | 0 | 0 | × | 0 |

| Head Write Xitnand V/I Hasedcin LEM Copy Clear Operation (1919) Terminal bias cormand (torque) 13 93 9 × × 0 0 × 0 7 0 0 × 0 0 × 0 0 × 0 0 × 0 | | | Ins | tructio | 1 code ^{*1} | Co | ontrol metho | d ^{*2} | F | Paramete | r |
|---|-------|-------------------------------------|------|---------|----------------------|----|---------------|-----------------|--------------------|---------------------|----------------------------|
| (P19) (P17) (P17) (P18) | Pr. | Name | Read | Write | Extended | | Magnetic flux | PM | Copy ^{*3} | Clear ^{*3} | All clear ^{*3} |
| (1919) (1970) (1970)(13) (1970)(14) | - | Terminal 1 bias command (torque) | 13 | 93 | 9 | × | × | 0 | 0 | × | 0 |
| 1200 Ierrinal 1 gain (corque) 14 94 9 × × 0 0 × 0 1200 Ierrinal 1 gain (corque) 14 94 9 × × 0 | | Terminal 1 bias (torque) | 13 | 93 | 9 | × | × | 0 | 0 | × | 0 |
| (p20) Iterminal 1 gain (torque) 14 94 9 × × × 0 <t< th=""><th>-</th><th>Terminal 1 gain command (torque)</th><th>14</th><th>94</th><th>9</th><th>×</th><th>×</th><th>0</th><th>0</th><th>×</th><th>0</th></t<> | - | Terminal 1 gain command (torque) | 14 | 94 | 9 | × | × | 0 | 0 | × | 0 |
| 1330 Current output bias signal 1E 9E 9 0 <t< th=""><th></th><th>Terminal 1 gain (torque)</th><th>14</th><th>94</th><th>9</th><th>×</th><th>×</th><th>0</th><th>0</th><th>×</th><th>0</th></t<> | | Terminal 1 gain (torque) | 14 | 94 | 9 | × | × | 0 | 0 | × | 0 |
| (33) Current output gain signal 1E 9E 9 ○ < | - | Current output bias signal | 1E | 9E | 9 | 0 | 0 | 0 | 0 | 0 | 0 |
| Garrent output gain signal 1F 9F 9 0 | - | Current output bias current | 1E | 9E | 9 | 0 | 0 | 0 | 0 | 0 | 0 |
| (B31) Current output gain current 11 97 9 0 | - | Current output gain signal | 1F | 9F | 9 | 0 | 0 | 0 | 0 | 0 | 0 |
| (932) Terminal 4 bias command (torque) 20 A0 9 × × 0 × 0 C39 (32) Terminal 4 bias (torque) 20 A0 9 × × 0 0 × 0 C40 (33) Terminal 4 gain command (torque) 21 A1 9 × × 0 0 × 0 C41 (33) Terminal 4 gain (torque) 21 A1 9 × × 0 0 × 0 C42 (934) PID display bias coefficient 22 A2 9 0 0 0 × 0 C43 (934) PID display gain coefficient 23 A3 9 0 0 0 0 × 0 C44 (935) PID display gain analog value 23 A3 9 0 0 0 0 × 0 99 PID display gain analog value 23 A3 9 0 0 0 × 0 | | Current output gain current | 1F | 9F | 9 | 0 | 0 | 0 | 0 | 0 | 0 |
| (932) Ierminal 4 gain command (torque) 20 A0 9 × × 0 0 × 0 C40 (33) Terminal 4 gain command (torque) 21 A1 9 × × 0 0 × 0 C41 (33) Terminal 4 gain (torque) 21 A1 9 × × ∞ 0 0 × ∞ 0 C42 (934) PID display bias coefficient 22 A2 9 0 0 0 0 × ∞ | (932) | Terminal 4 bias command (torque) | 20 | A0 | 9 | × | × | 0 | 0 | × | 0 |
| (933) ferminal 4 gain command (torque) 21 A1 9 × × o o × o C41 (33) ferminal 4 gain (torque) 21 A1 9 × × o o × o C42 (34) PID display bias coefficient 22 A2 9 o o o o × o C43 (344) PID display bias analog value 22 A2 9 o o o o x o C44 (935) PID display gain coefficient 23 A3 9 o o o o x o C44 (935) PID display gain analog value 23 A3 9 o o o o o x o 977 Input voltage mode selection 4D CD 9 o o o o o o o o 989 Parameter cory anareter digital manalog value 5C DC < | (932) | Terminal 4 bias (torque) | 20 | A0 | 9 | × | × | 0 | 0 | × | 0 |
| (933) Terminal 4 gain (torque) 21 A1 9 × × 0 0 × 0 C42 (934) PID display bias coefficient 22 A2 9 0 0 0 0 × 0 C43 (934) PID display bias analog value 22 A2 9 0 0 0 0 × 0 C44 (935) PID display gain coefficient 23 A3 9 0 0 0 0 × 0 C45 (935) PID display gain analog value 23 A3 9 0 0 0 0 × 0 977 Input voltage mode selection 4D CD 9 0 0 0 0 0 0 0 × 0 971 Input voltage mode selection 5A DA 9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | (933) | Terminal 4 gain command (torque) | 21 | A1 | 9 | × | × | 0 | 0 | × | 0 |
| PID display bias coefficient 22 A2 9 0 0 0 × 0 G43 (934) PID display bias analog value 22 A2 9 0 0 0 × 0 C44 (935) PID display gain analog value 23 A3 9 0 0 0 × 0 SP Parameter cory alarm release 59 D9 9 0 0 0 × 0 SP Parameter cory alarm release 59 D9 9 0 0 0 0 × 0 99 Purcentrop anel setting dial push monitor selection 55 DC 9 0 | (933) | Terminal 4 gain (torque) | 21 | A1 | 9 | × | × | 0 | 0 | × | 0 |
| (934) PID display bias analog value 22 A2 9 ○ | (934) | PID display bias coefficient | 22 | A2 | 9 | 0 | 0 | 0 | 0 | × | 0 |
| (935) PID display gain coefficient 23 A3 9 ○ ○ ○ ○ × ○ C46 (935) PID display gain analog value 23 A3 9 ○ ○ ○ ○ ○ × ○ 977 Input voltage mode selection 4D CD 9 ○ ○ ○ ○ × ↓○ 989 Parameter copy alarm release 59 D9 9 ○ ○ ○ ○ × ↓○ 991 PU cortrast adjustment 5B DB 9 ○ | (934) | PID display bias analog value | 22 | A2 | 9 | 0 | 0 | 0 | 0 | × | 0 |
| (935) PID display gain analog value 23 A3 9 ○ ○ ○ ○ × ○ 977 Input voltage mode selection 4D CD 9 ○ ○ ○ ○ × × ○ 989 Parameter copy alarm release 59 D9 9 ○ ○ ○ ○ ○ × ○ 990 PU contrast adjustment 5B DB 9 ○ ○ ○ ○ ○ × ○ 991 PU contrast adjustment 5B DB 9 ○ ○ ○ ○ × ○ | (935) | PID display gain coefficient | 23 | A3 | 9 | 0 | 0 | 0 | 0 | × | 0 |
| 989 Parameter copy alarm release 59 D9 9 0 0 0 0 × 0 990 PU buzzer control 5A DA 9 0 | (935) | | | | | 0 | 0 | 0 | 0 | | 0 |
| 990 PU buzzer control 5A DA 9 0 | - | | | - | - | | | | | | |
| 991 PU contrast adjustment 5B DB 9 0 0 0 × 0 992 Operation panel setting dial push monitor selection 5C DC 9 0 0 0 0 × 0 997 Fault initiation 61 E1 9 0 0 0 0 × 0 0 997 Fault initiation 61 E1 9 0 | | | | - | - | | | | | | |
| 992 Operation panel setting dial push monitor selection 5C DC 9 0 | | | | | | | | | | | |
| 997 Fault initiation 61 E1 9 0 0 0 × 0 0 998 PM parameter initialization 62 E2 9 0 <t< th=""><th></th><th>Operation panel setting dial push</th><th>-</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></t<> | | Operation panel setting dial push | - | | | | | | | | |
| 999 Automatic parameter setting 63 E3 9 0 0 × × 0 1000 Direct setting selection 00 80 A 0 | 997 | | 61 | E1 | 9 | 0 | 0 | 0 | × | 0 | 0 |
| 1000 Direct setting selection 00 80 A 0 | 998 | PM parameter initialization | 62 | E2 | 9 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1002 Lq tuning target current adjustment coefficient 02 82 A × × ∞ | 999 | Automatic parameter setting | 63 | E3 | 9 | 0 | 0 | 0 | × | × | 0 |
| 1002 coefficient 02 82 A × × 0 | 1000 | Direct setting selection | 00 | 80 | A | 0 | 0 | 0 | 0 | 0 | 0 |
| 1007 Clock (month, day) 07 87 A 0 0 × × × 1008 Clock (hour, minute) 08 88 A 0 0 × × × 1013 Running speed after emergency drive retry reset 0D 8D A 0 0 × × × × 1015 Integral stop selection at limited frequency 0F 8F A 0 0 0 × 0 1016 PTC thermistor protection detection time 10 90 A 0 0 0 × 0 1018 Monitor with sign selection 12 92 A 0 | 1002 | | 02 | 82 | А | × | × | 0 | 0 | 0 | 0 |
| 1008Clock (hour, minute)0888A00××××1013Running speed after emergency drive retry reset0D8DA0000×01015Integral stop selection at limited frequency0F8FA0000×01016PTC thermistor protection detection time1090A0000×01018Monitor with sign selection1292A00000001019Analog meter voltage negative output selection AY1393A000000001020Trace mode selection1595A0000000001022Sampling cycle1696A000000001023Number of analog channels1797A00000000 | | | | | | 0 | 0 | 0 | | | × |
| 1013Running speed after emergency drive retry reset0D8DA000x01015Integral stop selection at limited frequency0F8FA00000001016PTC thermistor protection detection time1090A0000000001018Monitor with sign selection1292A0000000001019Analog meter voltage negative output selection AY1393A000 | | | | | | | | | | | |
| 1015Integral stop selection at limited frequency0F8FA0000001016PTC thermistor protection detection time1090A0000×01018Monitor with sign selection1292A00000001019Analog meter voltage negative output selection AY1393A00000001020Trace operation selection1494A00000001021Trace mode selection1595A00000001022Sampling cycle1696A00000001023Number of analog channels1797A0000000 | | Running speed after emergency | | | | | | | | | |
| 1016 PTC thermistor protection detection time 10 90 A 0 0 0 × 0 1018 Monitor with sign selection 12 92 A 0 | 1015 | Integral stop selection at limited | 0F | 8F | A | 0 | 0 | 0 | 0 | 0 | 0 |
| 1018 Monitor with sign selection 12 92 A o < | 1016 | PTC thermistor protection detection | 10 | 90 | A | 0 | 0 | 0 | 0 | × | 0 |
| 1019Analog meter voltage negative output selection AY1393A00000001020Trace operation selection1494A00000001021Trace mode selection1595A00000001022Sampling cycle1696A00000001023Number of analog channels1797A000000 | 1018 | | 12 | 92 | A | 0 | 0 | 0 | 0 | 0 | 0 |
| 1020 Trace operation selection 14 94 A 0 <th< th=""><th></th><th>Analog meter voltage negative</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></th<> | | Analog meter voltage negative | | | | | | | | | |
| 1021 Trace mode selection 15 95 A o <th>1020</th> <th></th> <th>14</th> <th>94</th> <th>A</th> <th>0</th> <th>0</th> <th>0</th> <th>0</th> <th>0</th> <th>0</th> | 1020 | | 14 | 94 | A | 0 | 0 | 0 | 0 | 0 | 0 |
| 1023 Number of analog channels 17 97 A o <th< th=""><th></th><th>-</th><th>15</th><th>95</th><th>A</th><th>0</th><th>0</th><th>0</th><th>0</th><th>0</th><th>0</th></th<> | | - | 15 | 95 | A | 0 | 0 | 0 | 0 | 0 | 0 |
| | 1022 | | 16 | 96 | A | 0 | 0 | 0 | 0 | 0 | 0 |
| 1024 Sampling auto start | 1023 | Number of analog channels | 17 | 97 | A | 0 | 0 | 0 | 0 | 0 | 0 |
| | 1024 | Sampling auto start | 18 | 98 | А | 0 | 0 | 0 | 0 | 0 | 0 |

680 9. APPENDIX

9.5 Parameters (functions) and instruction codes under different control methods

| | | Ins | tructio | n code ^{*1} | Co | ntrol metho | d ^{*2} | F | Paramete | r |
|--------------|---|----------|----------|----------------------|-----|---------------|-----------------|--------------------|---------------------|----------------------------|
| Pr. | Name | Read | Write | Extended | V/F | Magnetic flux | PM | Copy ^{*3} | Clear ^{*3} | All clear ^{*3} |
| 1025 | Trigger mode selection | 19 | 99 | A | 0 | 0 | 0 | 0 | 0 | 0 |
| 1026 | Number of sampling before trigger | 1A | 9A | A | 0 | 0 | 0 | 0 | 0 | 0 |
| 1027 | Analog source selection (1ch) | 1B | 9B | A | 0 | 0 | 0 | 0 | 0 | 0 |
| 1028 | Analog source selection (2ch) | 1C | 9C | A | 0 | 0 | 0 | 0 | 0 | 0 |
| 1029 | Analog source selection (3ch) | 1D | 9D | A | 0 | 0 | 0 | 0 | 0 | 0 |
| 1030 | Analog source selection (4ch) | 1E | 9E | A | 0 | 0 | 0 | 0 | 0 | 0 |
| 1031 | Analog source selection (5ch) | 1F | 9F | A | 0 | 0 | 0 | 0 | 0 | 0 |
| 1032 | Analog source selection (6ch) | 20 | A0 | A | 0 | 0 | 0 | 0 | 0 | 0 |
| 1033 | Analog source selection (7ch) | 21 | A1 | A | 0 | 0 | 0 | 0 | 0 | 0 |
| 1034 | Analog source selection (8ch) | 22 | A2 | A | 0 | 0 | 0 | 0 | 0 | 0 |
| 1035 | Analog trigger channel | 23 24 | A3 A4 | A | 0 | 0 | 0 | 0 | 0 | 0 |
| 1036 1037 | Analog trigger operation selection | 24 25 | A4 A5 | A | 0 | 0 | 0 | 0 | 0 | 0 |
| 1037 | Analog trigger level | 25 26 | A5 A6 | A | 0 | 0 | 0 | 0 | 0 | 0 |
| | Digital source selection (1ch) | - | - | | 0 | 0 | 0 | 0 | 0 | 0 |
| 1039 1040 | Digital source selection (2ch) Digital source selection (3ch) | 27 28 | A7 A8 | A A | 0 | 0 | 0 | 0 | 0 | 0 |
| 1040 | Digital source selection (3ch) | 28 29 | A8 A9 | A | 0 | 0 | 0 | 0 | 0 | 0 |
| 1041 | Digital source selection (4ch) | 29 2A | A9 AA | A | 0 | 0 | 0 | 0 | 0 | 0 |
| 1042 | Digital source selection (5ch) | 2A 2B | AA | A | 0 | 0 | 0 | 0 | 0 | 0 |
| 1044 | Digital source selection (7ch) | 2D 2C | AC | A | 0 | 0 | 0 | 0 | 0 | 0 |
| 1044 | Digital source selection (7ch) | 20 2D | AD | A | 0 | 0 | 0 | 0 | 0 | 0 |
| 1046 | Digital trigger channel | 2E | AE | A | 0 | 0 | 0 | 0 | 0 | 0 |
| 1047 | Digital trigger operation selection | 2E 2F | AF | A | 0 | 0 | 0 | 0 | 0 | 0 |
| 1048 | Display-off waiting time | 30 | B0 | A | 0 | 0 | 0 | 0 | 0 | 0 |
| 1049 | USB host reset | 31 | B1 | A | 0 | 0 | 0 | × | 0 | 0 |
| 1106 | Torque monitor filter | 06 | 86 | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1107 | Running speed monitor filter | 07 | 87 | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1108 | Excitation current monitor filter | 08 | 88 | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1132 | Pre-charge change increment amount | 20 | A0 | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1133 | Second pre-charge change increment amount | 21 | A1 | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1136 | Second PID display bias coefficient | 24 | A4 | В | 0 | 0 | 0 | 0 | × | 0 |
| 1137 | Second PID display bias analog value | 25 | A5 | В | 0 | 0 | 0 | 0 | × | 0 |
| 1138 | Second PID display gain coefficient | 26 | A6 | В | 0 | 0 | 0 | 0 | × | 0 |
| 1139 | Second PID display gain analog value | 27 | A7 | В | 0 | 0 | 0 | 0 | × | 0 |
| 1140 | Second PID set point/deviation input selection | 28 | A8 | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1141 | Second PID measured value input selection | 29 | A9 | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1142 | Second PID unit selection | 2A | AA | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1143 | Second PID upper limit | 2B | AB | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1144 | Second PID lower limit | 2C | AC | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1145 | Second PID deviation limit | 2D | AD | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1146 | Second PID signal operation selection | 2E | AE | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1147 | Second output interruption detection time | 2F | AF | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1148 | Second output interruption detection level | 30 | B0 | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1149 | Second output interruption cancel level | 31 | B1 | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1150 | User parameter 1 | 32 | B2 | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1151 | User parameter 2 | 33 | B3 | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1152 | User parameter 3 | 34 | B4 | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1153 | User parameter 4 | 35 | B5 | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1154 | User parameter 5 | 36 | B6 | В | 0 | 0 | 0 | 0 | 0 | 0 |

| | | Ins | tructio | n code ^{*1} | Co | ntrol metho | d ^{*2} | F | Paramete | r |
|--------------|--|----------|----------|----------------------|----|---------------|-----------------|--------------------|---------------------|----------------------------|
| Pr. | Name | Read | Write | Extended | | Magnetic flux | PM | Copy ^{*3} | Clear ^{*3} | All clear ^{*3} |
| 1155 | User parameter 6 | 37 | B7 | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1156 | User parameter 7 | 38 | B8 | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1157 | User parameter 8 | 39 | B9 | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1158 | User parameter 9 | 3A | BA | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1159 | User parameter 10 | 3B | BB | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1160 | User parameter 11 | 3C | BC | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1161 | User parameter 12 | 3D | BD | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1162 | User parameter 13 | 3E | BE | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1163 | User parameter 14 | 3F | BF | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1164 | User parameter 15 | 40 | C0 | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1165 | User parameter 16 | 41 | C1 | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1166 | User parameter 17 | 42 | C2 | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1167 | User parameter 18 | 43 | C3 | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1168 | User parameter 19 | 44 | C4 | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1169 | User parameter 20 | 45 | C5 | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1170 | User parameter 21 | 46 | C6 | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1171 | User parameter 22 | 47 | C7 | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1172 | User parameter 23 | 48 | C8 | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1173 | User parameter 24 | 49 | C9 | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1174 | User parameter 25 | 4A | CA | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1175 | User parameter 26 | 4B | CB | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1176 | User parameter 27 | 4C | | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1177 | User parameter 28 | 4D | CD | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1178 | User parameter 29 | 4E | CE | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1179 | User parameter 30 | 4F | CF | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1180 | User parameter 31 | 50 | D0 | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1181 | User parameter 32 | 51 | D1 | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1182 | User parameter 33 | 52 | D2 | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1183 | User parameter 34 | 53 | D3 | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1184 | User parameter 35 | 54 | D4 | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1185 | User parameter 36 | 55 | D5 D6 | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1186 | User parameter 37 | 56 57 | D6 D7 | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1187 1188 | User parameter 38 | 57 58 | D7 D8 | В | 0 | 0 | 0 | 0 | 0 | 0 |
| 1189 | User parameter 39 User parameter 40 | 59 | D8 D9 | B | 0 | 0 | 0 | 0 0 | 0 0 | 0 |
| 1190 | User parameter 40 | 59 5A | D9 DA | B | 0 | 0 | 0 | | 0 | 0 |
| 1190 | User parameter 42 | 5B | DA | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1192 | User parameter 42 | 5C | DC | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1192 | User parameter 44 | 50 5D | DD | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1194 | User parameter 45 | 5E | DE | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1195 | User parameter 46 | 5E | DF | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1196 | User parameter 47 | 60 | E0 | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1197 | User parameter 48 | 61 | E1 | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1198 | User parameter 49 | 62 | E2 | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1199 | User parameter 50 | 63 | E3 | B | 0 | 0 | 0 | 0 | 0 | 0 |
| 1211 | PID gain tuning timeout time | 0B | 8B | C | 0 | 0 | 0 | 0 | 0 | 0 |
| 1212 | Step manipulated amount | 00 | 8C | C | 0 | 0 | 0 | 0 | 0 | 0 |
| 1213 | Step response sampling cycle | 0D | 8D | C | 0 | 0 | 0 | 0 | 0 | 0 |
| 1214 | Timeout time after the maximum slope | 0E | 8E | C | 0 | 0 | 0 | 0 | 0 | 0 |
| 1215 | Limit cycle output upper limit | 0F | 8F | С | 0 | 0 | 0 | 0 | 0 | 0 |
| 1216 | Limit cycle output lower limit | 10 | 90 | C | 0 | 0 | 0 | 0 | 0 | 0 |
| 1217 | Limit cycle hysteresis | 11 | 91 | C | 0 | 0 | 0 | 0 | 0 | 0 |
| 1218 | PID gain tuning setting | 12 | 92 | C | 0 | 0 | 0 | 0 | 0 | 0 |
| 1219 | PID gain tuning start/status | 13 | 93 | C | 0 | 0 | 0 | × | × | × |
| 1344 | R-S turns ratio compensation AVP | 2C | AC | D | 0 | 0 | 0 | 0 | × | × |
| 1345 | T-S turns ratio compensation AVP | 20 2D | AD | D | 0 | 0 | 0 | 0 | × | × |
| 1343 | 1-5 turns ratio compensation AVP | 20 | | U | U | U | 0 | 0 | ^ | ^ |

| Pr. | Name | Instruction code ^{*1} | | Control method ^{*2} | | | Parameter | | | |
|----------------------|---|--------------------------------|----------|------------------------------|---|---------------|-----------|--------------------|---------------------|----------------------------|
| | | Read | Write | Extended | | Magnetic flux | PM | Copy ^{*3} | Clear ^{*3} | All clear ^{*3} |
| 1346 | PID lower limit operation detection time | 2E | AE | D | 0 | 0 | 0 | 0 | 0 | 0 |
| 1361 | Detection time for PID output hold | 3D | BD | D | 0 | 0 | 0 | 0 | 0 | 0 |
| 1362 | PID output hold range | 3E | BE | D | 0 | 0 | 0 | 0 | 0 | 0 |
| 1363 | PID priming time | 3F | BF | D | 0 | 0 | 0 | 0 | 0 | 0 |
| 1364 | Stirring time during sleep | 40 | C0 | D | 0 | 0 | 0 | 0 | 0 | 0 |
| 1365 | Stirring interval time | 41 | C1 | D | 0 | 0 | 0 | 0 | 0 | 0 |
| 1366 | Sleep boost level | 42 | C2 | D | 0 | 0 | 0 | 0 | 0 | 0 |
| 1367 | Sleep boost waiting time | 43 | C3 | D | 0 | 0 | 0 | 0 | 0 | 0 |
| 1368 1369 | Output interruption cancel time Check valve closing completion | 44 45 | C4 C5 | D D | 0 | 0 | 0 | 0 | 0 | 0 |
| | frequency Detection time for PID limiting | | | | | | | | | |
| 1370 | operation PID upper/lower limit pre-warning | 46 | C6 | D | 0 | 0 | 0 | 0 | 0 | 0 |
| 1371 | level range | 47 | C7 | D | 0 | 0 | 0 | 0 | 0 | 0 |
| 1372 | PID measured value control set point change amount | 48 | C8 | D | 0 | 0 | 0 | 0 | 0 | 0 |
| 1373 | PID measured value control set point change rate | 49 | C9 | D | 0 | 0 | 0 | 0 | 0 | 0 |
| 1374 | Auxiliary pressure pump operation starting level | 4A | CA | D | 0 | 0 | 0 | 0 | 0 | 0 |
| 1375 | Auxiliary pressure pump operation stopping level | 4B | СВ | D | 0 | 0 | 0 | 0 | 0 | 0 |
| 1376 | Auxiliary motor stopping level | 4C | СС | D | 0 | 0 | 0 | 0 | 0 | 0 |
| 1377 | PID input pressure selection | 4D | CD | D | 0 | 0 | 0 | 0 | 0 | 0 |
| 1378 | PID input pressure warning level | 4E | CE | D | 0 | 0 | 0 | 0 | 0 | 0 |
| 1379 | PID input pressure fault level | 4F | CF | D | 0 | 0 | 0 | 0 | 0 | 0 |
| 1380 | PID input pressure warning set point change amount | 50 | D0 | D | 0 | 0 | 0 | 0 | 0 | 0 |
| 1381 | PID input pressure fault operation selection | 51 | D1 | D | 0 | 0 | 0 | 0 | 0 | 0 |
| 1382 | MC switchover interlock time (for phase-synchronized bypass switching function) | 52 | D2 | D | 0 | 0 | × | 0 | 0 | 0 |
| 1383 | Phase compensation amount for synchronous bypass switching | 53 | D3 | D | 0 | 0 | × | 0 | 0 | 0 |
| 1384 | PLL tuning gain AVP | 54 | D4 | D | 0 | 0 | × | 0 | 0 | 0 |
| 1410 | Starting times lower 4 digits | 0 A | 8A | E | 0 | 0 | 0 | × | × | × |
| 1411 | Starting times upper 4 digits | 0B | 8B | E | 0 | 0 | 0 | × | × | × |
| 1412 | Motor induced voltage constant (phi f) exponent | 0C | 8C | Е | × | × | 0 | 0 | × | 0 |
| 1413 | Second motor induced voltage constant (phi f) exponent | 0D | 8D | E | × | × | 0 | 0 | × | 0 |
| 1442 | IP filter address 1 (Ethernet)NCG | 2A | AA | E | 0 | 0 | 0 | 0 | ° ^{*4} | ° ^{*4} |
| 1443 | IP filter address 2 (Ethernet)NCG | 2B | AB | E | 0 | 0 | 0 | 0 | °*4 | ° ^{*4} |
| 1444 | IP filter address 3 (Ethernet)NCG | 2C | AC | E | 0 | 0 | 0 | 0 | ° ^{*4} | °*4 |
| 1445 | IP filter address 4 (Ethernet) | 2D | AD | E | 0 | 0 | 0 | 0 | ° ^{*4} | ° ^{*4} |
| 1446 | IP filter address 2 range | 2E | AE | E | 0 | 0 | 0 | 0 | °*4 | °*4 |
| 1447 | specification (Ethernet) NCG IP filter address 3 range | 2F | AF | E | 0 | 0 | 0 | 0 | °*4 | °*4 |
| 1448 | specification (Ethernet) NCG IP filter address 4 range | 30 | B0 | E | 0 | 0 | 0 | 0 | °*4 | °*4 |
| 1440 | specification (Ethernet)NCG Clock source selectionNCG | 30 3B | BB | E | 0 | 0 | 0 | 0 | 0 | 0 |
| | PID multistage set point 1 | 3C | BC | E | 0 | 0 | 0 | 0 | 0 | 0 |
| 1460 | | | | | | | | | | 0 |
| 1460 1461 | | 30 | I RD | ⊢ ⊢ | 0 | 0 | 0 | 0 | 0 | |
| 1460 1461 1462 | PID multistage set point 2 PID multistage set point 3 | 3D 3E | BD BE | E | 0 | 0 | 0 | 0 | 0 | 0 |

| | | Inst | tructio | 1 code ^{*1} | Co | ontrol metho | d ^{*2} | F | Paramete | r |
|------|---|-----------------------|---------|----------------------|-----|---------------|-----------------|--------------------|---------------------|----------------------------|
| Pr. | Name | Read | Write | Extended | V/F | Magnetic flux | PM | Copy ^{*3} | Clear ^{*3} | All clear ^{*3} |
| 1464 | PID multistage set point 5 | 40 | C0 | E | 0 | 0 | 0 | 0 | 0 | 0 |
| 1465 | PID multistage set point 6 | 41 | C1 | E | 0 | 0 | 0 | 0 | 0 | 0 |
| 1466 | PID multistage set point 7 | 42 | C2 | E | 0 | 0 | 0 | 0 | 0 | 0 |
| 1469 | Number of cleaning times monitor | 45 | C5 | E | 0 | 0 | 0 | × | × | × |
| 1470 | Number of cleaning times setting | 46 | C6 | E | 0 | 0 | 0 | 0 | 0 | 0 |
| 1471 | Cleaning trigger selection | 47 | C7 | E | 0 | 0 | 0 | 0 | 0 | 0 |
| 1472 | Cleaning reverse rotation frequency | 48 | C8 | E | 0 | 0 | 0 | 0 | 0 | 0 |
| 1473 | Cleaning reverse rotation operation time | 49 | C9 | E | 0 | 0 | 0 | 0 | 0 | 0 |
| 1474 | Cleaning forward rotation frequency | 4A | CA | E | 0 | 0 | 0 | 0 | 0 | 0 |
| 1475 | Cleaning forward rotation operation time | 4B | СВ | E | 0 | 0 | 0 | 0 | 0 | 0 |
| 1476 | Cleaning stop time | 4C | CC | E | 0 | 0 | 0 | 0 | 0 | 0 |
| 1477 | Cleaning acceleration time | 4D | CD | E | 0 | 0 | 0 | 0 | 0 | 0 |
| 1478 | Cleaning deceleration time | leration time 4E CE E | | E | 0 | 0 | 0 | 0 | 0 | 0 |
| 1479 | Cleaning time trigger | 4F | CF E | | 0 | 0 | 0 | 0 | 0 | 0 |
| 1480 | Load characteristics measurement mode | 50 | D0 | E | 0 | 0 | 0 | 0 | 0 | 0 |
| 1481 | Load characteristics load reference 1 | 51 | D1 | E | 0 | 0 | 0 | 0 | 0 | 0 |
| 1482 | Load characteristics load reference 2 | 52 | D2 | E | 0 | 0 | 0 | 0 | 0 | 0 |
| 1483 | Load characteristics load reference 3 | 53 | D3 | E | 0 | 0 | 0 | 0 | 0 | 0 |
| 1484 | Load characteristics load reference 4 | 54 | D4 | E | 0 | 0 | 0 | 0 | 0 | 0 |
| 1485 | Load characteristics load reference 5 | 55 | D5 | E | 0 | 0 | 0 | 0 | 0 | 0 |
| 1486 | Load characteristics maximum frequency | 56 | D6 | E | 0 | 0 | 0 | 0 | 0 | 0 |
| 1487 | Load characteristics minimum frequency | 57 | D7 | E | 0 | 0 | 0 | 0 | 0 | 0 |
| 1488 | Upper limit warning detection width | 58 | D8 | E | 0 | 0 | 0 | 0 | 0 | 0 |
| 1489 | Lower limit warning detection width | 59 | D9 | E | 0 | 0 | 0 | 0 | 0 | 0 |
| 1490 | Upper limit fault detection width | 5A | DA | E | 0 | 0 | 0 | 0 | 0 | 0 |
| 1491 | Lower limit fault detection width | 5B | DB | E | 0 | 0 | 0 | 0 | 0 | 0 |
| 1492 | Load status detection signal delay time / load reference measurement waiting time | 5C | DC | E | 0 | 0 | 0 | 0 | 0 | 0 |
| 1499 | Parameter for manufacturer setting. Do | not set. | | | | | | | | |

9.6

For customers using communication options manufactured by HMS

List of inverter monitor items / command items

The following items can be set using a communication option.

16-bit data

| No. | Description | Unit | Туре | Read/ write |
|----------------|--|--------------------|----------|-------------|
| H0000 | No data | - | - | - |
| H0001 | Output frequency | 0.01 Hz | unsigned | R |
| H0002 | Output current | 0.01 A/0.1 A | unsigned | R |
| H0003 | Output voltage | 0.1 V | unsigned | R |
| H0004 | reserved | - | - | - |
| H0005 | Frequency setting value | 0.01 Hz | unsigned | R |
| H0006 | Motor speed | 1 r/min | unsigned | R |
| H0007 | Motor torque | 0.1% | unsigned | R |
| H0008 | Converter output voltage | 0.1 V | unsigned | R |
| H0009 | reserved | - | - | - |
| H000A | Electric thermal relay function load factor | 0.1% | unsigned | R |
| H000B | Output current peak value | 0.01 A/0.1 A | unsigned | R |
| H000C | Converter output voltage peak value | 0.1 V | unsigned | R |
| H000D | Input power | 0.01 kW/ 0.1 kW | unsigned | R |
| H000E | Output power | 0.01 kW/ 0.1 kW | unsigned | R |
| H000F | Input terminal status ^{*1} | - | - | R |
| H0010 | Output terminal status ^{*1} | - | - | R |
| H0011 | Load meter | 0.1% | unsigned | R |
| H0012 | Motor excitation current | 0.01 A/0.1 A | unsigned | R |
| H0013 | reserved | - | - | - |
| H0014 | Cumulative energization time | 1 h | unsigned | R |
| H0015 H0016 | reserved | - | - | - |
| H0017 | Actual operation time | 1 h | unsigned | R |
| H0018 | Motor load factor | 0.1% | unsigned | R |
| H0019 | Cumulative power | 1 kWh | unsigned | R |
| H001A to H0021 | reserved | - | - | - |
| H0022 | Motor output | 0.1 kW | unsigned | R |
| H0023 to H0025 | reserved | - | - | - |
| H0026 | Trace status | - | unsigned | R |
| H0027 | reserved | - | - | - |
| H0028 | PLC function user monitor 1 | - | unsigned | R |
| H0029 | PLC function user monitor 2 | - | unsigned | R |
| H002A | PLC function user monitor 3 | - | unsigned | R |
| H002B to H002D | reserved | - | - | - |
| H002E | Motor temperature | | | R |
| H002F to H0031 | reserved | - | - | - |
| H0032 | Power saving effect | - | unsigned | R |
| H0033 | Cumulative saving power | - | unsigned | R |
| H0034 | PID set point | 0.1% | unsigned | R/W |
| H0035 | PID measured value | 0.1% | unsigned | R/W |
| H0036 | PID deviation | 0.1% | unsigned | R/W |
| H0037 to H0039 | reserved | - | - | - |
| H003A | Option input terminal status 1 ^{*1} | | _ | R |
| | | | | |
| H003B | Option input terminal status 2 ^{*1} | - | - | R |

| No. | Description | Unit | Туре | Read/ write |
|----------------|---|--------|----------|-------------|
| H003C | Option output terminal status ^{*1} | - | - | R |
| H003D | Motor thermal load factor | 0.1% | unsigned | R |
| H003E | Transistor thermal load factor | 0.1% | unsigned | R |
| H003F | reserved | - | - | - |
| H0040 | PTC thermistor resistance | ohm | unsigned | R |
| H0041 | Output power (with regenerative display) | 0.1 kW | unsigned | R |
| H0042 | Cumulative regenerative power | 1 kWh | unsigned | R |
| H0043 | PID measured value 2 | 0.1% | unsigned | R |
| H0044 | Second PID set point | 0.1% | unsigned | R/W |
| H0045 | Second PID measured value | 0.1% | unsigned | R/W |
| H0046 | Second PID deviation | 0.1% | unsigned | R/W |
| H0047 to H004F | reserved | - | - | - |
| H0050 | Integrated power on time | 1 h | unsigned | R |
| H0051 | Running time | 1 h | unsigned | R |
| H0052 | Saving energy monitor | - | unsigned | R |
| H0053 | reserved | - | - | - |
| H0054 | Fault code (1) | - | - | R |
| H0055 | Fault code (2) | - | - | R |
| H0056 | Fault code (3) | - | - | R |
| H0057 | Fault code (4) | - | - | R |
| H0058 | Fault code (5) | - | - | R |
| H0059 | Fault code (6) | - | - | R |
| H005A | Fault code (7) | - | - | R |
| H005B | Fault code (8) | - | - | R |
| H005C to H005E | reserved | - | - | - |
| H005F | Second PID measured value 2 | 0.1% | unsigned | R |
| H0060 | Second PID manipulated variable | 0.1% | signed | R |
| H0061 to H0065 | reserved | - | - | - |
| H0066 | PID manipulated variable | 0.1% | signed | R |
| H0067 to H00F8 | reserved | - | - | - |
| H00F9 | Run command ^{*2} | - | - | R/W |
| H00FA to H01FF | reserved | - | - | - |

*1 For the details, refer to page 305.

*2 Operation command

This signal is assigned in the initial status. The description changes depending on the setting of **Pr.180 to Pr.189 (Input terminal function selection)**. (Refer to page 373.)

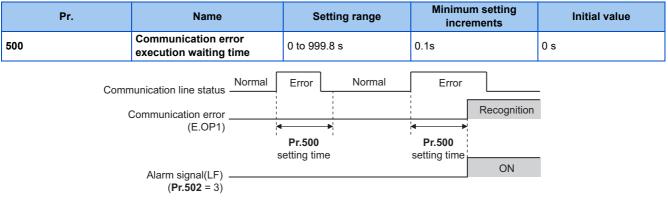
| b15 | | | | | | | | | | | | | | | b0 |
|-----|---|---|---|-----|---------------|----|-----|-----|----|----|----|----|---|---|----|
| - | - | - | - | RES | STP (STOP) | CS | JOG | MRS | RT | RH | RM | RL | - | - | AU |

32-bit data

| No. | Description | Unit | Туре | Read/ write | |
|----------------|---|---------------|----------|-------------|--|
| H0200 | reserved | - | - | - | |
| H0201 | Output frequency (0-15 bit) | 0.01 Hz | aignod | R | |
| H0202 | Output frequency (16-31 bit) | 0.01 HZ | signed | ĸ | |
| H0203 | Setting frequency (0-15 bit) | 0.01 Hz | unsigned | В | |
| H0204 | Setting frequency (16-31 bit) | 0.01 HZ | unsigned | R | |
| H0205 | Motor rotation (0-15 bit) | 1 r/min | aignod | R | |
| H0206 | Motor rotation (16-31 bit) | 1 1/11011 | signed | | |
| H0207 | Load meter (0-15 bit) | - 0.1% | unsigned | R | |
| H0208 | Load meter (16-31 bit) | 0.1% | unsigned | | |
| H0209, H020A | reserved | - | - | - | |
| H020B | Watt-hour meter (1 kWh step) (0-15 bit) | - 1 kWh | unsigned | D | |
| H020C | Watt-hour meter (1 kWh step) (16-31 bit) | | unsigned | R | |
| H020D | Watt-hour meter (0.1/0.01 kWh step) (0-15 bit) | 0.1/0.01 kWh | unsigned | R | |
| H020E | Watt-hour meter (0.1/0.01 kWh step) (16-31 bit) | 0.1/0.01 KVVN | unsigned | ĸ | |
| H020F to H03FF | reserved | - | - | - | |

Waiting time for the communication line error output after a communication error

Waiting time for the communication error output after a communication line error occurrence can be set.



- When a communication line error occurs and lasts longer than the time set in Pr.500, it is recognized as a communication error.
- If the communication returns to normal within the time, it is not recognized as a communication error, and the operation continues.

| NOTE | _ |
|---|---|
| The communication option error (E. 1) is not included in the targets of Pr.500. | |

• Operations at communication error occurrences can be selected with **Pr.502 Stop mode selection at communication error**. (Refer to page 501.)

• Displaying and clearing the communication error count

The cumulative count of communication error occurrences can be displayed. Write "0" to clear this cumulative count.

| Pr. | | Name | | Setti | ng range | Minimum setting increments | | | Initial value |
|-----|---------------------------------|---|--------|-------|-----------------------|-------------------------------|-------|--------|---------------|
| 501 | Communication occurrence cou | | - | 0 | | 1 | | 0 | |
| | | ning depending on cation line status | Normal | Error | Normal cremented by 1 | | Error | d by 1 | |

- When a communication line error occurs, the setting of Pr.501 Communication error occurrence count display increases by one.
- The cumulative count of communication error occurrences is counted from 0 to 65535. When the count exceeds 65535, the displayed value is cleared and the counting starts over from 0 again.

- NOTE

 Communication error count is temporarily stored in the RAM memory. The error count is stored in EEPROM only once per hour. If power reset or inverter reset is performed, Pr.501 setting will be the one that is last stored to EEPROM depending on the reset timing.

Error reset and Ready bit status selection

- An error reset command from a communication option can be invalidated in the External operation mode or the PU operation mode.
- The status of Ready bit is selectable.

| Pr. | Name | Initial value | Setting range | Description | | |
|------|--|--------------------------------|--|---|--|--|
| 349 | Communication reset selection/ Ready bit status selection/Reset selection after inverter faults are cleared/DriveControl writing restriction selection | 0 | 0, 1, 100, 101, 1000, 1001, 1100, 1101, 10000, 10001, 10100, 10101, 11000, 11001, 11100, 11101 | Use this parameter to select the error reset operation, Ready bit status, inverter reset operation when a fault is cleared, and DriveControl settings. | | |
| N010 | Communication reset selection | ommunication reset selection 0 | | Enables the error reset function in any operation mode. | | |
| NUTU | communication reset selection | 1 | | Enables the error reset function only in the Network operation mode. | | |
| N240 | Ready bit status selection | 0 | 0 | The status of Ready bit in communication data | | |
| N240 | Ready bit status selection | 0 | 1 | can be selected. | | |
| N241 | Reset selection after inverter | 0 | 0 | The inverter is reset when a fault is cleared. | | |
| NZ41 | faults are cleared | 0 | 1 | The inverter is not reset when a fault is cleared. | | |
| N040 | DriveControl writing restriction | 0 | 0 | DriveControl writing is not restricted. | | |
| N242 | selection | 0 | 1 | DriveControl writing is restricted. | | |

• The status of Ready bit in communication data can be changed when an HMS network option is installed. (P.N240)

• When an HMS network option is installed and the communication option is specified for the command source in Network operation mode, it is possible to select whether the inverter is reset after the "Fault reset" command is executed. (P.N241)

 When an HMS network option is installed, the command source to change the DriveControl settings can be restricted to only the command source selected by Pr.550 NET mode operation command source selection. (P.N242)

| | Set | ting val | ue | | | | Desc | ription | | | |
|--------|------|----------|------|------|--------------------------|-------------------------------------|---------------|--|---|--------------------------|--|
| | | | | | | cation reset ction ^{*1} | Ready bit sta | tus selection ^{*2} | Reset | DriveControl | |
| Pr.349 | N010 | N240 | N241 | N242 | NET operation mode | operation NET | | Main circuit: power-OFF ^{*3} | selection after inverter faults are cleared | writing restriction | |
| 0 | 0 | 0 | 0 | 0 | Reset enabled | Reset enabled | Ready bit: ON | Ready bit: ON | Reset | Not restricted | |
| 1 | 1 | 0 | 0 | 0 | Reset enabled | Reset disabled | Ready bit: ON | Ready bit: ON | Reset | Not restricted | |
| 100 | 0 | 1 | 0 | 0 | Reset enabled | Reset enabled | Ready bit: ON | Ready bit: OFF | Reset | Not restricted | |
| 101 | 1 | 1 | 0 | 0 | Reset enabled | Reset disabled | Ready bit: ON | Ready bit: OFF | Reset | Not restricted | |
| 1000 | 0 | 0 | 1 | 0 | Reset enabled | Reset enabled | Ready bit: ON | Ready bit: ON | Not reset ^{*4} | Not restricted | |
| 1001 | 1 | 0 | 1 | 0 | Reset enabled | Reset disabled | Ready bit: ON | Ready bit: ON | Not reset ^{*4} | Not restricted | |
| 1100 | 0 | 1 | 1 | 0 | Reset enabled | Reset enabled | Ready bit: ON | Ready bit: OFF | Not reset ^{*4} | Not restricted | |
| 1101 | 1 | 1 | 1 | 0 | Reset enabled | Reset disabled | Ready bit: ON | Ready bit: OFF | Not reset ^{*4} | Not restricted | |
| 10000 | 0 | 0 | 0 | 1 | Reset enabled | Reset enabled | Ready bit: ON | Ready bit: ON | Reset | Restricted*4 | |
| 10001 | 1 | 0 | 0 | 1 | Reset enabled | Reset disabled | Ready bit: ON | Ready bit: ON | Reset | Restricted ^{*4} | |
| 10100 | 0 | 1 | 0 | 1 | Reset enabled | Reset enabled | Ready bit: ON | Ready bit: OFF | Reset | Restricted ^{*4} | |
| 10101 | 1 | 1 | 0 | 1 | Reset enabled | Reset disabled | Ready bit: ON | Ready bit: OFF | Reset | Restricted*4 | |
| 11000 | 0 | 0 | 1 | 1 | Reset enabled | Reset enabled | Ready bit: ON | Ready bit: ON | Not reset ^{*4} | Restricted*4 | |
| 11001 | 1 | 0 | 1 | 1 | Reset enabled | Reset disabled | Ready bit: ON | Ready bit: ON | Not reset ^{*4} | Restricted ^{*4} | |
| 11100 | 0 | 1 | 1 | 1 | Reset enabled | Reset enabled | Ready bit: ON | Ready bit: OFF | Not reset ^{*4} | Restricted ^{*4} | |
| 11101 | 1 | 1 | 1 | 1 | Reset enabled | Reset disabled | Ready bit: ON | Ready bit: OFF | Not reset ^{*4} | Restricted*4 | |

*1 The operation mode affects the availability of communication reset.

*2 The ON/OFF state of the power supply affects the ON/OFF state of Ready bit.

*3 When either the external 24 V power supply or the control circuit power supply is ON.

*4 Available when the HMS network option is installed.

9.7 Ready bit status selection (Pr.349, N240)

To select the error reset operation at inverter failure

- The status of Ready bit in communication data can be selected when a communication option (FR-A8ND, FR-A8NF, or FR-A8NL) is installed.
- An error reset command from a communication option can be invalidated in the External operation mode or the PU
 operation mode.
- The status of Ready bit is selectable.

| Pr. | Name | Initial value | Setting range | Function | | |
|--------------------|--|---------------|---|--|--|--|
| | Communication reset | | 0, 100 | Error reset is enabled independently of operation mode. | | |
| | selection/Ready bit | | 1, 101 | Error reset is enabled in the Network operation mode. | | |
| 349 ^{*1} | status selection/Reset selection after inverter faults are cleared/ DriveControl writing restriction selection | 0 | 1000, 1001, 1100, 1101, 10000, 10001, 10100, 10101, 11000, 11001, 11100, 11101 | For details, refer to page 685. | | |
| N010 ^{*1} | Communication reset | 0 | 0 | Enables the error reset function in any operation mode. | | |
| | selection | U | 1 | Enables the error reset function only in the Network operation mode. | | |
| N040*1 | Ready bit status | 0 | 0 | The status of Ready bit in communication data can be | | |
| N240 ^{*1} | selection | U | 1 | selected when a communication option is installed. | | |

*1 The setting is available only when a communication option is installed.

Ready bit status selection (P.N240)

The status of Ready bit in communication data can be selected.

| Setting value | | | Description | | | | | | | |
|---------------|------|---|---------------|-------------------|----------------------------|---|--|--|--|--|
| | | | Communication | n reset selection | Ready bit status selection | | | | | |
| Pr.349 | N010 | N240 NET operation mode Other than NET operation mode | | | Main circuit: power- ON | Main circuit: power- OFF ^{*1} | | | | |
| 0 | 0 | 0 | Reset enabled | Reset enabled | Ready bit: ON | Ready bit: ON | | | | |
| 1 | 1 | 0 | Reset enabled | Reset disabled | Ready bit: ON | Ready bit: ON | | | | |
| 100 | 0 | 1 | Reset enabled | Reset enabled | Ready bit: ON | Ready bit: OFF | | | | |
| 101 | 1 | 1 | Reset enabled | Reset disabled | Ready bit: ON | Ready bit: OFF | | | | |

*1 When either the external 24 V power supply or the control circuit power supply is ON.

• FR-A8ND

Class 0x29 Instance 1

| Attribute ID | Access | Name | Data type | Number of data bytes | lnitial value | Range | | Description |
|--------------|--------|-------|--------------|----------------------------|------------------|-------|---|---|
| | | | | | | 0 | Other than the below | |
| 9 | Get | Ready | BOOL | 1 | 1 | 1 | Pr.349 = "0, 1" N240 = "0" | During stop / during acceleration / during constant speed operation / during deceleration / during reverse rotation deceleration |
| | | | | | | | Pr.349 = "100, 101" N240 = "1" | During stop while the RY signal is ON / during acceleration / during constant speed operation / during deceleration / during reverse rotation deceleration |

• FR-A8NF

Inverter status monitor

| Bit | Name | Description | | | | |
|-----|-----------------|--------------|---|--|--|--|
| 14 | READY signal | Reset cancel | Pr.349 = "0, 1" N240 = "0" | 0: During an inverter reset / during startup after power-ON. 1: During normal operation | | |
| 14 | | | Pr.349 = "100, 101" N240 = "1" | 0: RY signal is OFF 1: RY signal is ON | | |

• FR-A8NL

Inverter output signal (network output SNVT_state nvolnvOutputSig)

| Bit | Signal name | Description | | | |
|-----|----------------|---|--|--|--|
| 15 | Ready signal | Pr.349 = "0, 1" N240 = "0" | The value in the bit turns to 1 when the inverter is ready for operation after power-ON. ^{*1} | | |
| 15 | , , | Pr.349 = "100, 101" N240 = "1" | The value in the bit turns to 1 when the RY signal turns ON. | | |

*1 The value in the bit turns to 1 when power is supplied to the control circuit only.

MEMO

REVISIONS

*The manual number is given on the bottom left of the back cover.

| Revision date | *Manual number | Revision |
|---------------|---------------------|---|
| Jul. 2014 | IB(NA)-0600547ENG-A | First edition |
| Aug. 2015 | IB(NA)-0600547ENG-B | Added Setting values "7, 14, and 17" of Pr.554 PID signal operation selection PID control enhanced functions (Pr.111, Pr.1361 to Pr.1381) Pr.1018 Monitor with sign selection MM-EFS (3000 r/min specification) Speed detection signal (FB, FB2) |
| Mar. 2018 | IB(NA)-0600547ENG-C | Added • Start count monitor (Pr.1410 , Pr.1411) • Excitation current low-speed scaling factor (Pr.14 = "12 to 15", Pr.85 , Pr.86 , Pr.565 , Pr.566 , Pr.617) • Backup/restore function • Input signals (JOGF, JOGR) • Output signal (SAFE) • MODBUS RTU communication stop bit length selection • Continuous operation at communication error (Pr.502 = "4") • PID manipulated amount: 0 to 100% (Pr.1015 = "2, 12") • Motor induced voltage constant (Pr.1412 , Pr.1413) • Undervoltage level setting of the 200 V class inverters (Pr.598) • User parameter auto storage function (Pr.675) • User parameter read source selection (Pr.414 = "11, 12") • Reset selection (Pr.75 = "1000 to 1003, 1014 to 1017, 1100 to 1103, 1114 to 1117") • Direct setting selection (Pr.1000) • IP55 compatible model • Compatibility with the FR-A8NF and FR-A8NL |
| Feb. 2019 | IB(NA)-0600547ENG-D | Added Setting values "1000 to 1003, 1010 to 1013" of Pr.162 Automatic restart after instantaneous power failure selection Setting values "109 and 110" of Pr.800 Control method selection Setting value "1" of Pr.1018 Monitor with sign selection N010 Communication reset selection N240 Ready bit status selection |
| Apr. 2020 | IB(NA)-0600547ENG-E | Added • Setting value "11" of Pr.259 Main circuit capacitor life measuring • Pr.506 Display estimated main circuit capacitor residual life • Setting values "11 to 14, 21 to 24" of Pr.573 4 mA input check selection • RLF signal and RLR signal • Input terminal monitor (for terminals S1 and S2) • Reset selection after inverter faults are cleared (with the HMS network option installed) • Compliance with the latest BACnet standard |
| Nov. 2021 | IB(NA)-0600547ENG-F | Added • Cooling fan operation selection during the test operation (Pr.244 = "1000, 1001, 1101 to 1105") • Display/reset ABC relay contact life (Pr.507 , Pr.508) • DriveControl writing restriction selection (Pr.349 = "10000, 10001, 10100, 10101, 11000, 11001, 11100, 11101") • Pr.1346 PID lower limit operation detection time • Pr.890 Internal storage device status indication • Internal storage device fault (E.PE6) |

FR-F800 Series Instruction Manual Supplement

1

Monitoring terminals S1 and S2 (FR Configurator2)

Graph display using FR Configurator2 is supported for terminals S1 and S2 (data from the high speed sampling and the USB trace file).

The state of terminals S1 and S2 can be displayed in graph form using FR Configurator2.

The FR Configurator2 version 1.28E or later supports graph display for terminals S1 and S2.

For details on FR Configurator2, refer to the FR Configurator2 Instruction Manual.

Digital source (monitor item) selection

37

- Terminals S1 and S2 can be selected as digital sources for the trace function.
- Select the digital sources (input/output signals) to be set to **Pr.1038 to Pr.1045** from the following table. When a value other than the ones in the following table is set, "0" (OFF) is applied for indication.

| Setting value | Signal name |
|------------------|----------------|
| 1 | STF |
| 2 | STR |
| 3 | AU |
| 4 | RT |
| 5 | RL |
| 6 | RM |
| 7 | RH |
| 8 | JOG |
| 9 | MRS |
| 10 | STP(STOP) |
| 11 | RES |
| 12 | CS |
| 15 | S2 |
| 16 | S1 |

| Setting | Signal |
|---------|--------|
| value | name |
| 21 | X0 |
| 22 | X1 |
| 23 | X2 |
| 24 | Х3 |
| 25 | X4 |
| 26 | X5 |
| 27 | X6 |
| 28 | X7 |
| 29 | X8 |
| 30 | X9 |
| 31 | X10 |
| 32 | X11 |
| 33 | X12 |
| 34 | X13 |
| 35 | X14 |
| 36 | X15 |
| | |

DY

| Setting | Signal |
|---------|--------|
| value | name |
| 101 | RUN |
| 102 | SU |
| 103 | IPF |
| 104 | OL |
| 105 | FU |
| 106 | ABC1 |
| 107 | ABC2 |
| 121 | DO0 |
| 122 | DO1 |
| 123 | DO2 |
| 124 | DO3 |
| 125 | DO4 |
| 126 | DO5 |
| 127 | DO6 |
| 128 | RA1 |
| 129 | RA2 |
| 130 | RA3 |

2 Note for use with the Type E combination motor controller

When Appendix "Instructions for UL and cUL" in the Instruction Manual (Startup) mentions the Type E combination motor controller, only the MMP-T series controllers with the UL mark affixed are applicable for certification.

FR-F800 Series Instruction Manual Supplement

1 Earth (ground) fault detection at start / restricting reset method for an earth (ground) fault

The reset method for the output side earth (ground) fault overcurrent (E.GF) can be restricted.

- Select whether to enable or disable the earth (ground) fault detection at start. When enabled, the earth (ground) fault detection is performed immediately after a start signal input to the inverter.
- Select whether to restrict the reset method for an earth (ground) fault.

| Pr. | Name | Initial value | Setting range | Description | |
|-------------|---|---------------|---------------|--------------------------------|----------------|
| F1. | Name | | | Earth (ground) fault | Reset method |
| 249 H101 | Earth (ground) fault detection at start | 0 | 0 | Not detected at start | Not restricted |
| | | | 1 | - Detected at start Restricted | NOLIESINCLEO |
| | | | 2 | | Restricted |

Selecting whether to perform the earth (ground) fault detection at start Magneticitiz

- If an earth (ground) fault is detected at start while **Pr.249** = "1 or 2", the output side earth (ground) fault overcurrent (E.GF) is detected and output is shut off.
- Earth (ground) fault detection at start is enabled under V/F control and Advanced magnetic flux vector control.
- · When the Pr.72 PWM frequency selection setting is high, enable the earth (ground) fault detection at start.

NOTE

- · Because the detection is performed at start, output is delayed for approx. 20 ms every start.
- Use **Pr.249** to enable/disable the earth (ground) fault detection at start. During operation, earth (ground) faults are detected regardless of the **Pr.249** setting.

Restricting reset method for an earth (ground) fault

- The reset method when the output is shut off due to the output side earth (ground) fault overcurrent (E.GF) can be restricted. When E.GF occurs while **Pr.249** = "2", E.GF can be reset only by turning OFF the control circuit power.
- This restriction prevents the inverter from being damaged due to repeated reset operations by the other methods such as entering the RES signal.
- When E.GF occurs while Pr.249 = "2", the output short-circuit detection (ALM4) signal can be output.
- For the terminal used to output the ALM4 signal, set "23" (positive logic) or "123" (negative logic) in any of **Pr.190** to **Pr.196 (Output terminal function selection)**.
- If **Pr.249** is set to "2" while the retry function is enabled (**Pr.67** is not set to "0"), no retry is performed even when E.GF occurs.
- If **Pr.249** is set to "2" while the automatic bypass switching after inverter fault is enabled (**Pr.138** is not set to "1"), the operation is not switched to the commercial power supply operation even when E.GF occurs.

- NOTE

- Changing the terminal assignment using **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.
- E.GF is not cleared by turning ON the Fault clear (X51) signal when Pr.249 = "2".
- If E.GF occurs during emergency drive operation when Pr.249 = "2", the output is shut off.

Select the reset operation and fault indication for an output short-circuit.

| Pr. | Name | Initial value | Setting range | Description | |
|------|----------------------|------------------|---------------|---------------------------|----------------|
| F1. | | | | Operation after detection | Reset method |
| 521 | Output short-circuit | 0 | 0 | E.OC1 to E.OC3 | Not restricted |
| H194 | 194 detection | | 1 | E.SCF | Restricted |

- The fault indication for an output short-circuit (E.OC1 to E.OC3, and E.SCF) can be changed by the **Pr.521** setting.
- When an output short-circuit is detected while **Pr.521** = "1", E.SCF is displayed and the inverter output is shut off.
- When E.SCF occurs while **Pr.521** = "1", E.SCF can be reset only by turning OFF the control circuit power. (E.OC1 to E.OC3 can be reset by any reset method.)
- This restriction prevents the inverter from being damaged due to repeated reset operations by the other methods such as entering the RES signal.
- · When E.SCF occurs, the output short-circuit detection (ALM4) signal can be output.
- For the terminal used to output the ALM4 signal, set "23" (positive logic) or "123" (negative logic) in any of **Pr.190** to **Pr.196 (Output terminal function selection)**.
- If the automatic bypass switching after inverter fault is enabled (**Pr.138** is not set to "1"), the operation is not switched to the commercial power supply operation even when E.SCF occurs.

| Operation panel indication | E.SCF | E. | SEF | FR-LU08 indication | Fault |
|---|--|----|-----|-------------------------------------|-------|
| Name | Output short-circuit fault | | | | |
| Description | The inverter output is shut off when an output short-circuit is detected while Pr.521 = "1". When Pr.521 = "0" (initial value), E.OC1, E.OC2, or E.OC3 appears when an output short-circuit is detected. | | | | |
| Check point | int Check for output short-circuit. | | | | |
| Corrective action Check the wiring to make sure that any output short circuit does not occur, then turn OFF the circuit power to reset the inverter. | | | | ot occur, then turn OFF the control | |

- NOTE

- When short-circuit resistance is large, the current does not reach the short-circuit detection level. In such a case, an output short-circuit cannot be detected.
- Changing the terminal assignment using **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.
- E.SCF does not activate the retry function.
- E.SCF is not cleared by turning ON the Fault clear (X51) signal.
- If E.SCF occurs during emergency drive operation, the output is shut off.
- The communication data code for E.SCF is 20 (H14).

3 Extended detection time of the output current and zero current

The setting range of the **Pr.151 Output current detection signal delay time** and **Pr.153 Zero current detection time** is extended.

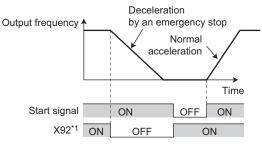
| Pr. | Name | Initial value | Setting range | Description |
|-------------|--|------------------|---------------|---|
| 151 M461 | Output current detection signal delay time | 0 s | 0 to 300 s | Set the output current detection time. Enter the time from when the output current reaches the set current or higher to when the Output current detection (Y12) signal is output. |
| 153 M463 | Zero current detection time | 0.5 s | 0 to 300 s | Set the time from when the output current drops to the Pr.152 setting or lower to when the Zero current detection (Y13) signal is output. |

4 Emergency stop function (Pr.1103)

When a fault occurs in the superordinate controller, the motor can be decelerated by the signal input via an external terminal.

| Pr. | Name | Initial value | Setting range | Description |
|--------------|--|------------------|---------------|---|
| 815 H710 | Torque limit level 2 | 9999 | 0 to 400% | Set the torque limit level at a deceleration by turning ON the X92 signal. |
| H /10 | | | 9999 | The torque limit set to Pr.22 is valid. |
| 1103 F040 | Deceleration time at emergency stop | 5 s | 0 to 3600 s | Set the motor deceleration time at a deceleration by turning ON the X92 signal. |

- The motor will decelerate to stop according to the settings of Pr.1103 Deceleration time at emergency stop and Pr.815 Torque limit level 2 when the Emergency stop (X92) signal is turned OFF (when the contact is opened).
- To input the X92 signal, set "92" in any of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the function to a terminal.
- The X92 signal is a normally closed input (NC contact input).
- "PS" is displayed on the operation panel during activation of the emergency stop function.



*1 ON/OFF indicates the input status of the physical terminal.

🦰 ΝΟΤΕ

• The X92 signals can be assigned to an input terminal by setting **Pr.178 to Pr.189 (Input terminal function selection)**. Changing the terminal assignment may affect other functions. Set parameters after confirming the function of each terminal.

| Model | FR-F800 TORISETSU SHOUSAI EIBUN |
|------------|------------------------------------|
| Model code | 1AJ065 |

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