



INSTRUCTION MANUAL (Applied)

CC-Link communication function

FR-E720-0.1KNC to 15KNC FR-E740-0.4KNC to 15KNC FR-E720S-0.1KNC to 2.2KNC

OUTLINE 1

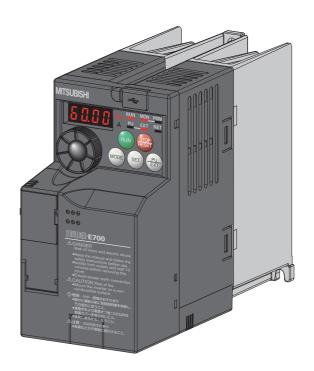
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PRECAUTIONS FOR USE OF THE INVERTER

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Thank you for choosing this Mitsubishi Inverter.

This Instruction Manual (Applied) provides instructions for advanced use of the FR-E700 series CC-Link type inverters. Incorrect handling might cause an unexpected fault. Before using the inverter, always read this Instruction Manual and the Instruction Manual (Basic) [IB-0600401ENG] packed with the product carefully to use the equipment to its optimum performance.

This section is specifically about safety matters

Do not attempt to install, operate, maintain or inspect the inverter until you have read through the Instruction Manual and appended documents carefully and can use the equipment correctly. Do not use this product until you have a full knowledge of the equipment, safety information and instructions.

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

⚠WARNING

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

⚠CAUTION

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

The <u>ACAUTION</u> level may even lead to a serious consequence according to conditions. Both instruction levels must be followed because these are important to personal safety.

1. Electric Shock Prevention

⚠WARNING

- While power is ON or when the inverter is running, do not open the front cover. Otherwise you may get an electric shock.
- Do not run the inverter with the front cover or wiring cover removed. Otherwise you may access the exposed highvoltage terminals or the charging part of the circuitry and get an electric shock.
- Even if power is OFF, do not remove the front cover except for wiring or periodic inspection. You may accidentally touch the charged inverter circuits and get an electric shock.
- Before wiring or inspection, power must be switched OFF. To confirm that, LED indication of the operation panel must be checked. (It must be OFF.) Any person who is involved in wiring or inspection shall wait for at least 10 minutes after the power supply has been switched 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 inverter must be earthed (grounded). Earthing (grounding) must conform to the requirements of national and local safety regulations and electrical code (NEC section 250, IEC 536 class 1 and other applicable standards).
 - A neutral-point earthed (grounded) power supply for 400V class inverter in compliance with EN standard must be used.
- Any person who is involved in wiring or inspection of this equipment shall be fully competent to do the work.
- The inverter must be installed before wiring. Otherwise you may get an electric shock or be injured.
- Setting dial and key operations must be performed with dry hands to prevent an electric shock.
- Do not subject the cables to scratches, excessive stress, heavy loads or pinching. Otherwise you may get an electric shock.
- Do not change the cooling fan while power is ON. It is dangerous to change the cooling fan while power is ON.
- Do not touch the printed circuit board or handle the cables with wet hands. Otherwise you may get an electric shock.
- When measuring the main circuit capacitor capacity, the DC voltage is applied to the motor for 1s at powering OFF.
 Never touch the motor terminal, etc. right after powering OFF to prevent an electric shock.

2. Fire Prevention

MCAUTION

- Inverter must be installed on a nonflammable wall without holes (so that nobody touches the inverter heatsink on the rear side, etc.). Mounting it to or near flammable material can cause a fire.
- If the inverter has become faulty, the inverter power must be switched OFF. A continuous flow of large current could cause a fire.
- When using a brake resistor, a sequence that will turn OFF power when a fault signal is output must be configured. Otherwise the brake resistor may overheat due to damage of the brake transistor and possibly cause a fire.
- Do not connect a resistor directly to the DC terminals P/+ and N/-. Doing so could cause a fire.

3.Injury Prevention

⚠CAUTION

- The voltage applied to each terminal must be the ones 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.
- Polarity must be correct. Otherwise burst, damage, etc. may occur.
- While power is ON or for some time after power-OFF, do not touch the inverter as they will be extremely hot. Doing so can cause burns.

4. Additional Instructions

Also the following points must be noted to prevent an accidental failure, injury, electric shock, etc.

(1) Transportation and Mounting

↑ CAUTION

- The product must be transported in correct method that corresponds to the weight. Failure to do so may lead to injuries.
- Do not stack the boxes containing inverters higher than the number recommended.
- The product must be installed to the position where withstands the weight of the product according to the information in the Instruction Manual.
- Do not install or operate the inverter if it is damaged or has parts missing.
- When carrying the inverter, do not hold it by the front cover or setting dial; it may fall off or fail.
- Do not stand or rest heavy objects on the product.
- The inverter mounting orientation must be correct.
- Foreign conductive objects must be prevented from entering the inverter. That includes screws and metal fragments or other flammable substance such as oil.
- As the inverter is a precision instrument, do not drop or subject it to impact.
- The inverter must be used under the following environment. Otherwise the inverter may be damaged.

Surrounding air temperature	-10°C to +50°C (non-freezing)
Ambient humidity	90%RH or less (non-condensing)
Storage temperature	-20°C to +65°C *1
Atmosphere	Indoors (free from corrosive gas, flammable gas, oil mist, dust and dirt)
Altitude/ vibration	Maximum 1,000m above sea level. 5.9m/s ² or less at 10 to 55Hz (directions of X, Y, Z axes)
	air temperature Ambient humidity Storage temperature Atmosphere

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

ACAUTION

- Do not install a power factor correction capacitor or surge suppressor/capacitor type filter on the inverter output side. These devices on the inverter output side may be overheated or burn out.
- The connection orientation of the output cables U, V, W to the motor affects the rotation direction of the motor.

(3) Trial run

ACAUTION

 Before starting operation, each parameter must be confirmed and adjusted. A failure to do so may cause some machines to make unexpected motions.

(4) Usage

WARNING

- Any person must stay away from the equipment when the retry function is set as it will restart suddenly after trip.
- Since pressing (STOP) RESET key may not stop output depending on the function setting status, separate circuit and switch that make an emergency stop (power OFF, mechanical brake operation for emergency stop, etc.) must be provided.
- OFF status of the start signal must be confirmed before resetting the inverter fault. Resetting inverter alarm with the start signal ON restarts the motor suddenly.
- The inverter must be used for three-phase induction motors.
 Connection of any other electrical equipment to the inverter output may damage the equipment.
- Do not modify the equipment.
- Do not perform parts removal which is not instructed in this manual. Doing so may lead to fault or damage of the product.

⚠CAUTION

- The electronic thermal relay function does not guarantee protection of the motor from overheating. It is recommended to install both an external thermal for overheat protection.
- Do not use a magnetic contactor on the inverter input for frequent starting/stopping of the inverter. Otherwise the life of the inverter decreases.
- The effect of electromagnetic interference must be reduced by using a noise filter or by other means.
 Otherwise nearby electronic equipment may be affected.
- Appropriate measures must be taken to suppress harmonics. Otherwise power supply harmonics from the inverter may heat/damage the power factor correction capacitor and generator.
- When driving a 400V class motor by the inverter, the motor must be an insulation-enhanced motor or measures must be taken to suppress surge voltage. Surge voltage attributable to the wiring constants may occur at the motor terminals, deteriorating the insulation of the motor.
- When parameter clear or all parameter clear is performed, the required parameters must be set again before starting operations because all parameters return to the initial value.
- The inverter can be easily set for high-speed operation.
 Before changing its setting, the performances of the motor and machine must be fully examined.
- Stop status cannot be hold by the inverter's brake function. In addition to the inverter's brake function, a holding device must be installed to ensure safety.
- Before running an inverter which had been stored for a long period, inspection and test operation must be performed.
- For prevention of damage due to static electricity, nearby metal must be touched before touching this product to eliminate static electricity from your body.
- If you are installing the inverter to drive a three-phase device while you are contracted for lighting and power service, consult your electric power supplier.

(5) Emergency stop

ACAUTION

- A safety backup such as an emergency brake must be provided to prevent hazardous condition to the machine and equipment in case of inverter failure.
- When the breaker on the inverter input side trips, the wiring must be checked for fault (short circuit), and internal parts of the inverter for a damage, etc. The cause of the trip must be identified and removed before turning ON the power of the breaker.
- When any protective function is activated, appropriate corrective action must be taken, and the inverter must be reset before resuming operation.

(6) Maintenance, inspection and parts replacement

ACAUTION

 Do not carry out a megger (insulation resistance) test on the control circuit of the inverter. It will cause a failure.

(7) Disposal

ACAUTION

• The inverter must be treated as industrial waste.

General instruction

Many of the diagrams and drawings in this Instruction Manual show the inverter without a cover or partially open for explanation. Never operate the inverter in this manner. The cover must be always reinstalled and the instruction in this Instruction Manual must be followed when operating the inverter.

Harmonic suppression guideline (when inverters are used in .lanan)

All models of general-purpose inverters used by specific consumers are covered by "Harmonic suppression guideline for consumers who receive high voltage or special high voltage". (For further details, *refer to page 37*.)

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MEMO

1 / OUTLINE

This chapter explains the "OUTLINE" for use of this product. Always read the instructions before using the equipment.

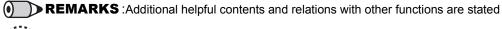
1.1	Product checking and parts identification
1.2	Inverter and peripheral devices3
	Removal and reinstallation of the cover5
1.4	Installation of the inverter and enclosure design 8

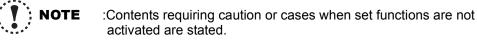
<abbreviations></abbreviations>	
Inverter	Mitsubishi inverter FR-E700 series CC-Link type
FR-E700-NC	Mitsubishi inverter FR-E700 series CC-Link type
Pr	Parameter number (Number assigned to function)
PU operation	Operation using the operation panel
Mitsubishi standard motor	SF-JR
Mitsubishi constant-torque motor	SF-HRCA
Virtual terminal	Input/output device for CC-Link communication. The assigned
	signal (function) can be selected with input/output terminal
	function selection parameters (Pr.180 to Pr.184, Pr.190 to Pr.192,
	Pr.313 to Pr.315).
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<Trademarks>

 Company and product names herein are the trademarks and registered trademarks of their respective owners.

<Marks>





POINT :Useful contents and points are stated.

Parameters referred to: Related parameters are stated.

Specifications differ according to the date assembled. Refer to page 275 to check the SERIAL number.

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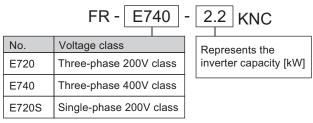
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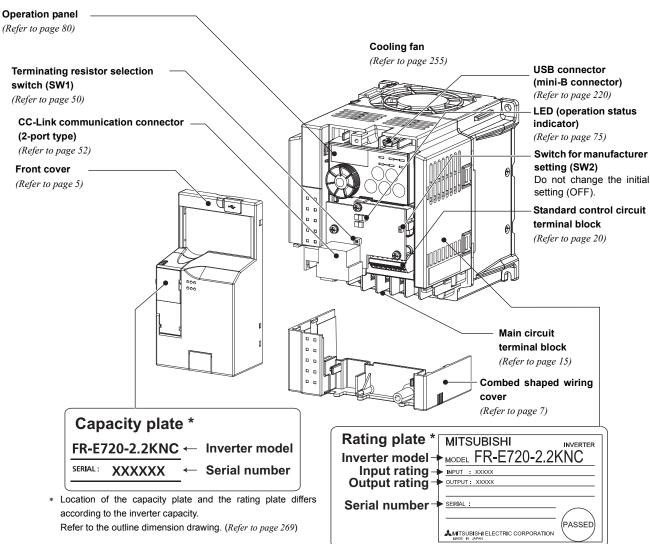
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1.1 Product checking and parts identification

Unpack the inverter and check the capacity plate on the front cover and the rating plate on the inverter side face to ensure that the product agrees with your order and the inverter is intact.

Inverter model





Accessory

· P-clip (for M4 screw)

Use this to ground (earth) the CC-Link dedicated cable. (Refer to page 52)



· Fan cover fixing screws (M3 × 35mm)

These screws are necessary for compliance with the EU Directive (Refer to the Instruction Manual (Basic))

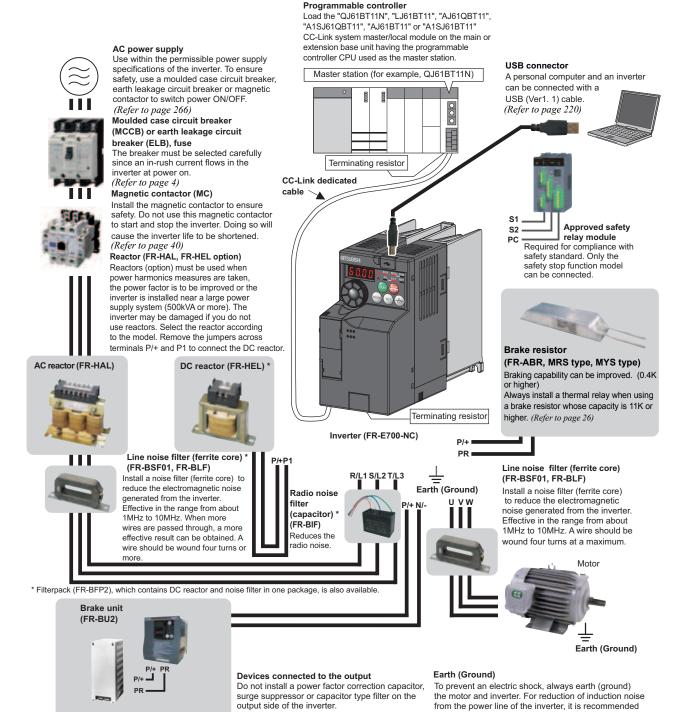
Capacity	Quantity
FR-E720-1.5KNC to 3.7KNC, FR-E740-1.5KNC to 3.7KNC, FR-E720S-0.75KNC to 2.2KNC	1
FR-E720-5.5KNC to 15KNC, FR-E740-5.5KNC to 15KNC	2

REMARKS

For how to find the SERIAL number, refer to page 275.

to wire the earthing cable by returning it to the earth (ground) terminal of the inverter.

Inverter and peripheral devices



NOTE

Resistor unit (FR-BR)

Install this as required.

Discharging resistor (GZG, GRZG)

The regenerative braking capability of the inverter can be exhibited fully.



circuit breaker.

- Up to 42 inverters can be connected when using CC-Link communication.

 The life of the inverter is influenced by 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. (Refer
- to page 8)
 Wrong wiring might lead to damage of the inverter. The control signal lines must be kept fully away from the main circuit to protect them from noise. (Refer to page 14)

 Do not install a power factor correction capacitor, surge suppressor or capacitor type filter on the inverter output side.
- This will cause the inverter to trip or the capacitor and surge suppressor to be damaged. If any of the above devices are connected, immediately remove them. 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. In this case, install options among the radio noise filter FR-BIF (for use in the input side only), and the line noise filter FR-BSF01/FR-BLF to minimize the interference. (Refer
- Refer to the instruction manual of each option and peripheral devices for details of peripheral devices.

When installing a moulded case circuit breaker

on the output side of the inverter, contact each

manufacturer for selection of the moulded case

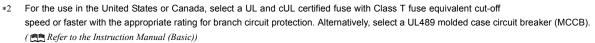
1.2.1 Peripheral devices

Check the inverter model of the inverter you purchased. Appropriate peripheral devices must be selected according to the capacity. Refer to the following list and prepare appropriate peripheral devices:

Applicable Inverter Model		Motor Output (kW)	(MCC or Earth Leakage (ELE	Circuit Breaker CB) *1 e Circuit Breaker B) *2 onnection	*	ontactor (MC) 3 onnection	Rea	ctor
			without	with	without	with	FR-HAL	FR-HEL
	FR-E720-0.1KNC 0.1			5A	S-N10	S-N10	0.4K *4	0.4K *4
			5A	-			_	
	FR-E720-0.2KNC	0.2	5A	5A	S-N10	S-N10	0.4K *4	0.4K *4
\geq	FR-E720-0.4KNC	0.4	5A	5A	S-N10	S-N10	0.4K	0.4K
200V	FR-E720-0.75KNC	0.75	10A	10A	S-N10	S-N10	0.75K	0.75K
Se	FR-E720-1.5KNC	1.5	15A	15A	S-N10	S-N10	1.5K	1.5K
Three-Phase	FR-E720-2.2KNC	2.2	20A	15A	S-N10	S-N10	2.2K	2.2K
<u>4</u>	FR-E720-3.7KNC	3.7	30A	30A	S-N20, S-N21	S-N10	3.7K	3.7K
hre	FR-E720-5.5KNC	5.5	50A	40A	S-N25	S-N20, S-N21	5.5K	5.5K
-	FR-E720-7.5KNC	7.5	60A	50A	S-N25	S-N25	7.5K	7.5K
	FR-E720-11KNC	11	75A	75A	S-N35	S-N35	11K	11K
	FR-E720-15KNC	15	125A	100A	S-N50	S-N50	15K	15K
	FR-E740-0.4KNC	0.4	5A	5A	S-N10	S-N10	H0.4K	H0.4K
>	FR-E740-0.75KNC	0.75	5A	5A	S-N10	S-N10	H0.75K	H0.75K
400V	FR-E740-1.5KNC	1.5	10A	10A	S-N10	S-N10	H1.5K	H1.5K
	FR-E740-2.2KNC	2.2	15A	10A	S-N10	S-N10	H2.2K	H2.2K
has	FR-E740-3.7KNC	3.7	20A	15A	S-N10	S-N10	H3.7K	H3.7K
С	FR-E740-5.5KNC	5.5	30A	20A	S-N20, S-N21	S-N11, S-N12	H5.5K	H5.5K
Three-Phase	FR-E740-7.5KNC	7.5	30A	30A	S-N20, S-N21	S-N20, S-N21	H7.5K	H7.5K
F	FR-E740-11KNC	11	50A	40A	S-N20, S-N21	S-N20, S-N21	H11K	H11K
	FR-E740-15KNC	15	60A	50A	S-N25	S-N20, S-N21	H15K	H15K
>0	FR-E720S-0.1KNC	0.1	5A	5A	S-N10	S-N10	0.4K *4	0.4K *4
200V	FR-E720S-0.2KNC	0.2	5A	5A	S-N10	S-N10	0.4K *4	0.4K *4
Phase	FR-E720S-0.4KNC	0.4	10A	10A	S-N10	S-N10	0.75K *4	0.75K *4
-Ph	FR-E720S-0.75KNC	0.75	15A	10A	S-N10	S-N10	1.5K *4	1.5K *4
Single-I	FR-E720S-1.5KNC	1.5	20A	20A	S-N10	S-N10	2.2K *4	2.2K *4
Sin	FR-E720S-2.2KNC	2.2	40A	30A	S-N20, S-N21	S-N10	3.7K *4	3.7K *4

^{*1 •}Select an MCCB according to the power supply capacity.

[•]Install one MCCB per inverter.



- *3 Magnetic contactor is selected based on the AC-1 class. The electrical durability of magnetic contactor is 500,000 times. When the magnetic contactor is used for emergency stop during motor driving, the electrical durability is 25 times.
 - When using the MC for emergency stop during motor driving or using on the motor side during commercial-power supply operation, select the MC with class AC-3 rated current for the motor rated current.
- *4 The power factor may be slightly lower.

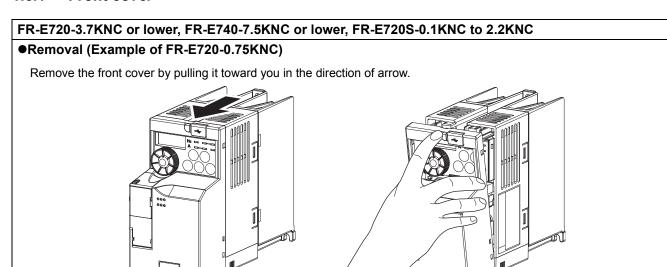


- When the inverter capacity is larger than the motor capacity, select an MCCB and a magnetic contactor according to the inverter model and cable and reactor according to the motor output.
- When the breaker on the inverter input side trips, check for a wiring fault (short circuit), damage to internal parts of the inverter, etc. Identify the cause of the trip, then remove the cause and power on the breaker.

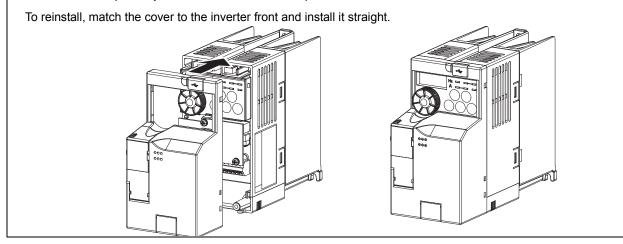


1.3 Removal and reinstallation of the cover

1.3.1 Front cover



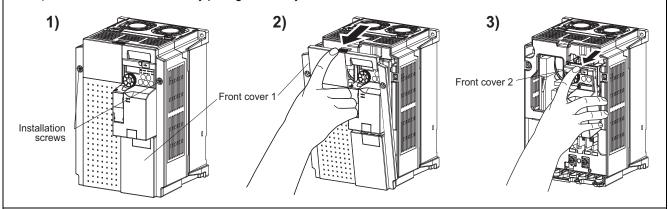
●Reinstallation (Example of FR-E720-0.75KNC)



FR-E720-5.5KNC or higher, FR-E740-11KNC or higher

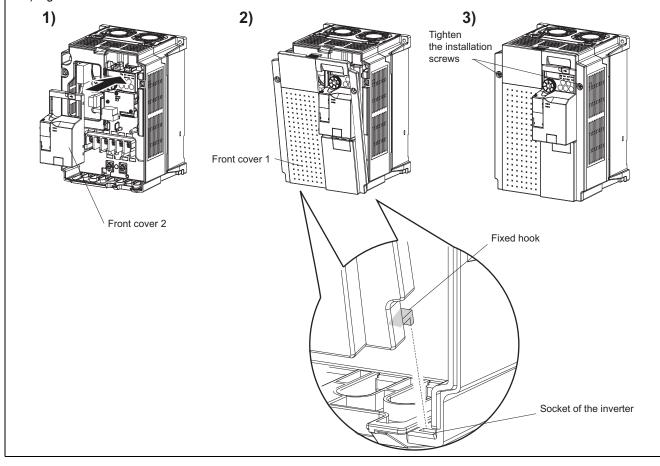
●Removal (Example of FR-E720-5.5KNC)

- 1) Loosen the installation screws of the front cover 1.
- 2) Remove the front cover 1 by pulling it toward you in the direction of arrow.
- 3) Remove the front cover 2 by pulling it toward you in the direction of arrow.



● Reinstallation (Example of FR-E720-5.5KNC)

- 1) Match the front cover 2 to the inverter front and install it straight.
- 2) Insert the two fixed hooks on the lower side of the front cover 1 into the sockets of the inverter.
- 3) Tighten the screw of the front cover 1.



7

- Fully make sure that the front cover has been reinstalled securely.
- The same serial number is printed on the capacity plate of the front cover and the rating plate of the inverter. Since these plates have the same serial numbers, always reinstall the removed cover onto the original inverter.

1.3.2 Wiring cover

•Removal and reinstallation

The cover can be removed easily by pulling it toward you. To reinstall, fit the cover to the inverter along the guides.

, , , , , , , , , , , , , , , , , , , ,	
FR-E720-0.1KNC to 0.75KNC FR-E720S-0.1KNC to 0.4KNC	FR-E720-1.5KNC to 3.7KNC FR-E740-0.4KNC to 3.7KNC FR-E720S-0.75KNC to 2.2KNC
Guide Wiring cover	Guide Wiring cover
Example of FR-E720-0.75KNC	Example of FR-E740-3.7KNC
	FR-E720-5.5KNC to 15KNC
FR-E740-5.5KNC, 7.5KNC	FR-E740-11KNC, 15KNC
Guide Wiring cover	
Dent	Guide Wiring cover
For removal, push the dent on the wiring cover with your finger and	
pull toward you. Example of FR-E740-5.5KNC	Example of FR-E720-5.5KNC

1.4 Installation of the inverter and enclosure design

When an inverter enclosure is to be designed and manufactured, heat generated by contained equipment, etc., the environment of an operating place, and others must be fully considered to determine the enclosure structure, size and equipment layout. The 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.

1.4.1 Inverter installation environment

As the inverter installation environment should satisfy the standard specifications indicated in the following table, operation in any place that does not meet these conditions not only deteriorates the performance and life of the inverter, but also causes a failure. Refer to the following points and take adequate measures.

Environmental standard specifications of inverter

Item	Description
Surrounding air temperature	-10 to +50°C (non-freezing)
Ambient humidity	90%RH or less (non-condensing)
Atmosphere	Indoors (free from corrosive gas, flammable gas, oil mist, dust and dirt)
Maximum altitude	1,000m or less
Vibration	5.9m/s ² or less at 10 to 55Hz (directions of X, Y, Z axes)

(1) Temperature

The permissible surrounding air temperature of the inverter is between -10 and +50°C. 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 so that the surrounding air temperature of the inverter falls within the specified range.

- 1) Measures against high temperature
 - Use a forced ventilation system or similar cooling system. (Refer to page 10)
 - Install the panel in an air-conditioned electrical 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 panel well.
- 2) 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.)
- 3) 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.

(2) Humidity

Normally operate the inverter within the 45 to 90% range of the ambient humidity. Too high humidity will pose problems of reduced insulation and metal corrosion. On the other hand, too low humidity may produce a spatial electrical breakdown. The insulation distance specified in JEM1103 "Control Equipment Insulator" is defined as humidity 45 to 85%.

- 1) Measures against high humidity
 - Make the panel enclosed, and provide it with a hygroscopic agent.
 - · Take dry air into the enclosure from outside.
 - Provide a space heater in the enclosure.
- 2) Measures against low humidity

What is important in fitting or inspection of the unit in this status is to discharge your body (static electricity) beforehand and keep your body from contact with the parts and patterns, besides blowing air of proper humidity into the panel from outside.

3) Measures against condensation

Condensation may occur if frequent operation stops change the in-panel 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 in 1).
- Do not power OFF the inverter. (Keep the start signal of the inverter OFF.)



(3) Dust, dirt, oil mist

Dust and dirt will cause such faults as poor contact of contact points, reduced insulation or reduced cooling effect due to moisture absorption of accumulated dust and dirt, and in-panel temperature rise due to clogged filter. In the 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.

Countermeasures

- Place in a totally enclosed enclosure.
 Take measures if the in-enclosure temperature rises. (Refer to page 10)
- Purge air.

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

(4) 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 Section 3.

(5) 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.

(6) Highland

Use the inverter at the altitude of within 1000m. 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.

(7) Vibration, impact

The vibration resistance of the inverter is up to 5.9m/s^2 at 10 to 55 Hz frequency and 1mm amplitude for the directions of X, Y, Z axes. Vibration or impact, if less than the specified value, applied for a long time may make the mechanism loose or cause poor contact to the connectors.

Especially when impact is imposed repeatedly, caution must be taken as the part pins are likely to break.

Countermeasures

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

1.4.2 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-panel temperature lower than the permissible temperatures of the in-panel equipment including the inverter.

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

- 1) Cooling by natural heat dissipation from the enclosure surface (totally enclosed type)
- 2) Cooling by heatsink (aluminum fin, etc.)
- 3) Cooling by ventilation (forced ventilation type, pipe ventilation type)
- 4) Cooling by heat exchanger or cooler (heat pipe, cooler, etc.)

	Cooling System	Enclosure Structure	Comment				
Natural	Natural ventilation (enclosed, open type)	INV	Low in cost and generally used, but the enclosure size increases as the inverter capacity increases. For relatively small capacities.				
cooling	Natural ventilation (totally enclosed type)	INV	Being a totally enclosed type, the most appropriate for hostile environment having dust, dirt, oil mist, etc. The enclosure size increases depending on the inverter capacity.				
	Fin cooling	Heatsink NV	Having restrictions on the heatsink mounting position and area, and designed for relative small capacities.				
Forced cooling	Forced ventilation		For general indoor installation. Appropriate for enclosure downsizing and cost reduction, and often used.				
	Heat pipe	Heat pipe	Totally enclosed type for enclosure downsizing.				



1.4.3 Inverter placement

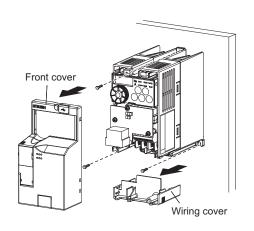
(1) Installation of the inverter

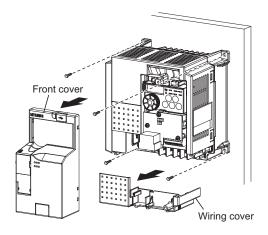
Enclosure surface mounting

Remove the front cover and wiring cover to fix the inverter to the surface. (Remove the covers in the directions of the arrows.)

- FR-E720-0.1KNC to 0.75KNC
- FR-E720S-0.1KNC to 0.4KNC

- FR-E720-1.5KNC or higher
- FR-E740-0.4KNC or higher
- FR-E720S-0.75KNC or higher

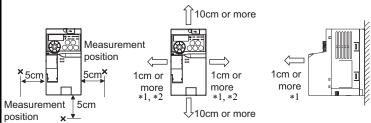


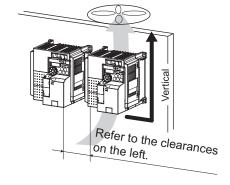




Note

- When encasing multiple inverters, install them in parallel as a cooling measure.
- · Install the inverter vertically.
- For heat dissipation and maintenance, take at least the clearances shown in the table below from the inverter to the other devices and to the enclosure surface.





- -10 °C to +50 °C (non-freezing)
- Take 5cm or more clearances for 5.5K or higher.
- *2 When using the inverters at the surrounding air temperature of 40°C or less, the inverters can be installed without any clearance between them (0cm clearance).

(2) Above 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.

(3) Arrangement of multiple inverters

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

When mounting multiple inverters, fully take caution not to make the surrounding air temperature of the inverter higher than the permissible value by providing ventilation and increasing the enclosure size.

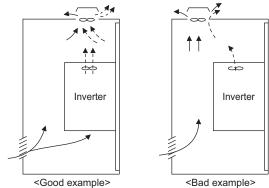
Inverter Inverter Inverter Inverter Guide Guide Guide Inverter Inverter **Enclosure Enclosure**

(a) Horizontal arrangement Arrangement of multiple inverters

(b) Vertical arrangement

(4) Arrangement of 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 the air flow. (Air passes through areas of low resistance. Make an airway and airflow plates to expose the inverter to cool air.)



Placement of ventilation fan and inverter

2 WIRING

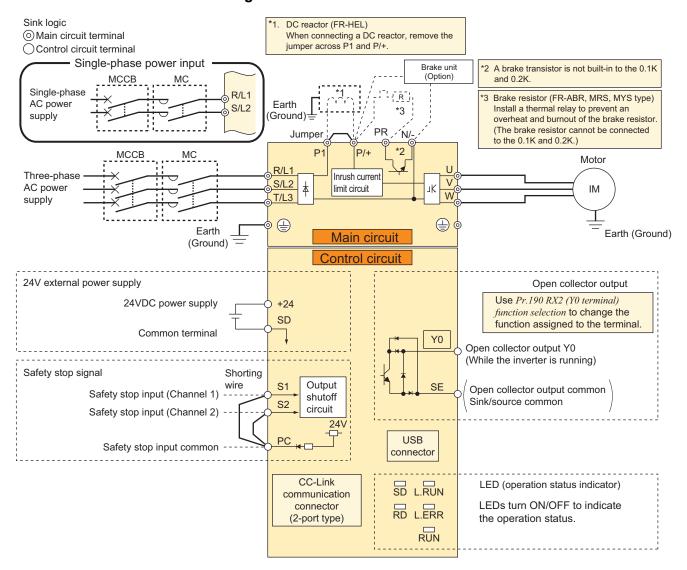
This chapter describes the basic "WIRING" for use of this product.

Always read the instructions before using the equipment.

2.1	Wiring	. 14
	Main circuit terminal specifications	
	Control circuit specifications	
	Connection of stand-alone ontion unit	26

2.1 Wiring

2.1.1 Terminal connection diagram





- To prevent a malfunction caused by noise, separate the signal cables more than 10cm from the power cables. Also, separate the main circuit cables of the input side from the main circuit cables of the output side.
- After wiring, cables offcuts must not be left in the inverter.
 Wire offcuts can cause an alarm, 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 output of the single-phase power input model is three-phase 200V.



2.2 Main circuit terminal specifications

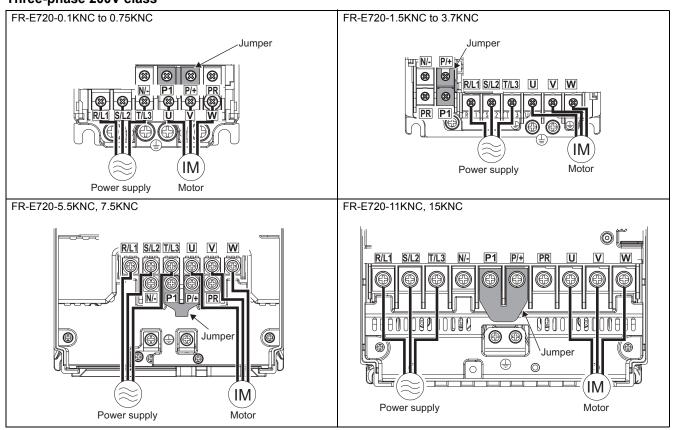
2.2.1 Specification of main circuit terminal

Terminal	Terminal Name	Description
Symbol	Terminal Name	Description
R/L1,		
S/L2,	AC power input	Connect to the commercial power supply.
T/L3 *1		
U, V, W	Inverter output	Connect a three-phase squirrel-cage motor.
		Connect a brake resistor (FR-ABR, MRS type, MYS type) across terminals P/+ and
P/+, PR	Brake resistor connection	PR.
		(The brake resistor cannot be connected to the 0.1K or 0.2K.)
P/+, N/-	Brake unit connection	Connect a brake unit (FR-BU2).
P/+, P1	DC reactor connection	Remove the jumper across terminals P/+ and P1 and connect a DC reactor.
	Earth (Ground)	For earthing (grounding) the inverter chassis. Must be earthed (grounded).

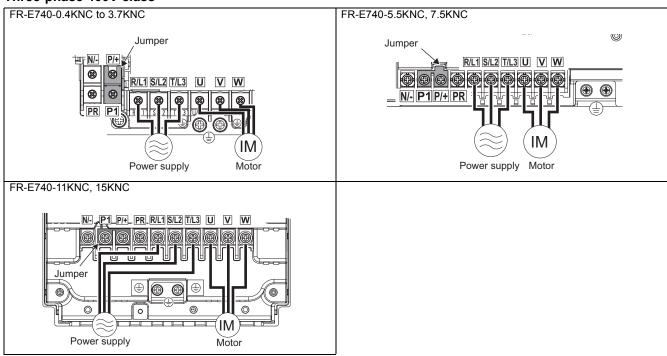
^{*1} When using a single-phase power input model, terminals are R/L1 and S/L2.

2.2.2 Terminal arrangement of the main circuit terminal, power supply and the motor wiring

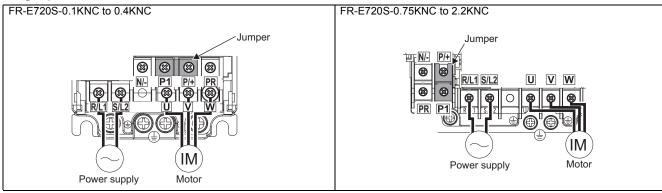
Three-phase 200V class



Three-phase 400V class



Single-phase 200V class





- Make sure the power cables are connected to the R/L1, S/L2, T/L3. (Phase need not be matched.) Never connect the power cable to the U, V, W of the inverter. Doing so will damage the inverter.
- Connect the motor to U, V, W. Turning ON the forward rotation switch (signal) at this time rotates the motor counterclockwise when viewed from the load shaft.



2.2.3 Cables and wiring length

(1) Applicable cable size

Select the recommended cable size to ensure that a voltage drop will be 2% or less.

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

The following table indicates a selection example for the wiring length of 20m.

Three-phase 200V class (when input power supply is 220V)

			Cri	mping				Cab	le Size				
Applicable Inverter	_	Tightening	Terminal		HIV (HIV Cables, etc. (mm ²) *1			VG *2	PVC Cables, etc. (mm ²) *3			
Model	Screw Size *4	Torque N·m	R/L1 S/L2 T/L3	U, V, W	R/L1 S/L2 T/L3	U, V, W	Earthing (grounding) cable	R/L1 S/L2 T/L3		R/L1 S/L2 T/L3	U, V, W	c. (mm²) *3 Earthing grounding) cable 2.5 2.5 4 6	
FR-E720-0.1KNC to	M3.5	1.2	2-3.5	2-3.5	2	2	2	14	14	2.5	2.5	2.5	
0.75KNC	1013.5	1010.5	1.2	2-3.3	2-0.0	_	2	2		14	2.0	2.0	2.0
FR-E720-1.5KNC,	M4	1.5	2-4	2-4	2	2	2	14	14	2.5	2.5	2.5	
2.2KNC	1014	1.5	2-4	2-4	_	2	2	14	14	2.5	2.5	2.5	
FR-E720-3.7KNC	M4	1.5	5.5-4	5.5-4	3.5	3.5	3.5	12	12	4	4	4	
FR-E720-5.5KNC	M5	2.5	5.5-5	5.5-5	5.5	5.5	5.5	10	10	6	6	6	
FR-E720-7.5KNC	M5	2.5	14-5	8-5	14	8	5.5	6	8	16	10	6	
FR-E720-11KNC	M5	2.5	14-5	14-5	14	14	14	6	6	16	16	16	
FR-E720-15KNC	M6(M5)	4.4	22-6	22-6	22	22	14	4	4	25	25	16	

Three-phase 400V class (when input power supply is 440V)

			Crin	nping				Cab	le Size			
Applicable Inverter	Terminal		Ter	minal	HIV Cables, etc. (mm ²) *			AV	/G *2	PVC (Cables, e	etc. (mm²) *3
Model	Screw Size *4	Torque N·m	R/L1 S/L2 T/L3	U, V, W	R/L1 S/L2 T/L3	U, V, W	Earthing (grounding) cable	R/L1 S/L2 T/L3	u, v, w	R/L1 S/L2 T/L3	u, v, w	Earthing (grounding) cable
FR-E740-0.4KNC to 3.7KNC	M4	1.5	2-4	2-4	2	2	2	14	14	2.5	2.5	2.5
FR-E740-5.5KNC	M4	1.5	5.5-4	2-4	3.5	2	3.5	12	14	4	2.5	4
FR-E740-7.5KNC	M4	1.5	5.5-4	5.5-4	3.5	3.5	3.5	12	12	4	4	4
FR-E740-11KNC	M4	1.5	5.5-4	5.5-4	5.5	5.5	8	10	10	6	6	10
FR-E740-15KNC	M5	2.5	8-5	8-5	8	8	8	8	8	10	10	10

Single-phase 200V class (when input power supply is 220V)

			Crin	nping				Cabl	e Size			
Applicable Inverter	Terminal	0	Terminal		HIV C	ables, e	etc. (mm²) *1	AWG *2		PVC Cables, etc. (mm ²) *3		
Model	Screw Size *4	Torque N·m	R/L1 S/L2	U, V, W	R/L1 S/L2	U, V, W	Earthing (grounding) cable	R/L1 S/L2	u, v, w	R/L1 S/L2	u, v, w	Earthing (grounding) cable
FR-E720S-0.1KNC to 0.4KNC	M3.5	1.2	2-3.5	2-3.5	2	2	2	14	14	2.5	2.5	2.5
FR-E720S-0.75KNC	M4	1.5	2-4	2-4	2	2	2	14	14	2.5	2.5	2.5
FR-E720S-1.5KNC	M4	1.5	2-4	2-4	2	2	2	14	14	2.5	2.5	2.5
FR-E720S-2.2KNC	M4	1.5	5.5-4	2-4	3.5	2	2	12	14	4	2.5	2.5

- *1 The cable size is that of the cable (HIV cable (600V class 2 vinyl-insulated cable) etc.) with continuous maximum permissible temperature of 75°C. Assumes that the surrounding air temperature is 50°C or less and the wiring distance is 20m or less.
- *2 The recommended cable size is that of the cable (THHW cable) with continuous maximum permissible temperature of 75°C. Assumes that the surrounding air temperature is 40°C or less and the wiring distance is 20m or less. (Selection example for use mainly in the United States.)
- *3 The recommended cable size is that of the cable (PVC cable) with continuous maximum permissible temperature of 70°C. Assumes that the surrounding air temperature is 40°C or less and the wiring distance is 20m or less. (Selection example for use mainly in Europe.)
- *4 The terminal screw size indicates the terminal size for R/L1, S/L2, T/L3, U, V, W, and a screw for earthing (grounding).

 A screw for earthing (grounding) of the FR-E720-15KNC is indicated in ().

 (For single-phase power input, the terminal screw size indicates the size of terminal screw for R/L1, S/L2, U, V, W, PR, P/+, N/-, P1 and a screw for earthing (grounding).)



NOTE

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

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

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

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

(2) Earthing (Grounding) precautions

- Always earth (ground) the motor and inverter.
 - 1) 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 flow into the case. The purpose of earthing (grounding) the case of an electrical apparatus is to prevent operator from getting an electric shock from this leakage current when touching it.

To avoid the influence of external noises, this earthing (grounding) is important to audio equipment, sensors, computers and other apparatuses that handle low-level signals or operate very fast.

2) Earthing (grounding) methods and earthing (grounding) work

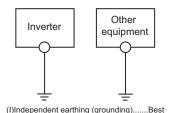
As described previously, earthing (grounding) is roughly classified into an electrical shock prevention type and a noise-affected malfunction prevention type. Therefore, these two types should be discriminated clearly, and the following work must be done to prevent the leakage current having the inverter's high frequency components from entering the malfunction prevention type earthing (grounding):

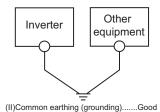
(a)If possible, use (I) independent earthing (grounding) in figure below for the inverter. If independent earthing (grounding) is not available, use (II) joint earthing (grounding) in the figure below which the inverter is connected with the other equipment at an earthing (grounding) point. The (III) common earthing (grounding) as in the figure below, which inverter shares a common earthing (grounding) cable with the other equipment, must be avoided.

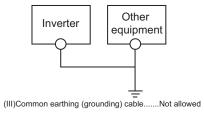
A leakage current including many high frequency components flows in the earthing cables of the inverter and inverter-driven motor. Therefore, use the independent earthing (grounding) and separate the earthing (grounding) cable of the inverter from equipment sensitive to EMI.

In a high building, it may be effective to use the EMI prevention type earthing (grounding) connecting to an iron structure frame, and electric shock prevention type earthing (grounding) with the independent earthing (grounding) together.

- (b)This inverter must be earthed (grounded). Earthing (Grounding) must conform to the requirements of national and local safety regulations and electrical codes. (NEC section 250, IEC 536 class 1 and other applicable standards).
- Use an neutral-point earthed (grounded) power supply for 400V class inverter in compliance with EN standard. (c)Use the thickest possible earthing (grounding) cable. The earthing (grounding) cable size should be no less than the
- size indicated in the table on the *page 17*. (d)The grounding point should be as close as possible to the inverter, and the ground wire length should be as short as possible.
- (e)Run the earthing (grounding) cable as far away as possible from the I/O wiring of equipment sensitive to noises and run them in parallel in the minimum distance.









POINT

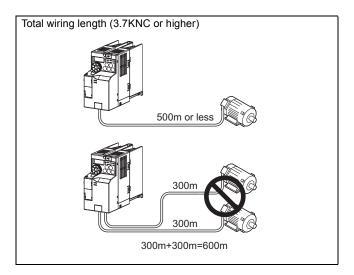
To be compliant with the EU Directive (Low Voltage Directive), refer to the Instruction Manual (Basic).



(3) Total wiring length

The overall wiring length for connection of a single motor or multiple motors should be within the value in the table below.

Pr. 72 PWM frequency selection Setting (carrier frequency)		0.1K	0.2K	0.4K	0.75K	1.5K	2.2K	3.7K or higher
1 (1kHz) or less	200V class	200m	200m	300m	500m	500m	500m	500m
1 (18112) 01 1655	400V class	-	-	200m	200m	300m	500m	500m
2 to15	200V class	30m	100m	200m	300m	500m	500m	500m
(2kHz to 14.5kHz)	400V class	-	-	30m	100m	200m	300m	500m



When driving a 400V class motor by the inverter, surge voltages attributable to the wiring constants may occur at the motor terminals, deteriorating the insulation of the motor. (Refer to page 124)



- Especially for long-distance wiring, the inverter may be affected by a charging current caused by the stray capacitances of the wiring, leading to a malfunction of the overcurrent protective function, fast response current limit function, or stall prevention function or a malfunction or fault of the equipment connected on the inverter output side. If malfunction of fast-response current limit function occurs, disable this function. If malfunction of stall prevention function occurs, increase the stall level. (Refer to page 120 for Pr. 22 Stall prevention operation level and Pr. 156 Stall prevention operation selection)
- Refer to page 192 for details of Pr. 72 PWM frequency selection.
- When using the automatic restart after instantaneous power failure function with wiring length exceeding 100m, select without frequency search (Pr. 162 = "1 (initial value), 11"). (Refer to page 180)

2.3 Control circuit specifications

2.3.1 Control circuit terminal

indicates that terminal functions can be selected using Pr.190 RX2 (terminal Y0) function selection. (Refer to page 167).

(1) Input signal

Туре	Terminal	Terminal Name	Description	Rated Specifications	Referto
Турс	Symbol	Terminal Hame	Description	Nated Opecifications	Page
power supply	+24	24V external power supply	Even when the main circuit power supply is OFF, CC-Link communication continues with the input from the 24V external power supply.	Input voltage 23.5 to 26.5VDC Input current 0.7A or less	23
24V external p	SD	24V external power supply common terminal	Common terminal for the terminal +24		
	S1	Safety stop input (Channel 1)	Terminal S1/S2 are safety stop signals for use with in conjunction with an approved external safety unit. Both	Input resistance 4.7kΩ	
Safety stop function	S2	Safety stop input (Channel 2)	terminal S1/S2 must be used in dual channel form. Inverter output is shutoff depending on shorting/ opening between S1 and PC, S2 and PC. In the initial status, terminal S1 and S2 are shorted with terminal PC by shorting wire. Remove the shorting wire and connect the safety relay module when using the safety stop function. Voltage when contagency are open 21 to 26VDC When contacts are circuited 4 to 6mADC		24
	PC	Safety stop input terminal common	Common terminal for safety stop input terminals S1 and S2.		

(2) Output signal

Туре	Terminal	Terminal Name	Description	Rated Specifications	Refer to			
.,,,,	Symbol	101111111111111111111111111111111111111	2000	Trained operations	Page			
Open collector	YO	Open collector output Y0 (Inverter running)	brake operation. (Low indicates that the open collector output transistor	Permissible load 24VDC (maximum 27VDC) 0.1A (a voltage drop is 3.4V maximum when the signal is ON)	24, 167			
	SE	Open collector output common	Common terminal of terminal Y0.					

(3) Communication

CC-Link communication can be performed with the CC-Link communication connector.

Туре	Connector Name	Pin Arrangement	Pin Numb		Signal Name	Communication Connector Plug		Refer to Page
				1	DA	One-touch connector f communication	or CC-Link	
~	∠ CONA 5 4 3 2 1		CONA	2	DB			
CC-Link	CONB	CONA CONB	CONB	3	DG			52
	CONB	CONB	CONB	4	NC	Model Name	Manufacturer	
						A6CON-L5P	Mitsubishi Electric Corporation	
				5	SLD	35505-6000-B0M GF	Sumitomo 3M Limited	

Type	Terminal	Terminal Name	Description	
Туре	Symbol			
USB	_	USB connector	The FR Configurator can be operated by connecting the inverter to the personal computer through USB. • Interface: conforms to USB1.1 • Transmission speed: 12Mbps • Connector: USB mini B connector (receptacle mini B type)	220

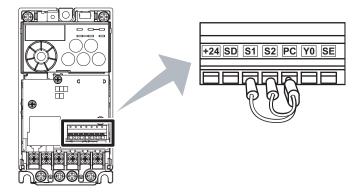


2.3.2 Wiring of control circuit

(1) Control circuit terminal model

Recommend wire size:

0.3mm² to 0.75mm²



(2) Wiring method

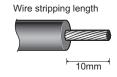
Wiring

Use a blade terminal and a wire with a sheath stripped off for the control circuit wiring. For a single wire, strip off the sheath of the wire and apply directly.

Insert the blade terminal or the single wire into a socket of the terminal.

1) Strip off the sheath about the size below. If the length of the sheath peeled is too long, a short circuit may occur among neighboring wires. If the length is too short, wires might come off.

Wire the stripped wire after twisting it to prevent it from becoming loose. In addition, do not solder it.

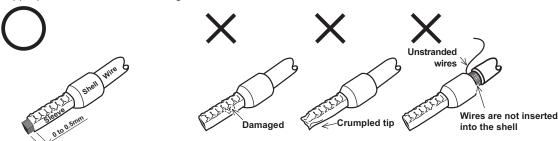






2) Crimp the blade terminal.

Insert wires to a blade terminal, and check that the wires come out for about 0 to 0.5 mm from a sleeve. Check the condition of the blade terminal after crimping. Do not use a blade terminal of which the crimping is inappropriate, or the face is damaged.



Blade terminals available on the market (as of January 2010)

Phoenix Contact Co.,Ltd.

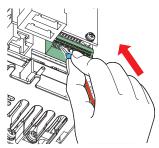
Mino Cino (mano2)		Blade terminal		
Wire Size (mm ²)	with insulation sleeve	without insulation sleeve	for UL wire*	crimping tool
0.3	AI 0,5-10WH	_	_	
0.5	AI 0,5-10WH	_	AI 0,5-10WH-GB	
0.75	AI 0,75-10GY	A 0,75-10	AI 0,75-10GY-GB	CRIMPFOX 6
1	AI 1-10RD	A1-10	AI 1-10RD/1000GB	CRIMPFOX
1.25, 1.5	AI 1,5-10BK	A1,5-10	_	
0.75 (for two wires)	AI-TWIN 2 x 0,75-10GY	_	_	

^{*} A blade terminal with an insulation sleeve compatible with MTW wire which has a thick wire insulation

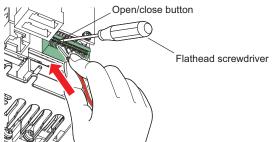
●NICHIFU Co.,Ltd.

Wire Size (mm²) Blade terminal product number		Insulation product number	Blade terminal crimping tool	
0.3 to 0.75	BT 0.75-11	VC 0.75	NH 67	

3) Insert the wire into a socket.



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



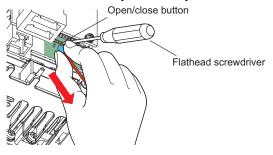


NOTE

- When using a stranded wire without a blade 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 to damage of inverter or injury.

Wire removal

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





NOTE

- Pulling out the terminal block forcefully without pushing the open/close button all the way down may damage the terminal block.
- Use a small flathead screwdriver (Tip thickness: 0.4mm/tip width: 2.5mm).

If a flathead screwdriver with a narrow tip is used, terminal block may be damaged.

Introduced products (as of January 2010)

Product	Туре	Manufacturer	
Flathead screwdriver	SZF 0- 0,4 x 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 to damage of inverter or injury.

(3) Control circuit common terminals (SD, SE)

Terminals SD and SE are common terminals for I/O signals. (Both common terminals are isolated from each other.) Do not earth them.

Terminal SD is a common terminal for the 24V external power supply terminal (+24). The open collector circuit is isolated from the internal control circuit by photocoupler.

Terminal SE is a common terminal for the open collector output terminal (Y0). The contact input circuit is isolated from the internal control circuit by photocoupler.

(4) Wiring instructions

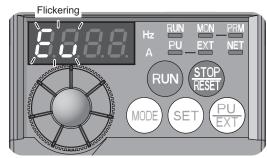
- 1) It is recommended to use the cables of 0.3mm² to 0.75mm² gauge for connection to the control circuit terminals.
- 2) The maximum wiring length should be 30m.
- 3) Do not short across terminals +24 and SD. It may cause a failure to the external power supply.
- 4) Use shielded or twisted cables for connection to the control circuit terminals and run them away from the main and power circuits (including the 200V relay sequence circuit).



2.3.3 Connecting the 24V external power supply

CC-Link communication between the master module and the inverter can be continued while the main power circuit is OFF if the 24V external power supply is connected across terminals +24 and SD. When the main circuit power supply is turned ON, the power supply changes from the 24V external power supply to the main circuit power supply.

- (1) Specification of the applied 24V external power supply
 - Input voltage 23.5 to 26.5VDC
 - Input current 0.7A or less
- (2) Confirming the 24V external power supply
 - "EV" flickers in the monitor display on the operation panel while the 24V external power is being supplied. The 24V external power supply operation signal (EV) is also output. For the EV signal, assign the function to the terminal Y0 or a virtual terminal of CC-Link communication by setting "68 (positive logic) or 168 (negative logic)" in *Pr. 190 to Pr. 192* or *Pr. 313 to Pr. 315 (Output terminal function selection)*.



- (3) Function of the 24V external power supply operation
 - When the main power supply is turned ON during the 24V external power supply operation, a reset is performed in the inverter, then the power supply changes to the main circuit power supply. During the reset operation in the inverter, the inverter cannot be controlled through the CC-Link communication.
 - The operation stops when the power supply changes to the 24V external power supply from the main circuit power supply regardless of the operating status (in a stop, in running, in automatic restart after instantaneous power failure, in offline tuning, in main circuit capacitor life measurement).
 - All start signals (STF signal, STR signal, and (RUN) on the operation panel) are invalid during the 24V external power supply operation.
 - Faults 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 also valid during the 24V external power supply operation. When the safety stop function is active, however, "SA" is not displayed because "EV" is displayed. The "EV" display has priority over the "SA" display.
 - The following items can be monitored during the 24V external power supply operation:
 Frequency setting, output current peak value*, converter output voltage peak value*, cumulative energization time, actual operation time*, cumulative power*, PID set point, PID measured value, PID deviation, and cumulative power 2* (dedicated to CC-Link communication)
 - * The monitored data is not updated after the power supply is changed from the main circuit power supply. (Refer to *page 176* for the details of each monitor.)
 - The valid signals when the 24V external power supply is ON are EV, SAFE, SAFE2, Y90, Y91, Y95, REM, LF, and ALM. (Other signals are OFF.)
 (Refer to page 167 for the detail of each signal.)
 - 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 24V external power supply. Perform the inverter reset to reset the alarms.
 - The retry function is invalid for all alarms when the 24V external power supply is ON.
 - If the power supply changes from the main circuit power supply to the 24V 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").



- When the 24V external power supply is input while the main circuit power supply is OFF, the CC-Link communication is enabled, but the inverter operation is disabled.
- Inrush current higher than the value described in (1) may flow at a power-ON. Confirm that the power supply and
 other devices are not affected by the inrush current and the voltage drop caused by it.
- 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.
- "E.SAF" may appear when the start-up time of the 24V power supply is too long in the 24V external power supply operation.

2.3.4 Safety stop function war up

(1) Description of the function

The terminals related to the safety stop function are shown below.

Terminal Syr	nbol	Description			
S1 *1		For input of safety stop channel 1.	Between S1 and PC / S2 and PC Open: In safety stop state.		
S2 *1		For input of safety stop channel 2.	Short: Other than safety stop state.		
PC *1		Common terminal for terminal S1 and S2.			
Y0 or virtual terminal of CC-Link	SAFE signal *3	Outputs the safety stop status. The signal is output when inverter output is shut off due to the safety stop function.	OFF: Drive enabled or drive stop (at an internal safety circuit failure*5) ON: Drive stop (no internal safety circuit failure*5)		
communication*2	SAFE2 signal *4	Outputs when an alarm or failure is detected. The signal is output when no internal safety circuit failure s exists.	OFF: Internal safety circuit failure*5 ON: No internal safety circuit failure*5		
SE		Common terminal for open collector outputs (terminal Y0)			

- *I In the initial status, terminals S1 and S2 are shorted with terminal PC by shortening wire. Remove the shortening wire and connect the safety relay module when using the safety stop function.
- *2 Inverter running (RUN signal) is assigned to the terminal Y0 in the initial status. (Refer to page 167)
- *3 To use the SAFE signal, set "80 (positive logic) or 180 (negative logic)" in any of Pr. 190 to Pr. 192 or Pr. 313 to Pr. 315 (Output terminal function selection) to assign the function. (Refer to page 167)
- *4 To use the SAFE2 signal, set "81 (positive logic) or 181 (negative logic)" in any of Pr. 190 to Pr. 192 or Pr. 313 to Pr. 315 (Output terminal function selection) to assign the function. (Refer to page 167)
- *5 At an internal safety circuit failure, one of E.SAF, E.6, E.7, and E.CPU is displayed on the operation panel.

Ver. UP Specifications differ according to the date assembled. Refer to page 275 to check the SERIAL number.



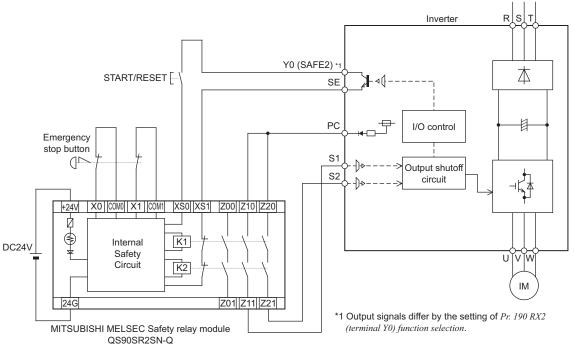
NOTE

- Hold the ON or OFF status for 2ms or longer to input signal to terminal S1 or S2. Signal input shorter than 2ms is not recognized.
- Use SAFE signal to monitor safety stop status. SAFE signal cannot be used as safety stop input signal to other devices (other than the safety relay module).
- SAFE 2 signal can only be used to output an alarm or to prevent restart of an inverter. The signal cannot be used as safety stop input signal to other devices.

(2) Wiring connection diagram

To prevent restart at fault occurrence, connect terminals Y0 (SAFE 2 signal) and SE to terminals XS0 and XS1, which are the feedback input terminals of the safety relay module.

By setting Pr. 190 RX2 (terminal Y0) function selection = "81 (SAFE2 signal)", terminal RUN is turned OFF at fault occurrence.





NOTE

• Changing the terminal assignment of SAFE or SAFE2 signal using Pr. 190 RX2 (terminal Y0) function selection may affect the other functions. Set parameters after confirming the function of terminal Y0.



(3) Safety stop function operation

Input	Input Input signal		Internal safety circuit*1	Output signal		Inverter operation enable signal
power	S1-PC	S2-PC	internal Salety Circuit*	SAFE*3	SAFE2*3	inverter operation enable signal
OFF		_	_	OFF	OFF	Output shutoff (Safe state)
	Short	Short	No failure	OFF	ON	Drive enabled
			Failure	OFF	OFF	Output shutoff (Safe state)
ON	Open	Open	No failure *2	ON	ON	Output shutoff (Safe state)
ON			Failure	OFF	OFF	Output shutoff (Safe state)
	Short Open Failure		Failure	OFF	OFF	Output shutoff (Safe state)
	Open	Short	Failure	OFF	OFF	Output shutoff (Safe state)

- *1 At an internal safety circuit failure, one of E.SAF, E.6, E.7, and E.CPU is displayed on the operation panel.
- *2 SA is displayed when both of the S1 and S2 signals are in open status and no internal safety circuit failure exists.
- *3 ON: Transistor used for an open collector output is conducted. OFF: Transistor used for an open collector output is not conducted.

For more details, refer to the Safety stop function instruction manual (BCN-A211508-004). (Refer to the front cover of the Instruction Manual (Basic) for how to obtain the manual.)

2.4 Connection of stand-alone option unit

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 corresponding option unit manual.

2.4.1 Connection of a dedicated external brake resistor (MRS type, MYS type, FR-ABR) (0.4K or higher)

Install a dedicated brake resistor (MRS type, MYS type, FR-ABR) outside when the motor is made to run by the load, quick deceleration is required, etc. Connect a dedicated brake resistor (MRS type, MYS type, FR-ABR) to terminal P/+ and PR. (For the locations of terminal P/+ and PR, refer to the terminal block layout (page 15).) Set parameters below.

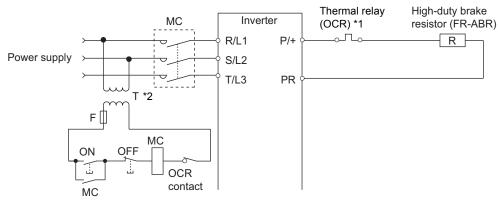
Connected Brake Resistor	Pr. 30 Regenerative function selection Setting	Pr. 70 Special regenerative brake duty Setting		ke duty Setting	
MRS type, MYS type	0 (initial value)		_		
MYS type (used at 100% torque / 6%ED)	1	6%		D of an 40 mm = 155	
FR-ABR	1	7.5K or less 10% 11K or more 6%		Refer to page 155	
FR-ABR	ı				

FR-E720-0.4KNC, 0.75KNC FR-E720S-0.4KNC	FR-E720-1.5KNC to 3.7KNC FR-E740-0.4KNC to 3.7KNC FR-E720S-0.75KNC to 2.2KNC
Connect the brake resistor across terminals P/+ and PR.	Connect the brake resistor across terminals P/+ and PR.
Jumper *1 Terminal P/+ Terminal PR Brake resistor	Jumper *1 Terminal PR Brake resistor
FR-E720-5.5KNC to 15KNC	FR-E740-5.5KNC to 15KNC
Connect the brake resistor across terminals P/+ and PR.	Connect the brake resistor across terminals P/+ and PR.
Jumper *1 Brake resistor	Jumper *1*2 Terminal P/+ Terminal PR Brake resistor

- *1 Do not remove the jumper across terminals P/+ and P1 except when connecting a DC reactor.
- *2 The shape of jumper differs according to capacities.



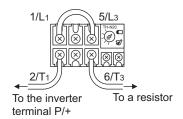
It is recommended to configure a sequence, which shuts off power in the input side of the inverter by the external thermal relay as shown below, to prevent overheat and burnout of the brake resistor (MRS type, MYS type) and high duty brake resistor (FR-ABR) in case the regenerative brake transistor is damaged. (The brake resistor cannot be connected to the 0.1K and 0.2K.)



- *1 Refer to the table below for the type number of each capacity of thermal relay and the diagram below for the connection. (Always install a thermal relay when using a brake resistor whose capacity is 11K or higher)
- *2 When the power supply is 400V class, install a stepdown transformer.

Power Supply Voltage	Brake Resistor	Thermal Relay Type (Mitsubishi product)	Contact Rating
	MRS120W200	TH-N20CXHZ-0.7A	
	MRS120W100	TH-N20CXHZ-1.3A	110VAC 5A,
200V	MRS120W60	TH-N20CXHZ-2.1A	220VAC 2A(AC11 class)
2007	MRS120W40	TH-N20CXHZ-3.6A	110VDC 0.5A,
	MYS220W50 (two units in parallel)	TH-N20CXHZ-5A	220VDC 0.25A(DC11class)

Power Supply	High-duty Brake Resistor	Thermal Relay Type (Mitsubishi product)	Contact Rating
Voltage	FR-ABR-0.4K	TH-N20CXHZ-0.7A	
	FR-ABR-0.75K	TH-N20CXHZ-0.7A	
	FR-ABR-2.2K	TH-N20CXHZ-2.1A	
	FR-ABR-3.7K	TH-N20CXHZ-3.6A	
200V	FR-ABR-5.5K	TH-N20CXHZ-5A	
	FR-ABR-7.5K	TH-N20CXHZ-6.6A	
	FR-ABR-11K	TH-N20CXHZ-11A	110VAC 5A,
	FR-ABR-15K	TH-N20CXHZ-11A	220VAC 2A(AC11 class)
	FR-ABR-H0.4K	TH-N20CXHZ-0.24A	110VDC 0.5A,
	FR-ABR-H0.75K	TH-N20CXHZ-0.35A	,
	FR-ABR-H1.5K	TH-N20CXHZ-0.9A	220VDC 0.25A(DC11 class)
	FR-ABR-H2.2K	TH-N20CXHZ-1.3A	
400V	FR-ABR-H3.7K	TH-N20CXHZ-2.1A	
	FR-ABR-H5.5K	TH-N20CXHZ-2.5A	
	FR-ABR-H7.5K	TH-N20CXHZ-3.6A	
	FR-ABR-H11K	TH-N20CXHZ-6.6A	
	FR-ABR-H15K	TH-N20CXHZ-6.6A	





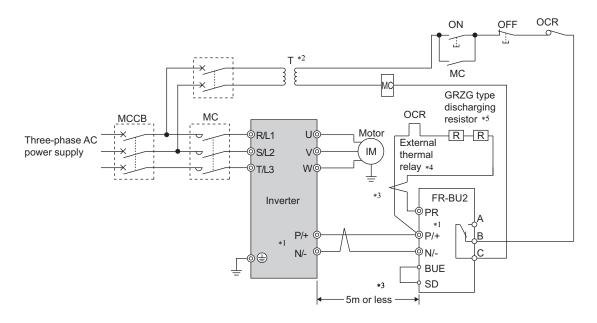
NOTE

- The brake resistor connected should only be the dedicated brake resistor.
- Perform wiring and operation according to the Instruction Manual of each option unit.
- Brake resistor can not be used with the brake unit, high power factor converter, power supply regeneration converter, etc.
- Do not use the brake resistor (MRS type, MYS type) with a lead wire extended.
- Do not connect a resistor directly to the terminals P/+ and N/-. This could cause a fire.

2.4.2 Connection of the brake unit (FR-BU2)

Connect the brake unit (FR-BU2(-H)) as shown below to improve the braking capability at deceleration. If the transistors in the brake unit should become faulty, the resistor can be unusually hot. To prevent unusual overheat and fire, install a magnetic contactor on the inverter's input side to configure a circuit so that a current is shut off in case of fault.

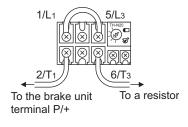
(1) Connection example with the GRZG type discharging resistor



- Connect the inverter terminals (P/+ and N/-) and brake unit (FR-BU2) terminals so that their terminal names match with each other.
 - (Incorrect connection will damage the inverter and brake unit.)
- When the power supply is 400V class, install a step-down transformer.
- The wiring distance between the inverter, brake unit (FR-BU2) and discharging resistor should be within 5m. Even when the wiring is twisted, the cable length must not exceed 10m.
- It is recommended to install an external thermal relay to prevent overheat of discharging resistors.
- Refer to FR-BU2 manual for connection method of discharging resistor.

<Recommended external thermal relay>

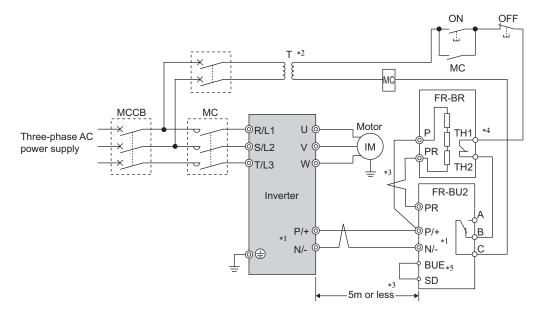
Brake Unit	Discharging Resistor	Recommended External
Diake Uliit	Discharging Resistor	Thermal Relay
FR-BU2-1.5K	GZG 300W-50Ω (one)	TH-N20CXHZ 1.3A
FR-BU2-3.7K	GRZG 200-10 Ω (three in series)	TH-N20CXHZ 3.6A
FR-BU2-7.5K	GRZG 300-5 Ω (four in series)	TH-N20CXHZ 6.6A
FR-BU2-15K	GRZG 400-2 Ω (six in series)	TH-N20CXHZ 11A
FR-BU2-H7.5K	GRZG 200-10 Ω (six in series)	TH-N20CXHZ 3.6A
FR-BU2-H15K	GRZG 300-5 Ω (eight in series)	TH-N20CXHZ 6.6A





- Set "1" in *Pr. 0 Brake mode selection* of the FR-BU2 to use GRZG type discharging resistor.
 Do not remove the jumper across terminals P/+ and P1 except when connecting a DC reactor.

(2) Connection example with the FR-BR(-H) type resistor



- Connect the inverter terminals (P/+ and N/-) and brake unit (FR-BU2) terminals so that their terminal names match
 - (Incorrect connection will damage the inverter and brake unit.)
- When the power supply is 400V class, install a step-down transformer.
- The wiring distance between the inverter, brake unit (FR-BU2) and resistor unit (FR-BR) should be within 5m. Even when the wiring is twisted, the cable length must not exceed 10m.
- The contact between TH1 and TH2 is closed in the normal status and is open at a fault.
- A jumper is connected across BUE and SD in the initial status.

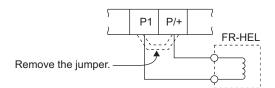


Do not remove the jumper across terminals P/+ and P1 except when connecting a DC reactor.

Connection of the DC reactor (FR-HEL)

When using the DC reactor (FR-HEL), connect it across terminals P/+ and P1.

In this case, the jumper connected across terminals P/+ and P1 must be removed. Otherwise, the reactor will not exhibit its performance.





- The wiring distance should be within 5m.

 The size of the cables used should be equal to or larger than that of the power supply cables (R/L1, S/L2, T/L3). (Refer

MEMO

PRECAUTIONS FOR USE OF THE INVERTER

This chapter explains the "PRECAUTIONS FOR USE OF THE INVERTER" for use of this product.

Always read the instructions before using the equipment.

3.1	EMC and leakage currents	32
3.2	Installation of power factor improving reactor	39
3.3	Power-OFF and magnetic contactor (MC)	40
3.4	Inverter-driven 400V class motor	41
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3.1 EMC and leakage currents

3.1.1 Leakage currents and countermeasures

Capacitances exist between the inverter I/O cables, other cables and earth and in the motor, through which a leakage current flows. Since its value depends on the static capacitances, carrier frequency, etc., low acoustic noise operation at the increased carrier frequency of the inverter will increase the leakage current. Therefore, take the following measures. Select the earth leakage current breaker according to its rated sensitivity current, independently of the carrier frequency setting.

(1) To-earth (ground) leakage currents

Leakage currents may flow not only into the inverter's own line but also into the other lines through the earthing (grounding) cable, etc. These leakage currents may operate earth (ground) leakage circuit breakers and earth leakage relays unnecessarily.

Suppression technique

- 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 for harmonic and surge suppression in the inverter's own line and other line, operation can be performed with the carrier frequency kept high (with low noise).
- •To-earth (ground) leakage currents
 - Take caution as long wiring will increase the leakage current. Decreasing the carrier frequency of the inverter reduces the leakage current.
 - Increasing the motor capacity increases the leakage current. The leakage current of the 400V class is larger than that of the 200V class.

(2) Line-to-line leakage currents

Harmonics of leakage currents flowing in static capacitances between the inverter output cables may operate the external thermal relay unnecessarily. When the wiring length is long (50m or more) for the 400V class small-capacity model (7.5kW(SC) or less), 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 data example (200V class)

Motor Capacity	Rated Motor	Leakage Current (mA) *			
(kW)	Current (A)	Wiring length 50m	Wiring length 100m		
0.4	1.8	310	500		
0.75	3.2	340	530		
1.5	5.8	370	560		
2.2	8.1	400	590		
3.7	12.8	440	630		
5.5	19.4	490	680		
7.5	25.6	535	725		

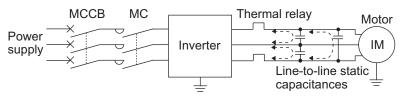
•Motor: SF-JR 4P

•Carrier frequency: 14.5kHz

•Used wire: 2mm², 4 cores

Cabtyre cable

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



Line-to-line leakage currents path

Measures

- 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 moulded case circuit breaker

Install a moulded case circuit breaker (MCCB) on the power receiving side to protect the wiring of the inverter input side. Select the 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, one of 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.



(3) Selection of rated sensitivity current of earth (ground) leakage current breaker

When using the earth leakage current breaker with the inverter circuit, select its rated sensitivity current as follows, independently of the PWM carrier frequency.

Ign:

 Breaker designed for harmonic and surge suppression

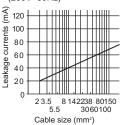
Rated sensitivity current: I∆n≥10×(Ig1+Ign+Igi+Ig2+Igm)

· Standard breaker

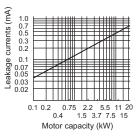
Rated sensitivity current:

 $|\Delta n \ge 10 \times \{|g1+|gn+|gi+3 \times (|g2+|gm)\}|$

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



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



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

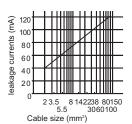
Leakage current of inverter input side noise filter

Igm: Leakage current of motor during commercial power

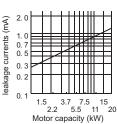
supply operation

lgi: Leakage current of inverter unit

Example of leakage current per 1km during the commercial power supply operation when the CV cable is routed in metal conduit (Three-phase three-wire delta connection 400V60Hz)

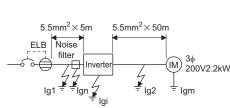


Example of leakage current of threephase induction motor during the commercial power supply operation (Totally-enclosed fan-cooled type motor 400V60Hz)



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

<Example>



		Breaker Designed for		
		Harmonic and Surge	Standard Breaker	
		Suppression		
	Leakage current lg1 (mA)	33 ×5r	n = 0.17	
	Leakage ourient ig t (iii) (i	100	0m	
	Leakage current Ign (mA)	0 (without noise filter)		
	Leakage current lgi (mA)	1		
٧	Leakage current lg2 (mA)	50	m = 1.65	
	Leakage current igz (IIIA)	33 ×	0m	
	Motor leakage current Igm (mA)	0.	18	
	Total leakage current (mA)	3.00	6.66	
	Rated sensitivity current (mA)	30	100	
	(≥lg × 10)	30	100	



NOTE

- Install the earth leakage breaker (ELB) on the input side of the inverter.
- In the A connection earthed-neutral system, the sensitivity current is blunt against an earth (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 536 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 less than the rating.
 - In this case, do not install the breaker since the eddy current and hysteresis loss will increase, leading to temperature rise.
- General products indicate the following models. BV-C1, BC-V, NVB, NV-L, NV-G2N, NV-G3NA, NV-2F earth leakage relay (except NV-ZHA), NV with AA neutral wire open-phase protection

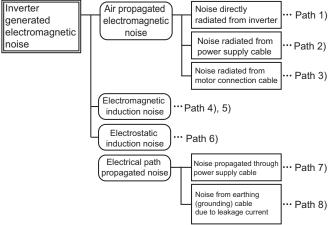
The other models are designed for harmonic and surge suppressionNV-C/NV-S/MN series, NV30-FA, NV50-FA, BV-C2, earth leakage alarm breaker (NF-Z), NV-ZHA, NV-H

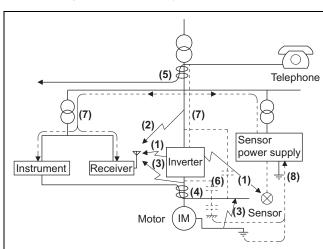
3.1.2 EMC measures

Some electromagnetic noises enter the inverter to malfunction it and others are radiated by the inverter to malfunction peripheral devices. Though the inverter is designed to have high immunity performance, it handles low-level signals, so it requires the following basic techniques. Also, since the inverter chops outputs at high carrier frequency, that could generate electromagnetic noises. If these electromagnetic noises cause peripheral devices to malfunction, EMI measures should be taken to suppress noises. These techniques differ slightly depending on EMI paths.

- (1) Basic techniques
 - 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 twisted shield cables for the detector connecting and control signal cables and connect the sheathes of the shield cables to terminal SD.
 - · Earth (Ground) the inverter, motor, etc. at one point.
- (2) Techniques to reduce electromagnetic noises that enter and malfunction the inverter (Immunity measures) When devices that generate many electromagnetic noises (which use magnetic contactors, magnetic brakes, many relays, for example) are installed near the inverter and the inverter may be malfunctioned by electromagnetic noises, the following measures must be taken:
 - Provide surge suppressors for devices that generate many electromagnetic noises to suppress electromagnetic noises.
 - Fit data line filters (page 35) to signal cables.
 - · Earth (Ground) the shields of the detector connection and control signal cables with cable clamp metal.
- (3) Techniques to reduce electromagnetic noises that are radiated by the inverter to malfunction peripheral devices (EMI measures)

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





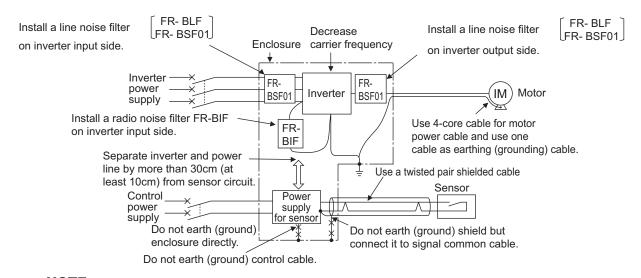


Propagation Path	Measures
	When devices that handle low-level signals and are liable to malfunction due to electromagnetic noises, e.g.
	instruments, receivers and sensors, are contained in the enclosure that contains the inverter or when their signal
	cables are run near the inverter, the devices may be malfunctioned by air-propagated electromagnetic noises. The
	following measures must be taken:
(1)(2)(3)	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.
	Insert a line noise filter into I/O and capacitors between the input lines to suppress cable-radiated noises.
	• Use shield cables as signal cables and power cables and run them in individual metal conduits to produce further effects.
	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 malfunction the devices and the following measures must be taken:
(4)(5)(6)	Install easily affected devices as far away as possible from the inverter.
(4)(3)(0)	Run easily affected signal cables as far away as possible from the I/O cables of the inverter.
	• Do not run the signal cables and power cables (inverter I/O cables) in parallel with each other and do not bundle them.
	• Use shield cables as signal cables and power cables and run them in individual metal conduits to produce further effects.
	When the power supplies of the peripheral devices are connected to the power supply of the inverter in the same line,
(7)	inverter-generated noises may flow back through the power supply cables to malfunction the devices and the
(1)	following measures must be taken:
	• Install the line noise filter (FR-BLF, FR-BSF01) to the power cables (output cable) of the inverter.
	When a closed loop circuit is formed by connecting the peripheral device wiring to the inverter, leakage currents may
(8)	flow through the earthing (grounding) cable of the inverter to malfunction the device. In such a case, disconnection of
	the earthing (grounding) cable of the device may cause the device to operate properly.

●Data line filter

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

EMC measures



NOTE

For compliance with the EU EMC directive, please refer to the Instruction Manual (Basic).

3.1.3 Power supply harmonics

The inverter may generate power supply harmonics from its converter circuit to affect the power generator, power 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.

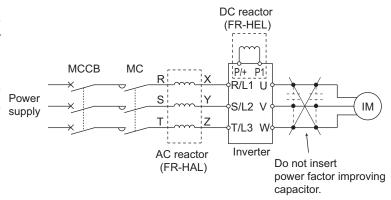
•The differences between harmonics and RF noises are indicated below:

Item	Harmonics	Noise
Frequency	Normally 40th to 50th degrees or less	High frequency (several 10kHz to 1GHz order)
requency	(up to 3kHz or less)	riigh hequency (several Toki iz to TOTIZ order)
Environment	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 load capacity	Change with current variation ratio (larger as switching
Generated amount	Nearly proportional to load capacity	speed increases)
Affected equipment immunity	Specified in standard per equipment	Different depending on maker's equipment specifications
Suppression example	Provide reactor.	Increase distance.

Suppression technique

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 they 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.



3.1.4 Harmonic Suppression Guidelines in Japan

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 200V input specifications 3.7kW or lower (single-phase 200V power input model 2.2kW or lower are previously covered by "Harmonic Suppression Guidelines for Household Appliances and General-purpose Products" and other models are covered by "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 "Harmonic Suppression Guidelines for Household Appliances and General-purpose Products" in January 2004 and "Harmonic Suppression Guidelines 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 covered by "Harmonic Suppression Guidelines for Consumers Who Receive High Voltage or Special High Voltage" (hereinafter referred to as "Specific Consumer Guidelines").

This guideline sets forth the maximum values of harmonic currents outgoing from a high-voltage or especially high-voltage 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.

Table 1 Maximum Values of Outgoing Harmonic Currents per 1kW Contract Power

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

(1) Application for specific consumers

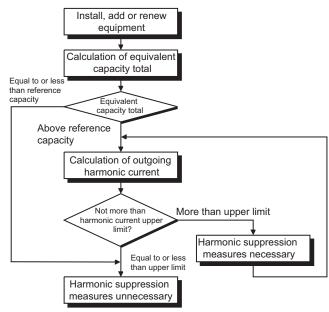


Table 2 Conversion Factors for FR-E700 Series

Class		Circuit Type		
		Without reactor	K31= 3.4	
2	Three-phase bridge	With reactor (AC side)	K32 = 1.8	
3	(Capacitor smoothing)	With reactor (DC side)	K33 = 1.8	
		With reactors (AC, DC sides)	K34 = 1.4	
4	Single-phase bridge	Without reactor	K41= 2.3	
4	(Capacitor smoothing)	With reactor (AC side)	K42 = 0.35 *	

^{*} K42=0.35 is a value when the reactor value is 20%. Since a 20% reactor is large and considered to be not practical, K42=1.67 is written as conversion factor for a 5% reactor in the technical data JEM-TR201 of The Japan Electrical Manufacturers' Association and this value is recommended for calculation for the actual practice.

Table 3 Equivalent Capacity Limits

Received Power Voltage	Reference Capacity
6.6kV	50kVA
22/33 kV	300kVA
66kV or more	2000kVA

[&]quot;Specific Consumer Guidelines"

7

Table 4 Harmonic Contents (Values at the fundamental current of 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
Three-phase bridge	Used (AC side)	38	14.5	7.4	3.4	3.2	1.9	1.7	1.3
(Capacitor smoothing)	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
Single-phase bridge	Not used	50	24	5.1	4.0	1.5	1.4	-	-
(Capacitor smoothing)	Used (AC side) *	6.0	3.9	1.6	1.2	0.6	0.1	-	-

^{*} The harmonic contents for "single-phase bridge/with reactor" in the table 4 are values when the reactor value is 20%. Since a 20% reactor is large and considered to be not practical, harmonic contents when a 5% reactor is used is written in the technical data JEM-TR201 of The Japan Electrical Manufacturers' Association and this value is recommended for calculation for the actual practice.

1) Calculation of equivalent capacity (P0) of harmonic generating equipment

The "equivalent capacity" is the capacity of a 6-pulse converter converted from the capacity of consumer's harmonic generating equipment and is calculated with the following equation. If the sum of equivalent capacities is higher than the limit in Table 3, harmonics must be calculated with the following procedure:

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

Ki: Conversion factor (refer to Table 2)

Pi: Rated capacity of harmonic generating equipment*[kVA]

i: Number indicating the conversion circuit type

* Rated capacity: Determined by the capacity of the applied motor and found in Table 5. It should be noted that the rated capacity used here is used to calculate generated harmonic amount and is different from the power supply capacity required for actual inverter drive.

2) Calculation of outgoing harmonic current

Outgoing harmonic current = fundamental wave current (value converted from received power voltage) \times operation ratio \times harmonic content

- Operation ratio: Operation ratio = actual load factor x operation time ratio during 30 minutes
- · Harmonic content: Found in Table 4.

Table 5 Rated Capacities and Outgoing Harmonic Currents for Inverter Drive

Applicable	Rated Current [A]		Fundamental Wave Current Converted	Rated Capacity	Outg		rmonic lo react					(mA)
Motor (kW)	200V	400V	from 6.6kV (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

³⁾ Application of the guideline for specific consumers

If the outgoing harmonic current is higher than the maximum value per 1kW contract power \times contract power, a harmonic suppression technique is required.

4) Harmonic suppression techniques

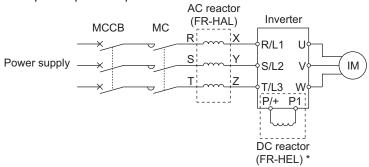
No.	Item	Description
1	Reactor installation	Install an AC reactor (FR-HAL) on the AC side of the inverter or a DC reactor (FR-HEL) on its DC side
•	(FR-HAL, FR-HEL)	or both to suppress outgoing harmonic currents.
2	Installation of power factor	When used with a series reactor, the power factor improving capacitor has an effect of absorbing
	improving capacitor	harmonic currents.
3	Transformer multi-phase	Use two transformers with a phase angle difference of 30° as in \curlywedge -Δ, Δ-Δ combination to provide an
3	operation	effect corresponding to 12 pulses, reducing low-degree harmonic currents.
4	Passive filter	A capacitor and a reactor are used together to reduce impedances at specific frequencies, producing a
4	(AC filter)	great effect of absorbing harmonic currents.
	Active filter	This filter detects the current of a circuit generating a harmonic current and generates a harmonic
5	(Active filter)	current equivalent to a difference between that current and a fundamental wave current to suppress a
	(total o mior)	harmonic current at a detection point, providing a great effect of absorbing harmonic currents.

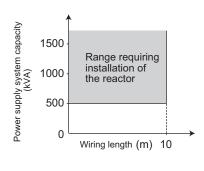


3.2 Installation of power factor improving reactor

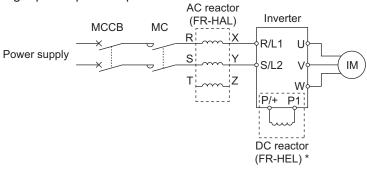
When the inverter is connected near a large-capacity power transformer (500kVA or more) or when a power capacitor is to be switched over, an excessive peak current may flow in the power input circuit, damaging the converter circuit. To prevent this, always install an optional reactor (FR-HAL, FR-HEL).

Three-phase power input





Single-phase power input



* When connecting the FR-HEL, remove the jumper across terminals P/+ and P1.
The wiring length between the FR-HEL and inverter should be 5m maximum and minimized.

⊕ R

> REMARKS

• Use the same wire size as that of the power supply wire (R/L1, S/L2, T/L3). (Refer to page 17)

3.3 Power-OFF and magnetic contactor (MC)

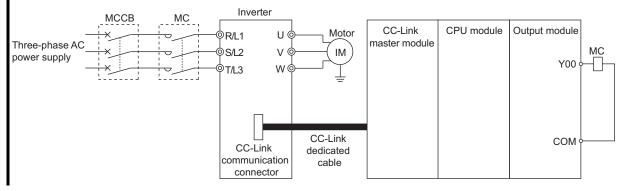
(1) Inverter input side magnetic contactor (MC)

On the inverter input side, it is recommended to provide an MC for the following purposes. (Refer to *page 4* for selection.)

- 1) To release the inverter from the power supply when the fault occurs or when the drive is not functioning (e.g. emergency stop operation). For example, MC avoids overheat or burnout of the brake resistor when heat capacity of the resistor is insufficient or brake regenerative transistor is damaged with short while connecting an optional brake resistor.
- 2) To prevent any accident due to an automatic restart at restoration of power after an inverter stop by a power failure
- 3) To separate the inverter from the power supply to ensure safe maintenance and inspection work.
 The inverter's input side MC is used for the above purpose, select class JEM1038-AC3 MC for the inverter input side current when making an emergency stop during normal operation.

• REMARKS

- 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/OFF an input signal (forward/reverse rotation command) via CC-Link communication to start/stop the inverter.
- For the system, which requires a shutoff of the main power supply at an inverter failure, configure a sequence for the programmable controller to monitor inverter failures and turn OFF the magnetic contactor at a failure via CC-Link communication. (Use the Y91 signal to check the failure, which arises from a faulty inverter circuit or faulty connection. *Refer to page 170* for the details of the Y91 signal.)



(2) Handling of inverter output side magnetic contactor

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 an MC is provided for switching to the commercial power supply, for example, switch it ON/OFF after the inverter and motor have stopped.



Inverter-driven 400V class motor 3.4

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

Measures

It is recommended to take either of the following measures:

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

For the 400V class motor, use an insulation-enhanced motor.

Specifically,

- 1) Specify the "400V class inverter-driven insulation-enhanced motor".
- 2) For the dedicated motor such as the constant-torque motor and low-vibration motor, use the "inverter-driven, dedicated
- 3) Set Pr. 72 PWM frequency selection as indicated below according to the wiring length

	Wiring Length			
	50m or less	50m to 100m	exceeding 100m	
Pr. 72 PWM frequency selection	15 (14.5kHz) or less	8 (8kHz) or less	2 (2kHz) or less	

(2) Suppressing the surge voltage on the inverter side

Connect the surge voltage suppression filter (FR-ASF-H/FR-BMF-H) on the inverter output side.



NOTE

For details of *Pr. 72 PWM frequency selection*, refer to page 192.
For explanation of surge voltage suppression filter (FR-ASF-H/FR-BMF-H), refer to the manual of each option.

3.5 Precautions for use of the inverter

The FR-E700 series 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.

- (1) Use crimping terminals with insulation sleeve to wire the power supply and motor.
- (2) Application of power to the output terminals (U, V, W) of the inverter will damage the inverter. Never perform such wiring.
- (3) After wiring, wire offcuts must not be left in the inverter.

Wire offcuts can cause an alarm, failure or malfunction. Always keep the inverter clean.

When drilling mounting holes in an enclosure etc., take care not to allow chips and other foreign matter to enter the inverter.

(4) Use cables of the size to make a voltage drop 2% maximum.

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

Refer to page 17 for the recommended wire sizes.

(5) The overall wiring length should be 500m maximum.

Especially for long distance wiring, the fast-response current limit function may decrease or the equipment connected to the secondary side may malfunction or become faulty under the influence of a charging current due to the stray capacity of the wiring. Therefore, note the overall wiring length. (*Refer to page 19*)

(6) 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. In this case, install options among the radio noise filter FR-BIF (for use in the input side only), and the line noise filter FR-BSF01/FR-BLF to minimize the interference.

(7) Do not install a power factor correction capacitor, surge suppressor or capacitor type filter on the inverter output side.

This will cause the inverter to trip or the capacitor and surge suppressor to be damaged. If any of the above devices are connected, immediately remove them. (When using radio noise filter (FR-BIF) for single-phase power input model, make sure of secure insulation of T/L3-phase, and connect to the input side of the inverter.)

(8) For some short time after the power is switched OFF, a high voltage remains in the smoothing capacitor.

When accessing the inverter for inspection, wait for at least 10 minutes after the power supply has been switched OFF, and then make sure that the voltage across the main circuit terminals P/+ and N/- of the inverter is not more than 30VDC using a tester, etc. The capacitor is charged with high voltage for some time after power OFF and it is dangerous.

(9) If "EV" is displayed on the operation panel of the safety stop function model, turn off the 24V external power supply before wiring and inspection.

(10) A short circuit or earth (ground) fault on the inverter output side may damage the inverter modules.

- 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 modules.
- Fully check the to-earth (ground) insulation and phase to phase insulation of the inverter output side before power-ON. Especially for an old motor or use in hostile atmosphere, securely check the motor insulation resistance etc.

(11) Do not use the inverter input side magnetic contactor to start/stop the inverter.

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 MC must be avoided. Always use the start signal (ON/OFF of STF and STR signals) to start/stop the inverter. (*Refer to page 40*)



(12) Across terminals P/+ and PR, connect only an external regenerative brake discharging resistor.

Do not connect a mechanical brake.

The brake resistor can not be connected to the 0.1K or 0.2K. Leave terminals P/+ and PR open.

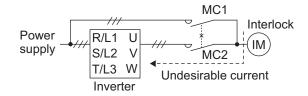
Also, never short between these terminals.

(13) Do not apply a voltage higher than the permissible voltage to the inverter I/O signal circuits.

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.

(14) Provide electrical and mechanical interlocks for MC1 and MC2 which are used for bypass operation.

When the wiring is incorrect and if there is a bypass operation circuit as shown right, the inverter will be damaged when the power supply is connected to the inverter U, V, W terminals, due to arcs generated at the time of switch-over or chattering caused by a sequence error.



(15) If the machine must not be restarted when power is restored after a power failure, provide a magnetic contactor in 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.

(16) Inverter input side magnetic contactor (MC)

On the inverter input side, connect a MC for the following purposes. (Refer to page 4 for selection.)

- 1)To release the inverter from the power supply when a fault occurs or when the drive is not functioning (e.g. emergency stop operation). For example, MC avoids overheat or burnout of the brake resistor when heat capacity of the resistor is insufficient or brake regenerative transistor is damaged with short while connecting an optional brake resistor.
- 2)To prevent any accident due to an automatic restart at restoration of power after an inverter stop made by a power failure
- 3)To separate the inverter from the power supply to ensure safe maintenance and inspection work.

 The inverter's input side MC is used for the above purpose, select class JEM1038-AC3 MC for the inverter input side current when making an emergency stop during normal operation.

(17) Handling of inverter output side magnetic contactor

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 MC is provided for switching to the commercial power supply, for example, switch it ON/OFF after the inverter and motor have stopped.

(18) Instructions for overload operation

When performing operation of frequent start/stop of 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. Decreasing current may increase the life. However, decreasing current will result in insufficient torque and the inverter may not start. Therefore, choose the inverter which has enough allowance for current (up to 2 rank larger in capacity).

(19) Make sure that the specifications and rating match the system requirements.

3.6 Failsafe of the system which uses the inverter

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

(1) Interlock method which uses the inverter status output signals By providing interlocks, inverter fault can be detected. For the interlocks, use different status output signals of the inverter (virtual terminals of the CC-Link communication) in combinations shown below.

No.	Interlock Method	Check Method	Used Signals	Refer to Page
1)	Inverter protective function operation	Operation check of an alarm contact Circuit error detection by negative logic	Fault output signal (ALM signal)	61, 170
2)	Inverter running status	Inverter running status Operation ready signal check Operation ready signal (RY signal)		61, 169
3)	Inverter running status	Logic check of the start signal and running signal	Start signal (STF signal, STR signal) Running signal (RUN signal)	60, 61, 169
4)	Inverter running status	Logic check of the start signal and output current	Start signal (STF signal, STR signal) Output current detection signal (Y12 signal)	60, 61, 172

1) Check by the output of the inverter fault signal

When the inverter's protective function activates and the inverter trips, the fault output signal (ALM signal) is output.

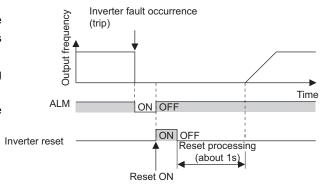
With this signal, you can check if the inverter is operating properly.

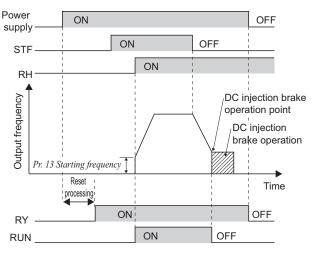
In addition, negative logic can be set (ON when the inverter is normal, OFF when a fault occurs).

- 2) Checking the inverter operating status by the inverter operation ready completion signal Operation ready signal (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.
- 3) Checking the inverter operating status by the start signal input to the inverter and inverter running signal.

The inverter running signal (RUN signal) is output when the inverter is running.

Check if RUN signal is output when inputting the start signal to the inverter (forward signal is STF signal and reverse signal is STR signal). For logic check, note that RUN signal is output for the period from the inverter decelerates until output to the motor is stopped, configure a sequence considering the inverter deceleration time





REMARKS

• RUN signal is assigned to the terminal Y0 in the initial status. In the initial setting, the operating status of the inverter can be checked with the lamp, etc., which is connected to the terminal Y0, or a virtual terminal of CC-Link communication.



4) Checking the motor operating status by the start signal input to the inverter and inverter output current detection signal.

The output current detection signal (Y12 signal) is output when the inverter operates and currents flows in the motor. Check if Y12 signal is output when inputting the start signal to the inverter (forward signal is STF signal and reverse signal is STR signal). Note that the current level at which Y12 signal is output is set to 150% of the inverter rated current in the initial setting, it is necessary to adjust the level to around 20% using no load current of the motor as reference with *Pr.150 Output current detection level*.

For logic check, as same as the inverter running signal (RUN signal), the inverter outputs for the period from the inverter decelerates until output to the motor is stopped, configure a sequence considering the inverter deceleration time.

Output	Pr. 190 to Pr. 192, Pr. 313 to Pr. 315				
signal	Setting				
Signal	Positive logic	Negative logic			
ALM	99	199			
RY	11	111			
RUN	0	100			
Y12	12	112			

• When using various signals, assign functions to *Pr. 190 to Pr. 192*, *Pr. 313 to Pr. 315 (output terminal function selection)* referring to the table on the left.



NOTE

Changing the assignment of the terminal Y0 or a virtual terminal of CC-Link communication with one of *Pr.190 to Pr.192*, and *Pr.313 to Pr.315 (output terminal function selection)* may affect other functions. Set parameters after confirming the functions of the terminal Y0 and virtual terminals.

(2) Backup method outside 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, when the inverter CPU fails, even if the interlock is provided using the inverter fault output signal, start signal and RUN signal output, there is a case where a fault output signal is not output and RUN signal is kept output even if an inverter fault occurs.

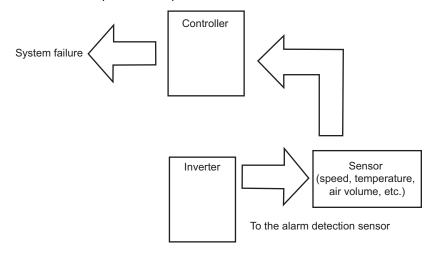
Provide a speed detector to detect the motor speed and current detector to detect the motor current and consider the backup system such as checking up as below according to the level of importance of the system.

1) 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 motor current runs as the motor is running for the period until the motor stops since the inverter starts decelerating even if the start signal turns off. For the logic check, configure a sequence considering the inverter deceleration time. In addition, it is recommended to check the three-phase current when using the current detector.

2) Command speed and actual operation check

Check if there is no gap between the actual speed and commanded speed by comparing the inverter speed command and detected speed of the speed detector.



MEMO

4 CC-LINK COMMUNICATION FUNCTION

This chapter explains the "CC-Link communication function" for use of this product.

Always read the instructions before using the equipment.

4.1	CC-Link communication specifications	48
4.2	CC-Link version	48
4.3	Wiring for CC-Link communication	49
4.4	Function overview	54
4.5	I/O signal list	56
4.6	Details of I/O signals	60
4.7	Programming examples	67
4.8	How to check for error using the LEDs	75

4.1 CC-Link communication specifications

Туре	Type Built-in to the inverter, one-touch connector connection, online connector (T type (2 to 1)) supported			
Power supply	Power supply Supplied from the inverter or the external 24VDC power supply			
Number of units	Number of units 42 units max. (Refer to page 106 for the number of stations occupied.) May be used with other			
connected	equipment.			
Station type	Station type Remote device station			
Number of stations	CC-Link Ver. 1: occupies one station			
occupied	CC-Link Ver. 2: occupies one station (selectable among double, quadruple and octuple)			
Communication cable CC-Link dedicated cable, CC-Link Ver. 1.10 compatible CC-Link dedicated cable				

4.2 CC-Link version

4.2.1 CC-Link Ver. 1.10

The conventional CC-Link products, whose inter-station cable lengths have equally been changed to 20cm or more to improve the inter-station cable length restriction, are defined as CC-Link Ver. 1.10. In comparison, the conventional products are defined as CC-Link Ver. 1.00.

Refer to the CC-Link Master Module Manual for the maximum overall cable lengths and inter-station cable lengths of CC-Link Ver. 1.00 and Ver. 1.10.

CC-Link Ver. 1.10 compatibility conditions

1)All modules that comprise a CC-Link system should be compatible with CC-Link Ver. 1.10.

2)All data link cables should be CC-Link Ver. 1.10 compatible, CC-Link dedicated cables.

(CC-Link Ver. 1.10 compatible cables have a CC-Link logo or Ver. 1.10 indication.)



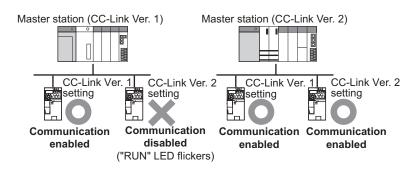
CAUTION

• In a system that uses the CC-Link Ver. 1.00 and Ver. 1.10 modules and cables together, the maximum overall cable length and inter-station cable length are as specified for CC-Link Ver. 1.00.

4.2.2 CC-Link Ver. 2

The FR-E700-NC is compatible with CC-Link Ver. 2.

When using the CC-Link Ver. 2 setting with the FR-E700-NC, the master station needs to be compatible with the CC-Link Ver. 2. For CC-Link Ver. 2, double, quadruple and octuple settings can be used to increase the remote register (RWr/w) points.





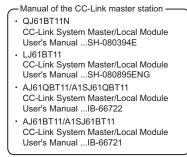
4.3 Wiring for CC-Link communication

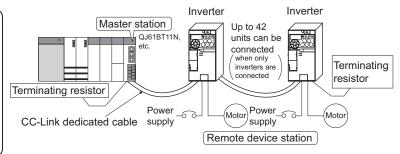
4.3.1 System configuration example

(1) Programmable controller side

Mount the "QJ61BT11N", "LJ61BT11", "AJ61QBT11", "A1SJ61QBT11", "AJ61BT11" or "A1SJ61BT11" "CC-Link system master/local module" on the main or extension base unit having the programmable controller CPU used as the master station.

(2) Connect the master station of the CC-Link programmable controller unit to the CC-Link communication connector of FR-E700-NC with the CC-Link dedicated cable.



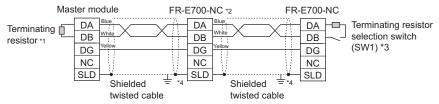


• REMARKS

- When the CPU has the automatic refresh function (example: QnA series CPU)
 Through communication with the corresponding devices using sequence ladder logic, data is automatically transferred to the refresh buffer of the master station at the execution of the END instruction to perform communication with the remote devices.
- When the CPU does not have the automatic refresh function (example: AnA series CPU)
 Data is transferred to the refresh buffer of the master station directly by sequence ladder logic to perform communication with the remote devices.

4.3.2 Connection of several inverters

An inverter can join the link system as a CC-Link remote device station, and such device stations can be controlled and monitored with a user program of a programmable controller. These devices can be useful components of an automated factory. Connect shielding wires of the CC-Link dedicated cable to "SLD" of each unit.



- *1 Use the terminating resistors supplied with the programmable controller.
- *2 Set "1" and "2" of the terminating resistor selection switch (SW1) to OFF (without terminating resistor) in the middle units.

	1	2	Description
1 0 0 2 0 N	OFF	OFF	Without terminating resistor (initial setting)
1 🗀 O 2 🚾 N	ON	OFF	Do not use.
1 0 0 2 0 N	OFF	ON	130Ω
1 🖂 0 2 🖂 N	ON	ON	110Ω

 130Ω is a resistance value for the CC-Link Ver. 1.00 dedicated high performance cable

- *3 Set the terminating resistor selection switch (SW1). Refer to page 2 for switch positions.)
 - Do not use the built-in terminating resistor selection switch (SW1) when using a one-touch connecter plug with terminating resistor. (SW1-OFF, 2-OFF) (Refer to page 53 for the details of the one-touch connector plug with terminating resistor.)
- *4 Use a conduction area of a P-clip (enclosed item) to ground (earth) shielding wires of the CC-Link dedicated cable to a position (as close as possible to the inverter) on the enclosure. Take caution not to subject the CC-Link communication connector to stress. (Refer to page 52)

(1) Maximum number of units connected to one master station (CC-Link Ver. 1.10) 42 units (when only inverters are connected)

If any other units are included, the number of stations occupied depends on the unit and therefore the following conditions must be satisfied:

$$\{(1 \times a) + (2 \times b) + (3 \times c) + (4 \times d)\} \le 64$$

- a: Number of units occupying 1 station c: Number of units occupying 3 stations
- b: Number of units occupying 2 stations d: Number of units occupying 4 stations

$$\{(16 \times A) + (54 \times B) + (88 \times C)\} \le 2304$$

- A: Number of remote I/O ≤ 64
- B: Number of remote device stations ≤ 42
- C: Number of local, standby master and intelligent device stations ≤ 26

(2) Maximum number of units connected to one master station (CC-Link Ver. 2.00) 42 units (when only inverters are connected)

If any other units are included, the number of stations occupied depends on the unit and therefore the following conditions must be satisfied:

- $\{(a + a2 + a4 + a8) + (b + b2 + b4 + b8) \times 2 + (c + c2 + c4 + c8) \times 3 + (d + d2 + d4 + d8) \times 4\} \le 64$
- $\{(a \times 32 + a2 \times 32 + a4 \times 64 + a8 \times 128) + (b \times 64 + b2 \times 96 + b4 \times 192 + b8 \times 384) + (c \times 96 + c2 \times 160 + c4 \times 320 + c8 \times 640) + (d \times 128 + d2 \times 224 + d4 \times 448 + d8 \times 896)\} \le 8192$
- $\{(a \times 4 + a2 \times 8 + a4 \times 16 + a8 \times 32) + (b \times 8 + b2 \times 16 + b4 \times 32 + b8 \times 64) + (c \times 12 + c2 \times 24 + c4 \times 48 + c8 \times 96) + (d \times 16 + d2 \times 32 + d4 \times 64 + d8 \times 128)\} \le 2048$
 - a: Number of single setting devices occupying one station
 - b: Number of single setting devices occupying two stations
 - c: Number of single setting devices occupying three stations
 - d: Number of single setting devices occupying four stations
 - a2: Number of double setting devices occupying one station
 - b2: Number of double setting devices occupying two stations
 - c2: Number of double setting devices occupying three stations
 - d2: Number of double setting devices occupying four stations
 - a4: Number of quadruple setting devices occupying one station
 - b4: Number of quadruple setting devices occupying two stations
 - c4: Number of quadruple setting devices occupying three stations
 - d4: Number of quadruple setting devices occupying four stations a8: Number of octuple setting devices occupying one station
 - b8: Number of octuple setting devices occupying two stations
 - c8: Number of octuple setting devices occupying three stations
 - d8: Number of octuple setting devices occupying four stations
- $16 \times A + 54 \times B + 88 \times C \le 2304$
 - A: Numbers of remote I/O \leq 64
 - B: Number of remote device stations \leq 42
 - C: Number of local and intelligent device stations $\leq 26\,$



4.3.3 Connection cable and plug

In the CC-Link system, use CC-Link dedicated cables.

If the cable used is other than the CC-Link dedicated cable, the performance of the CC-Link system is not guaranteed.

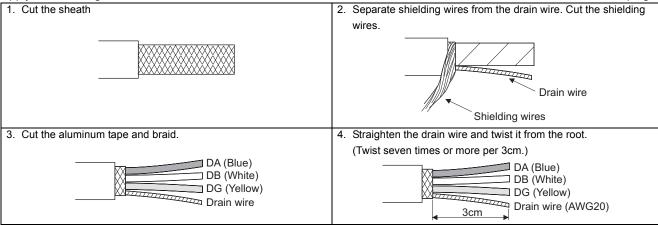
For the specifications of the CC-Link dedicated cable, refer to the website of the CC-Link Partner Association.

- · Website of the CC-Link Partner Association http://www.cc-link.org/
- One-touch communication connector plug (as of December 2009)
 Refer to the following table for the plug required to fabricate a cable on your own.

Model	Manufacturer
A6CON-L5P	Mitsubishi Electric Corporation
35505-6000-B0M GF	Sumitomo 3M Limited

(1) Cable-end treatment

Apply the following treatment to the CC-Link dedicated cable that is inserted to a one-touch communication connector plug.



• REMARKS

- Where possible, round the cable tip that is cut off with a tool such as nippers. If the cable is not rounded, it may get caught in the middle of a plug, without fully entering into the plug.
- If required, apply an insulation treatment to the shielding wire area where it is not covered by the one-touch communication connector plug.

(2) Plug cover check

Check that a plug cover is snapped into a plug



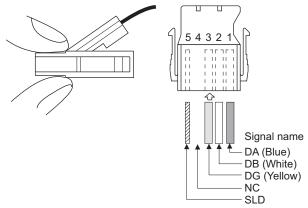


Note

Do not push the plug cover onto the plug before inserting a cable. Once crimped, the plug cover cannot be reused.

(3) Cable insertion

Lift up the tail of the plug cover, and fully insert a cable. Insert different signal wires to the one-touch communication connector plug as shown in the right figure.

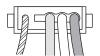


• REMARKS

- Insert the cable fully. Failure to do so may cause a crimping failure.
- A cable sometimes comes out of the head of the cover.
 In that case, pull the cable a little so that the cable stays under the plug cover.

(4) Crimping the plug cover

Push the plug cover onto the plug with a tool such as pliers. After crimping, check that the plug cover is securely snapped into the plug as shown in the right figure.



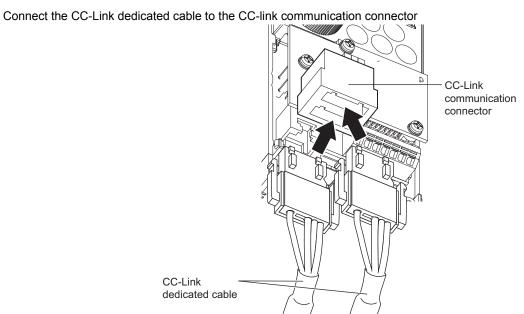


> REMARKS

· Misaligned latches between the plug cover and the plug may keep the cover lifted. The plug cover is not sufficiently crimped in this condition. Push the plug cover until it snaps into the plug.

4.3.4 Connection of CC-Link dedicated cable

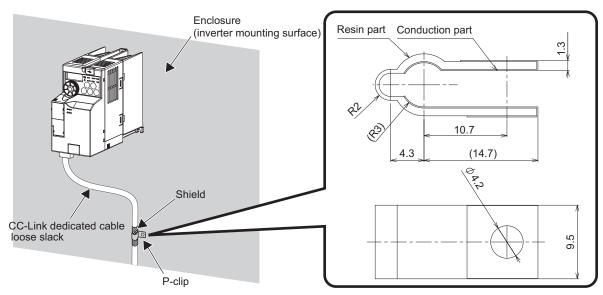
(1) Connection to the connector



(2) Grounding (earthing) the CC-Link dedicated cable

Use an M4 screw and a conduction area of a P-clip (enclosed item) to ground (earth) shielding wires of the CC-Link dedicated cable to a position (as close as possible to the inverter) on the enclosure.

Take caution not to subject the CC-Link communication connector to stress.



CAUTION

Take caution not to subject the cables to stress.

After wiring, wire offcuts must not be left in the inverter. Wire offcuts can cause an alarm, failure or malfunction.

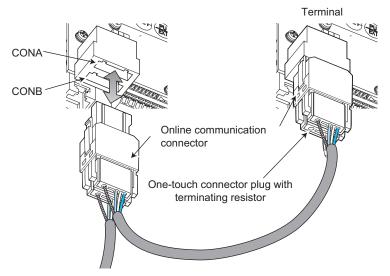


4.3.5 Unit replacement while online

Connect an online communication connector to the CC-Link communication connector. The online communication connector enables a unit replacement without interrupting the communication. Always connect the online communication connector to CONA (front side) of the CC-Link communication connector. (Do not connect it to CONB (back side) of the CC-Link communication connector. Doing so will cause a failure or breakage of the inverter and the connectors.)

Also connect a one-touch connector plug with terminating resistor to the CC-Link communication connector of FR-E700-NC at the end.

(A replacement while online is not available for the units, which are using the built-in terminating resistor selection switches (SW1).)



Use the following online communication connector and one-touch connector plug with terminating resistor.

• Online communication connector (as of December 2009)

Model	Manufacturer
35715-L010-B00 AK	Sumitomo 3M Limited

• One-touch connector plug with terminating resistor (as of December 2009)

Model	Manufacturer
A6CON-TR11	Mitsubishi Electric Corporation



Note

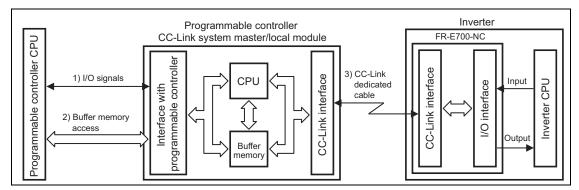
Do not use the online communication connector A6CON-LJ5P (Mitsubishi Electric Corporation) and 35720-L200-B00
 AK (Sumitomo 3M Limited) for this product. Doing so will cause a failure or breakage of the inverter and the connectors.

4.4 Function overview

4.4.1 Function block diagram

Using function blocks, this section explains I/O data transfer to/from an inverter in CC-Link:

• Link refresh is continuously executed between the master station and inverter in the CC-Link system at intervals of 1.1ms to 141ms (per station).



- 1)These are I/O signals assigned to the CC-Link system master/local module. These signals are used for communication between the programmable controller CPU and CC-Link system master/local module.

 *Refer to page 60 for details of the signals.
- 2)Reading of data input to the inverter, writing of inverter output data, and reading of a faulty CC-Link station are available. Automatic refresh function enables reading from/writing to buffer memory. (Use FROM/TO command of the sequence program to synchronize without using the automatic refresh function.) Refer to CC-Link system master/local module manual for the buffer memory details.
- 3)CC-Link communication start command is given from the sequence program. After the CC-Link communication starts, link refresh is always performed asynchronously (or synchronously) with execution of sequence program. For details, refer to the CC-Link system master/local module manual.



4.4.2 Output from the inverter to the network

Main items which can be output from the inverter to the master and their descriptions are explained below.

Item	Description	Refer to Page
Inverter status monitor	The output terminal status of the inverter can be monitored.	61
Output frequency monitor	The output frequency can be monitored.	63, 64
Output current monitor	The output current can be monitored.	64
Output voltage monitor	The output voltage can be monitored.	64
Special monitor	The monitor data selected can be checked.	64
Faults history	Fault records can be checked.	63, 64
Data at alarm occurrence	The inverter status at alarm occurrence can be checked.	63
Operation mode	The current operation mode can be checked.	64
Parameter read	Parameter settings can be read.	64
Read of set frequency	The current set frequency can be read.	64



• REMARKS

• Refer to page 104 for the operable functions via network in each operation mode.

4.4.3 Input to the inverter from the network

Main items which can be commanded from the master to the inverter and their descriptions are explained below.

Item	Description	Refer to Page
Forward rotation command	Gives the forward rotation command.	60
Reverse rotation command	Gives the reverse rotation command.	60
Input terminal function command	Executes functions assigned to the inverter input terminals.	60
Inverter output stop command	Stops the inverter output.	60
Error reset	Resets the inverter only when an inverter alarm occurs.	60
Frequency setting	Sets the frequency.	62, 64
Monitor command	Specifies the description monitored.	62, 64
Operation mode specification	Sets the operation mode.	64
Faults history clear	Erases past eight fault records.	64
All parameter clear	Returns the parameter descriptions to the initial value.	64
Inverter reset	Resets the inverter.	64
Parameter write	Writes parameter settings.	64
PID control	PID set point, PID measured value and PID deviation can be input from the network.	62



Refer to page 104 for the operable functions via network in each operation mode.

4.5 I/O signal list

4.5.1 I/O signals when CC-Link Ver. 1 one station (FR-E500 series compatible) is occupied (Pr. 544 = "0")

(1) Remote I/O (32 points fixed)

Device No.	Signal	Referto Page	Device No.	Signal	Refer to Page
RYn0	Forward rotation command (STF signal) *2	60	RXn0	Forward running	61
RYn1	Reverse rotation command (STR signal) *2	60	RXn1	Reverse running	61
RYn2	High-speed operation command (RH signal) *1	60	RXn2	Running (terminal Y0 function) *3	61
RYn3	Middle-speed operation command (RM signal) *1	60	RXn3	Up to frequency (SU signal) *2	61
RYn4	Low-speed operation command (RL signal) *1	60	RXn4	Overload alarm (OL signal) *2	61
RYn5	Not used	_	RXn5	Not used	_
RYn6	Second function selection (RT signal) *2	60	RXn6	Frequency detection (FU signal) *3	61
RYn7	Not used	_	RXn7	Error (ALM signal) *3	61
RYn8	Not used	_	RXn8	Not used	_
RYn9	Output stop (MRS signal) *1	60	RXn9	—·*4	61
RYnA	Not used	_	RXnA	—·*4	61
RYnB	— *1	60	RXnB	— *4	61
RYnC	Monitor command	60	RXnC	Monitoring	61
RYnD	Frequency setting command (RAM)	60	RXnD	Frequency setting completion (RAM)	61
RYnE	Frequency setting command (RAM, EEPROM)	60	RXnE	Frequency setting completion (RAM, EEPROM)	61
RYnF	Instruction code execution request	60	RXnF	Instruction code execution completion	61
RY(n+1)0 to RY(n+1)7	Reserved	_	RX(n+1)0 to RX(n+1)7	Reserved	_
RY(n+1)8	Not used (initial data process completion flag)	_	RX(n+1)8	Not used (initial data process request flag)	_
RY(n+1)9	Not used (initial data process request flag)	_	RX(n+1)9	Not used (initial data process completion flag)	
RY(n+1)A	Error reset request flag	60	RX(n+1)A	Error status flag	61
RY(n+1)0 to			RX(n+1)B	Remote station ready	61
` ′	Reserved	_	RX(n+1)0 to	Reserved	
RY(n+1)F			RX(n+1)F	Reserved	

("n" indicates a value determined according to the station number setting.)

- These signals are set in the initial status. Using Pr. 180 to Pr. 184, you can change input signal functions. Refer to page 163 for details of Pr. 180 to Pr. 184.
- The signal is not changeable.
- These signals are set in the initial status. Using Pr. 190 to Pr. 192, you can change output signal functions. Refer to page 167 for signals which can be assigned.
- No signal is assigned in the initial setting. Output signal can be assigned using *Pr. 313* to *Pr. 315*. Refer to page 167 for signals which can be assigned.

(2) Remote register

Address	Descr	Refer to	
Audiess	Upper 8 Bits	Lower 8 Bits	Page
RWwn	Monitor code 2	Monitor code 1	62
RWwn+1	Set frequency (0.0	62	
RWwn+2	H00 (arbitrary) *1 Instruction cod		62
RWwn+3	Write	62	

Address	Description	Refer to Page
RWrn	First monitor value	63
RWrn+1	Second monitor value	63
RWrn+2	Reply code	63
RWrn+3	Read data	63

("n" indicates a value determined according to the station number setting.)

- *1 The above 8 bit is always H00 even if a value other than H00 is set.
- When Pr. 37 is not equal to "0", this will be machine speed display (1 increments).



- Pr. 37 Speed display Refer to page 175
- Pr. 180 to Pr.184 (input terminal function selection) ** Refer to page 163
- Pr. 190 to Pr. 192, Pr. 313 to Pr.315 (output terminal function selection) Refer to page 167
- Pr. 544 CC-Link extended setting Refer to page 105



I/O signals when CC-Link Ver. 1 one station is occupied (Pr. 544 = "1") 4.5.2

(1) Remote I/O (32 points)

Same as when Pr. 544 = "0" (Refer to page 56)

(2) Remote register

	Descr	iption	Refer		Description		Refer
Address	Upper 8 Bits	Lower 8 Bits	to	Address	Upper 8 Bits	Lower 8 Bits	to
	Opper o Bits	S Lower o bits	Page		Opper o Bits	Lower o Dits	Page
RWwn	Monitor code 2	Monitor code 1	62	RWrn	First mon	itor value	63
RWwn+1	Set frequency (0.01Hz increments) *1		62	RWrn+1	Second mo	onitor value	63
RWwn+2	Link parameter extended setting	Instruction code	62	RWrn+2	Reply code 2	Reply code 1	63
RWwn+3	Write	data	62	RWrn+3	Read	l data	63

("n" indicates a value determined according to the station number setting.)

^{*1} When Pr. 37 is not equal to "0", this will be machine speed display (1 increments).



Parameters referred to

- Pr. 37 Speed display Refer to page 175
 Pr. 544 CC-Link extended setting Refer to page 105

I/O signals when CC-Link Ver. 2 double setting is selected (Pr. 544 = "12") 4.5.3

(1) Remote I/O (32 points)

Same as when Pr. 544 = "0" (Refer to page 56)

(2) Remote register

	Descr	Description			Desci	ription	Refer
Address	Upper 8 Bits	Lower 8 Bits	to Page	Address	Upper 8 Bits	Lower 8 Bits	to Page
RWwn	Monitor code 2	Monitor code 1	62	RWrn	First mor	nitor value	63
RWwn+1	Set frequency (0.01Hz increments) *1		62	RWrn+1	Second mo	onitor value	63
RWwn+2	Link parameter extended setting	Instruction code	62	RWrn+2	Reply code 2	Reply code 1	63
RWwn+3	Write data		62	RWrn+3	Read	d data	63
RWwn+4	Monitor code 3		62	RWrn+4	Third mor	nitor value	63
RWwn+5	Monitor code 4		62	RWrn+5	Fourth mo	nitor value	63
RWwn+6	-6 Monitor code 5		62	RWrn+6	Fifth mor	nitor value	63
RWwn+7	Monitor	code 6	62	RWrn+7	Sixth mor	nitor value	63

("n" indicates a value determined according to the station number setting.)

^{*1} When Pr. 37 is not equal to "0", this will be machine speed display (1 increments).



- Pr. 37 Speed display Refer to page 175
 Pr. 544 CC-Link extended setting Refer to page 105

I/O signals when CC-Link Ver. 2 quadruple setting is selected (Pr. 544 = "14")

(1) Remote I/O (32 points)

Same as when Pr. 544 = "0" (Refer to page 56)

(2) Remote register

	Descr	iption			Descr	iption	Refer
Address	Upper 8 Bits	Lower 8 Bits	to Page	Address	Upper 8 Bits	Lower 8 Bits	to Page
RWwn	Monitor code 2	Monitor code 1	62	RWrn	First mon	itor value	63
RWwn+1	Set frequency (0.0	1Hz increments)*2	62	RWrn+1	Second mo	nitor value	63
RWwn+2	Link parameter extended setting	Instruction code	62	RWrn+2	Reply code 2	Reply code 1	63
RWwn+3	Write	data	62	RWrn+3	Read	data	63
RWwn+4	Monitor	code 3	62	RWrn+4	Third mor	nitor value	63
RWwn+5	Monitor code 4		62	RWrn+5	Fourth monitor value		63
RWwn+6	Monitor code 5		62	RWrn+6	Fifth mon	itor value	63
RWwn+7	Monitor	code 6	62	RWrn+7	Sixth mor	nitor value	63
RWwn+8	Faults history No.	H00	62	RWrn+8	Faults history No.	Fault data	63
RWwn+9	PID set point (0.0	1% increments) *1	62	RWrn+9	Fault record (or	itput frequency)	63
RWwn+A	PID measured value (0.01% increments) *1		62	RWrn+A	Fault record (d	output current)	63
RWwn+B	PID deviation (0.01% increments) *1		62	RWrn+B	Fault record (d	output voltage)	63
RWwn+C	H00 (Free)			RWrn+C	Fault record (en	ergization time)	63
RWwn+D				RWrn+D			
RWwn+E				RWrn+E	H00 (Free)	_
RWwn+F	1			RWrn+F			

("n" indicates a value determined according to the station number setting.)

When Pr. 37 is not equal to "0", this will be machine speed display (1 increments).



- Pr. 37 Speed display Refer to page 175
 Pr. 128 PID action selection Refer to page 203
 Pr. 544 CC-Link extended setting Refer to page 105

^{*1} When *Pr. 128* = "50, 51, 60, 61", they are valid.



I/O signals when CC-Link Ver. 2 octuple setting is selected (Pr. 544 = "18") 4.5.5

(1) Remote I/O (32 points)

Same as when Pr. 544 = "0" (Refer to page 56)

(2) Remote register

	Descr	iption	Refer		Descr	iption	Refer
Address	Upper 8 Bits	Lower 8 Bits	to Page	Address	Upper 8 Bits	Lower 8 Bits	to Page
RWwn	Monitor code 2	Monitor code 1	62	RWrn		itor value	63
RWwn+1	Set frequency (0.0	1Hz increments) *2	62	RWrn+1	Second mo	onitor value	63
RWwn+2	Link parameter extended setting	Instruction code	62	RWrn+2	Reply code 2	Reply code 1	63
RWwn+3	Write	data	62	RWrn+3	Read	data	63
RWwn+4	Monitor	code 3	62	RWrn+4	Third mor	nitor value	63
RWwn+5	Monitor	code 4	62	RWrn+5	Fourth mo	nitor value	63
RWwn+6	Monitor	code 5	62	RWrn+6	Fifth mon	itor value	63
RWwn+7	Monitor	code 6	62	RWrn+7	Sixth mor	nitor value	63
RWwn+8	Faults history No.	H00	62	RWrn+8	Faults history No.	Fault data	63
RWwn+9	PID set point (0.0		62	RWrn+9		utput frequency)	63
RWwn+A	PID measured value (62	RWrn+A		output current)	63
RWwn+B	PID deviation (0.0	1% increments) *1	62	RWrn+B	Fault record (d	output voltage)	63
RWwn+C				RWrn+C	Fault record (er	nergization time)	63
RWwn+D	1100 /	Γ\		RWrn+D	1		
RWwn+E	H00 (Free)		_	RWrn+E	H00 (Free)		_
RWwn+F	1		RWrn+F				
RWwn+10	Link parameter extended setting	Instruction code	62	RWrn+10	Reply code		63
RWwn+11	Write	data	62	RWrn+11	Read	l data	63
RWwn+12	Link parameter extended setting	Instruction code	62	RWrn+12	Reply	code	63
RWwn+13	Write	data	62	RWrn+13	Read	l data	63
RWwn+14	Link parameter extended setting	Instruction code	62	RWrn+14	Reply	code	63
RWwn+15	Write	data	62	RWrn+15	Read	l data	63
RWwn+16	Link parameter extended setting	Instruction code	62	RWrn+16	Reply	code	63
RWwn+17	Write	data	62	RWrn+17	Read	l data	63
RWwn+18	Link parameter extended setting	Instruction code	62	RWrn+18	Reply	code	63
RWwn+19	Write	data	62	RWrn+19	19 Read data		63
RWwn+1A				RWrn+1A			
RWwn+1B RWwn+1C	H00 (Free)		_	RWrn+1B RWrn+1C	H00 ((Free)	
RWwn+1D RWwn+1E RWwn+1F	-	•		RWrn+1D RWrn+1E RWrn+1F		· ,	

("n" indicates a value determined according to the station number setting.)

- *1 When Pr. 128 = "50, 51, 60, 61", they are valid.
- *2 When Pr. 37 is not equal to "0", this will be machine speed display (1 increments).



- Pr. 37 Speed display Refer to page 175
 Pr. 128 PID action selection Refer to page 203
 Pr. 544 CC-Link extended setting Refer to page 105

4.6 Details of I/O signals

The following device numbers are for the station 1.

For the stations 2 and later, the device numbers are different. (Refer to *the master module manual* for the correspondence between device numbers and station numbers.)

4.6.1 Details of remote I/O signals

(1) Output signals (master module to inverter)

The output signals from the master module are indicated. (Input signals to the inverter)

Device No.	Signal		Description		
RY0	Forward rotation command (STF signal) *2	OFF: Stop command ON: Forward rotation start	When "1" is set, a start command is input to the inverter. When "1" is set in RY0 and RY1, a stop command is input.		
RY1	Reverse rotation command (STR signal) *2	OFF: Stop command ON: Reverse rotation start	(Refer to page 165 for the details of the STF and STR signals.)		
RY2	High-speed operation command (RH signal) *1	Turning ON the signal acti	ivates the function assigned to Pr. 182.		
RY3	Middle-speed operation command (RM signal) *1	Turning ON the signal acti	ivates the function assigned to Pr. 181.		
RY4	Low-speed operation command (RL signal) *1	Turning ON the signal acti	ivates the function assigned to Pr. 180.		
RY6	Second function selection (RT signal) *2	ON: Second function is selected			
RY9	Output stop (MRS signal) *1	Turning ON the signal acti	ivates the function assigned to Pr. 183.		
RYB	— * 3	Turning ON the signal acti	ivates the function assigned to Pr. 184.		
RYC	Monitor command	When "1" is set in the monitor command (RYC), the monitored value is set in the remote register RWr0, 1, 4 to 7, and "1" is set in the monitoring (RXC). While "1" is set in the monitor command (RYC), the monitored data is always updated.			
RYD *5	Frequency setting command (RAM)	is written to RAM of the in	uency setting command (RYD), the set frequency (RWw1) verter. *4 s, "1" is set in the frequency setting completion (RXD).		
RYE *5	Frequency setting command (RAM, EEPROM)	When "1" is set in the frequency setting command (RYE), the set frequency (RWw1) is written to RAM and EEPROM of the inverter. After the writing completes, "1" is set in the frequency setting completion (RXE). To change the frequency consecutively, be sure to write data to the inverter RAM.			
RYF *5	Instruction code execution request	When "1" is set in the instruction code execution request (RYF), processes corresponding to the instruction codes set to RWw2, 10, 12, 14, 16 and 18 are executed. "1" is set in the instruction code execution request (RXF) after completion of instruction codes. When an instruction code execution error occurs, a value other than "0" is set in the reply code (RWr2, 10, 12, 14, 16, 18).			
RY1A	Error reset request flag	When "1" is set in the erro	or reset request flag (RY1A) at an inverter fault, the inverter the error status flag (RX1A). *6		

^{*1} Signal names are initial values. Using Pr. 180 to Pr. 183, you can change input signal functions. Refer to page 163 for details of Pr. 180 to Pr. 183.

^{*2} The signal is not changeable.

^{*3} No signal is assigned in the initial setting. Using Pr. 184, you can change the assigned input signal. Refer to page 163 for the details of Pr. 184.

^{*4} While "1" is set in the frequency setting command (RYD), the set frequency (RWw1) is always applied.

If "1" is set in these registers at the same time while Pr: 544 = "0," only one of these is executed.

^{*6} Refer to page 110 for operation conditions of inverter reset.



(2) Input signals (inverter to master module)

The input signals to the master module are indicated. (Output signals from the inverter)

Device No.	Signal	Description
RX0	Forward running	OFF: Other than forward running (during stop or reverse rotation)
KAU	Torward running	ON: Forward running
RX1	Reverse running	OFF: Other than reverse running (during stop or forward rotation)
IXI	Neverse running	ON: Reverse running
RX2	Running (terminal Y0 function) *1	Turning ON the signal activates the function assigned to Pr. 190.
RX3	Up to frequency (SU signal) *2	ON: Output frequency has reached the set frequency
RX4	Overload alarm (OL signal) *2	ON: Overload alarm occurrence
RX6	Frequency detection (FU signal) *1	Turning ON the signal activates the function assigned to Pr.191.
RX7	Fault (ALM signal) *1	Turning ON the signal activates the function assigned to Pr.192.
RX9	— *3	Turning ON the signal activates the function assigned to <i>Pr.313</i> .
RXA	— *3	Turning ON the signal activates the function assigned to <i>Pr.</i> 314.
RXB	— *3	Turning ON the signal activates the function assigned to <i>Pr.</i> 315.
	RXC Monitoring	After "1" is set in the monitor command (RYC), and the monitored value is set in
RXC		the remote register Rwr0, 1, 4 to 7, "1" is set in this signal. When "0" is set in the
		monitor command (RYC), "0" is set in this signal.
		After "1" is set in the frequency setting command (RYD) and the frequency setting
RXD	Frequency setting completion (RAM)	command is written to the inverter RAM, "1" is set in this signal.
		When "0" is set in the frequency setting command (RYD), "0" is set in this signal.
	Frequency setting completion	After "1" is set in the frequency setting command (RYE) and the frequency setting
RXE	(RAM, EEPROM)	command is written to the inverter RAM and EEPROM, "1" is set in this signal.
	, - ,	When "0" is set in the frequency setting command (RYE), "0" is set in this signal.
		After "1" is set in the instruction code execution request (RYF) and the processes
->		corresponding to the instruction codes (RWw2, 10, 12, 14, 16 and 18) are
RXF	Instruction code execution completion	executed, "1" is set in this signal.
		When "0" is set in the instruction code execution request (RYF), "0" is set in this
		signal.
RX1A	Error status flag	When an inverter error occurs (protective function is activated), "1" is set in this
		signal.
		When the inverter goes into the ready status upon completion of initial setting after
RX1B	Remete station ready	power-ON or hardware reset, "1" is set in this signal. When an inverter error
KVID	Remote station ready	occurs (protective function is activated), "0" is set in this signal.
		The signal is used as an interlock signal during the write to/read from the master module.
	mes are initial values. Using Pr 100 to Pr 102 you	

Signal names are initial values. Using Pr. 190 to Pr. 192, you can change output signal functions. Refer to page 167 for details of Pr. 190 to Pr.192.

Signals are not assigned in the initial setting. Using Pr. 313 to Pr. 315, you can change output signal functions. Refer to Pr. 313 to Pr. 315 on page 167 for details of signals.



• All the outputs are shutoff at an option fault (ξ .

The signal is not changeable.

4.6.2 Details of remote registers

(1) Remote register (master module to inverter)

· Remote register definition

Device No.	Signal	Description					
DMM	Monitor code1/	Set the monitor code to be monitored (Refer to page 66). By setting "1" in RYC after setting, the					
RWw0	Monitor code2	specified monitored data is stored in RWr0/RWr1.					
RWw1	Set frequency *1, *2	 Specify the set frequency or machine speed. At this time, whether to write to RAM or EEPROM is decided with the RYD and RYE settings. After setting the set frequency in this register, set "1" in RYD or RYE to write the frequency. After writing of frequency is completed, "1" is set in RXD or RXE in response to the input command. The setting range is 0 to 400.00Hz (0.01Hz increments). Write "40000" when setting 400.00Hz. 					
RWw2	Link parameter extended setting/Instruction code	Set the instruction code for execution of operation mode rewrite, parameter read/write, error reference, error clear, etc. (<i>Refer to page 64</i>) Set "1" in RYF to execute the corresponding instruction after completing the register setting. "1" is set in RXF after completing the execution of the instruction. When a value other than "0" is set in <i>Pr. 544 CC-Link extended setting</i> , upper 8 bits are link parameter extended setting. Example) When reading <i>Pr. 160</i> , instruction code is H0200.					
RWw3	Write data	Set the data specified by the RWw2 instruction code. (When required) Set "1" in RYF after setting RWw2 and this register. Set zero when the write code is not required.					
RWw4	Monitor code 3	Set the monitor code to be monitored. By setting "1" in RYC after setting, the specified monitored data is stored in RWr□.					
RWw5	Monitor code 4						
RWw6	Monitor code 5						
RWw7	Monitor code 6	(□ indicates a register number. (RWr4 to 7))					
RWw8	Faults history No.	Set the individual fault number of the faults history that you want to read. Up to the 8th previous fault can be read. Last two digits: H00 (latest fault) to H07 (8th oldest fault) When H08 to HFF are set, fault record becomes an unfixed value.					
RWw9	PID set point *3	Set the PID set point Setting range: "0 to 100.00%" Input a value 100 times greater than the value to be					
RWwA	PID measured value *3	Set the PID measured value Setting range: "0 to 100.00%" Setting range: "0 to 100.00%" For example, input "10000" when setting 100.00%.					
RWwB	PID deviation *3	Set the PID deviation. Setting range: "-100.00% to 100.00%" *Refer to page 203 for details of PID control.					
RWw10, RWw12, RWw14, RWw16, RWw18	Link parameter extended setting/Instruction code	Set the instruction code (<i>refer to page 64</i>) for execution of operation mode rewrite, parameter read/write, error reference, error clear, etc. The instructions are executed in the following order by setting "1" in RYF after completing the register setting: RWw2, 10, 12, 14, 16, then 18. After completing the execution up to RWw18, "1" is set in RXF. Set HFFFF to disable an instruction by RWw10 to 18. (RWw2 is always executed.) The first 8 bits are link parameter extended setting. Example) When reading <i>Pr. 160</i> , instruction code is H0200.					
RWw11, RWw13, RWw15, RWw17, RWw19	Write data	Set the data specified by the instruction code of RWw10, 12, 14, 16, and 18. (when required) RWw10 and 11, 12 and 13, 14 and 15, 16 and 17, and 18 and 19 correspond each other. Set "1" in RYF after setting the instruction codes (RWw10, 12, 14, 16, and 18) and the corresponding register. Set "0" when the write code is not required.					

When Pr. 37 is not equal to "0", this will be machine speed display (1 increments).

For details refer to page 106.

^{*2} When Pr. 541 Frequency command sign selection (CC-Link) = "1", the setting value has either + or -. When the setting value is negative, the command is inversed from starting command.

Setting range: -327.68Hz to 327.67Hz (-327.68 to 327.67) $\,$ 0.01Hz increments.

^{*3} When *Pr. 128* = "50, 51, 60, 61", they are valid. If the data outside the range is set, the previous setting is retained. *Refer to page 203* for details of *Pr. 128*.



(2) Remote register (inverter to master module)

· Remote register definition

Device No.	Signal	Description
		When "1" is set in RYC, the specified monitored data is set to the lower 8 bits of the monitor
RWr0	First monitor value	code (RWw0).
IXVVIO	I list monitor value	When <i>Pr. 37 Speed display</i> ≠ 0 and output frequency or set frequency monitor is set for monitor
		code (RWw0), machine speed setting (1 unit) is monitored.
		When "0" is set to the upper 8 bits of the monitor code (RWw0), the current output frequency is
		always set. When a value other than "0" is set to the upper 8 bits of the monitor code (RWw0)
RWr1	Second monitor value	while "1" is set in RYC, the monitor data specified by the upper 8 bits of the monitor code
130011	(Output frequency)	(RWw0) is set.
		When Pr. 37 Speed display ≠ 0 and output frequency or set frequency monitor is set for monitor
		code (RWw0), machine speed setting (1 unit) is monitored.
	Reply code *	When "1" is set in RYD or RYE, the reply code for the frequency setting command is set. When
	(when $Pr. 544 = 0$)	"1" is set in RYF, the reply code corresponding to the instruction code RWw2 is set. The value
	(WIIGH 17. 344 – 0)	"0" is set for a normal reply and any digit other than "0" is set for data fault, mode error, etc.
RWr2	Reply code 1 *	Lower 8 bits of RWr2
	(when $Pr. 544 \neq 0$)	When "1" is set in RYD or RYE, the reply code for the frequency setting command is set.
	Reply code 2 *	Upper 8 bits of RWr2
	(when $Pr. 544 \neq 0$)	When "1" is set in RYF, the reply code corresponding to the instruction code RWw2 is set.
RWr3	Read data	For a normal reply, the reply data to the instruction specified by the instruction code is set.
RWr4	Third monitor value	When "1" is set in RYC, the monitored data specified by the monitor code (RWw□) is saved.
RWr5	Fourth monitor value	(□ indicates a register number (RWw4 to 7)
RWr6	Fifth monitor value	When Pr. 37 Speed display ≠ 0 and output frequency or set frequency monitor is set for monitor
RWr7	Sixth monitor value	code (RWw0), machine speed setting (1 unit) is monitored.
RWr8	Fault record (fault data)	The fault data of faults history No. specified by RWw8 is stored in the lower 8 bits.
11110	radit record (radit data)	Faults history No. specified is echo backed to the upper 8 bits.
RWr9	Fault record (output frequency)	Output frequency of the faults history No. specified in RWw8 is stored.
RWrA	Fault record (output current)	Output current of the faults history No. specified in RWw8 is stored.
RWrB	Fault record (output voltage)	Output voltage of the faults history No. specified in RWw8 is stored.
RWrC	Fault record	Energization time of the faults history No. specified in RWw8 is stored.
TAVVIO	(energization time)	Energization time of the faults history No. specified in NAWWO is stored.
RWr10		When "1" is set in RYF, the reply codes corresponding to the instruction codes RWw10, 12, 14,
to	Reply code *	16, and 18 are set. The value "0" is set for a normal reply and other than "0" is set for data
το RWr19		fault, mode error, etc.
IXVIII	Read data	For a normal reply, the reply data to the instruction specified by the instruction code is set.

^{*} Refer to the table below for the reply code definitions.

· Reply code definition

The reply to the instruction execution is set to RWr2, 10, 12, 14, 16, 18.

When executing the frequency setting (RYD, RYE) or instruction code execution (RYF), check the reply code (RWr2) in the remote register after execution.

	Data	Item	Alarm Definition	Remarks		
	H0000	Normal	No error (normal completion of instruction code execution)	· Reply code to Rwr2 when		
Dank	H0001	Write mode error	Parameter write was attempted during operation other	<i>Pr. 544</i> = "0"		
Reply	110001	Write mode endi	than a stop in the Network operation mode.	Reply code to RWr10, 12,		
Couc	H0002	Parameter selection error	Unregistered code number was set.	14, 16, and 18 when <i>Pr.</i>		
	H0003	Setting range error	Set data is outside the permissible data range.	544 = "18"		
	H00	Normal	No error (normal completion of instruction code execution))		
Donly	H01	Write mode error	Parameter write was attempted during operation other			
Reply code 1	пот	Write mode error	than a stop in the Network operation mode.			
code i	H03	Frequency command	Frequency outside the range is set	Reply code to RWwr2 when		
	поз	setting range error	Frequency outside the range is set			
	H00	Normal	No error (normal completion of instruction code execution)	<i>Pr. 544</i> ≠ "0"		
Donly	H01	Write mode error	Parameter write was attempted during operation other			
Reply code 2	пот	Write mode error	than a stop in the Network operation mode.	_		
Code 2	H02	Parameter selection error	Unregistered code number was set.			
	H03	Setting range error	Set data is outside the permissible data range.			



(3) Instruction codes

· Instruction code definition

Set the instruction code using a remote register (RWw). (Refer to page 62.) The definition read by the instruction code is stored in the remote register (RWr). (Refer to page 63.)

Operation mode Read H7B H0000: Network operation H0002: PU operation H0000: Network operation H0000: o	nts Vhen <i>Pr. 37 ≠</i> "0") ents 0.01A				
Operation mode Write HFB H0002: PU operation H0000: Network operation H0002: PU operation (When Pr. 79 = "6") H0000 to HFFFF: Running frequency 0.01Hz increme Machine speed 1 increments (V Output current Read H70 Output current (hexadecimal) Increme Output voltage Read H71 H0000 to HFFFF: Output voltage (hexadecimal)	nts Vhen <i>Pr. 37 ≠</i> "0") ents 0.01A				
Output frequency*1 Read H6F H0002: PU operation (When Pr. 79 = "6") H0000 to HFFFF: Running frequency 0.01Hz increme Machine speed 1 increments (V H0000 to HFFFF: Output current Read H70 Output current (hexadecimal) Increme Output voltage Read H71 H0000 to HFFFF: Output voltage (hexadecimal)	nts Vhen <i>Pr. 37 ≠</i> "0") ents 0.01A				
Output frequency *1 Read H6F Running frequency 0.01Hz increme Machine speed 1 increments (V Output current Read H70 Output current (hexadecimal) Increme Output voltage Read H71 H0000 to HFFFF: Output voltage (hexadecimal)	Vhen <i>Pr. 37</i> ≠ "0") ents 0.01A				
Output current Read H70 Machine speed 1 increments (V H0000 to HFFFF: Output current (hexadecimal) Increme Output voltage Read H71 H0000 to HFFFF: Output voltage (hexa	Vhen <i>Pr. 37</i> ≠ "0") ents 0.01A				
Output current Read H70 Output current (hexadecimal) Increme Output voltage Read H71 H0000 to HFFFF: Output voltage (hexa					
Output voltage Read H71 H0000 to HFFFF: Output voltage (hexa					
H0000 to HFFFF: Check the data of the	<u>'</u>				
Special monitor Read H72 instruction code HF3.	•				
Special monitor Read H73 H01 to H3F: Monitor selection data					
Monitor selection No. Write HF3 *2 Refer to monitor code. (Re.	1 9 /				
H0000 to HFFFF: Last two fault definition	ons				
b15 b8t H74 Second most recent fault in past	Most recent fault				
Faults history Read H74 to H77 H75 Fourth most recent fault in past	Third most recent fault in past				
H76 Sixth most recent fault in past	Fifth most recent fault in past				
H77 Eighth most recent fault in past	H77 Eighth most recent fault in past Seventh most recent fault in past				
Refer to the alarm data table (page 65)					
Set frequency (RAM) Read H6D Read set frequency or machine speed H0000 to HFFFF:	from RAM or EEPROM.				
Set frequency (EEPROM) Read H6E Set frequency 0.01Hz increme Machine speed 1 increments (W					
Set frequency (RAM) *3 Write HED H0000 to H9C40 (0 to 400.00Hz):					
Frequency 0.01Hz increme + H0000 to H270E (0 to 9998):	Frequency				
Set frequency (RAM and EEPROM) *3 Write HEE Machine speed 1 increments (Wachine					
RAM. (Instruction code: HED)					
Read H00 to H63 Refer to the instruction codes in the write parameters as required. Write to <i>Pr. 77</i> and <i>Pr. 79</i> is disabled.					
Parameter When setting <i>Pr.100</i> and later, set link					
Write H80 to HE3 as "9999". Write H80 to HE3 When changing the parameter value	 Set 65520 (HFFF0) as a parameter value "8888" and 65535 (HFFFF) as "9999". When changing the parameter values frequently, set "1" in <i>Pr. 342</i> to write them to the RAM. (<i>Refer to page 110.</i>) 				
	*				
Faults history batch clear Write HF4 H9696: Clears the faults history in batch All parameters return to the initial value					
Whether to clear communication paran	neters or not can be selected				
according to data. (O: Clear, x: Not cle	ear)				
Refer to page 84 for parameter clear, all parameters.	ciear, and communication				
Clear Type Data	Communication Pr.				
Parameter clear H9696	0				
All parameter clear Write HFC H5A5A	×*4				
All parameter clear H9966 H55AA	O				
	×*4				
	When clear is executed for H9696 or H9966, communication-related parameter settings also return to the initial values. When resuming				
operation, set the parameters again.	operation, set the parameters again.				
Executing clear will clear the instruction In the password locked status, only H9					
clear) are valid.	and Hosha (all parameter				



Item	Item Read / Code Write Number		Description		
Inverter reset	H9696: Resets the inverter.				
Link parameter extended			Parameter settings are switched according to the H00 to H09 settings. Refer to instruction codes in the parameter list on page 84 for the setting		
setting *5	Write	HFF	value details.		

- *1 When "100" is set in Pr. 52 DU/PU main display data selection, set frequency is monitored during a stop and output frequency is monitored during running.
- *2 Write data is hexadecimal and only lower two digits are valid. (Upper 2 digits are ignored.)
- *3 Setting from remote registers can be made.
- *4 Turning OFF the power supply while clearing parameters with H5A5A or H55AA also clears the communication parameter settings back to the initial settings.
- *5 Setting is valid only when Pr. 544 = "0". When $Pr. 544 \neq$ "0", set using RWw2 or RWw10, 12, 14, 16, or 18. (Refer to page 62)

· Fault data

Refer to page 233 for details of fault definitions.

Data	Definition
H00	No alarm
H10	E.OC1
H11	E.OC2
H12	E.OC3
H20	E.OV1
H21	E.OV2
H22	E.OV3
H30	E.THT
H31	E.THM
H40	E.FIN
H52	E.ILF
H60	E.OLT
H70	E.BE
H80	E.GF
H81	E.LF
HA0	E.OPT
HA1	E.OP1

E.PE E.RET E.PE2
E.PE2
E.CPU
E.IOH
E.USB
E.SAF
E.MB4
E.MB5
E.MB6
E.MB7
E.1
E.5
E.6
E.7
E.13

Fault record display example (instruction code H74)



(4) Monitor codes

Monitored items can be selected with the special monitor selection No. of the instruction code and the remote registers, RWw0 and RWw4 to 7.

Divide the monitor code (RWw0) into half to select the first monitor description (RWr0) from the lower 8 bits and the second monitor description (RWr1) from the upper 8 bits.

Refer to page 176 for the details of monitors.



• REMARKS

• When Pr. 544 = "12, 14, 18", descriptions of monitor codes 3 (RWw4) to 6 (RWw7) can be selected.

(Example) When output current is selected for the first monitor and output voltage is selected for the second monitor → monitor code is H0302

	Second Monitor Description	First, Third to Sixth Monitor			
Code Number	·	Description	Increments		
	(the upper 8 bits)	(the lower 8 bits)			
H00	Output frequency/machine speed *1	No monitoring (monitor value is 0)	0.01Hz/1		
H01	Output frequency/	machine speed *1	0.01Hz/1		
H02	Output	current	0.01A		
H03	Output	voltage	0.1V		
H05	Frequency setting value/	machine speed setting *1	0.01Hz/1		
H07	Motor	torque	0.1%		
H08	Converter ou	utput voltage	0.1V		
H09	Regenerativ	e brake duty	0.1%		
H0A	Electronic thermal rela	0.1%			
H0B	Output currer	0.01A			
H0C	Converter output v	0.1V			
H0E	Output	0.01kW			
H10	Output termi	_			
H14	Cumulative en	1h			
H17	Actual ope	1h			
H18	Motor loa	ad factor	0.1%		
H19	Cumulati	ve power	1kWh		
H34	PID se	t point	0.1%		
H35	PID measi	PID measured value			
H36	PID de	viation	0.1%		
H3D	Motor therma	al load factor	0.1%		
H3E	Inverter therm	nal load factor	0.1%		
H3F	Cumulativ	e power 2	0.01kWh		

When Pr. 37 is not equal to "0", this will be machine speed display (1 increments).

Input terminal monitor details

b15														b0
	_	_	_	_	_	_	_	_	RX7	RX6	_	_	_	RX2 (terminal Y0)



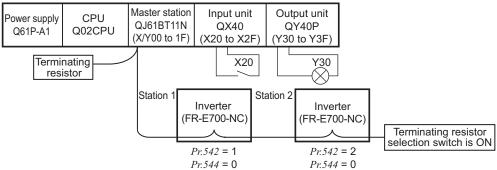
4.7 Programming examples

This chapter provides programming examples which control the inverter with sequence programs.

Item	Program Example	Refer to
item	Frogram Example	Page
Reading the inverter status	Reading the inverter status from the buffer memory of the master station	69
Setting the operation mode	Selecting the network operation mode	69
Setting the operation commands	Commanding the forward rotation and middle speed signals	70
Setting the monitoring function	Monitoring the output frequency	70
Reading a parameter value	Reading the value of Pr. 7 Acceleration time	71
Writing a parameter value	Setting "3.0s" in Pr. 7 Acceleration time	71
Setting the running frequency	Setting to 50.00Hz	72
(running speed)	Setting to 50.00112	/2
Reading the fault records	Reading the inverter faults	73
Inverter reset	Perform inverter reset at a fault occurrence.	73

(1) System configuration for programming example





(2) Network parameter setting of the master station

Network parameters are set as below.

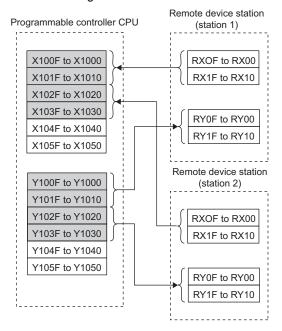
	Setting Conditions		
Start I/O No.	0000		
Operation settings	Data link alarm station setting	Input clear	
Settings	Setting at CPU stop	Refresh	
Туре	Master		
Mode	Remote net ver.1 mode		
All connect co	unt	2	
Remote input	X1000		
Remote outpu	Y1000		
Remote regist	W0		

	Setting Conditions					
Remote regist	er (RWw)	W100				
Special relay (SB)	SB0				
Special registe	er (SW)	SW0				
Retry count	Retry count					
Automatic reco	Automatic reconnection station count					
CPU down sel	CPU down select					
Scan mode se	Asynchronous					
Station information	Station type	Remote device station				

(3) Remote I/O

The relation between the device of the programmable controller CPU and remote I/O (RX, RY) of the remote device station is as follows:

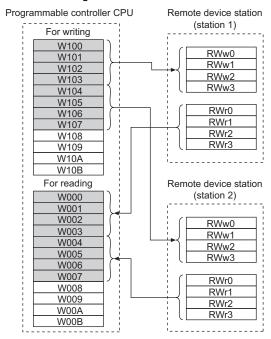
The devices used actually are indicated in shaded regions.



(4) Remote register

The relation between the device of the programmable controller CPU and remote register (RWw, RWr) of the remote device station is as follows:

The devices used actually are indicated in shaded regions.





4.7.1 Programming example for reading the inverter status

The following program turns ON Y00 of the output unit when station 1 inverter is running.

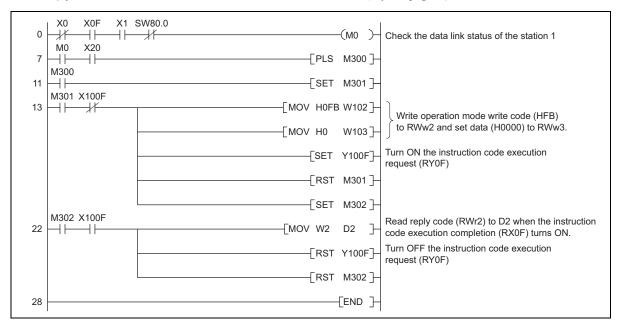
```
X1 SW80.0
                                                                         (мо )—
                                                                                   Check the data link status of the station 1
   Λ
                            -1/
            X1002
       M0
   7
                                                                         (Y30 )-
                                                                                   Turn ON the output unit (Y00)
              Inverter running (RX02)
  10
                                                                        -{END}
                                                                                                     X1000
               Remote input
                                          b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0
               RXF to RX0
                                           0 0
                                                   0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
     station
              RX1F to RX10
                                                                           [Inverter status]
                           Inverter status
                            b0 : During forward rotation
                            b1: Reverse running
                            b2 : Running (terminal Y0 function) *1
                            b3 : Up to frequency (SU signal) *2
                            b4 : Overload alarm (OL signal) *2
                            b6: Frequency detection (FU signal) *1
                            b7 : Fault (ALM signal) *1
                           b8:-
                           b9: - *1
                           b10: - *1
                           b11: — *1
These signals are initial values. You can change output signals using Pr. 190 to Pr. 192, Pr.313 to Pr.315 (output terminal function
selection). Refer to page 167 for the details of Pr. 190 to Pr. 192 and Pr. 313 to Pr. 315 (output terminal function selection).
The signal is not changeable
```

4.7.2 Programming example for setting the operation mode

The following explains a program to write various data to the inverter.

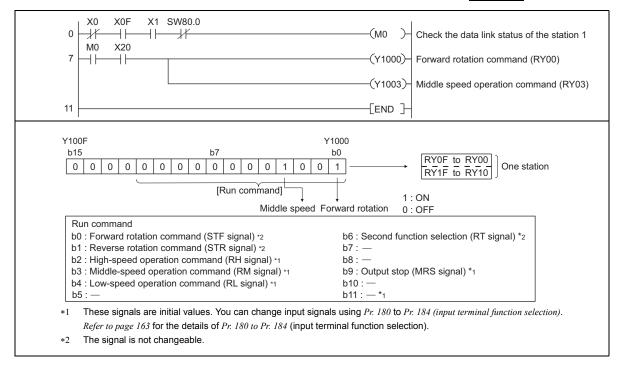
The following explains a program to change the operation mode of station 1 inverter to Network operation.

- · Operation mode writing code number: HFB (hexadecimal)
- · Network operation set data: H0000 (hexadecimal) (Refer to page 64)
- The reply code at the time of instruction code execution is set to D2. (Refer to page 63)



4.7.3 Programming example for setting the operation commands

The following program gives a forward command and middle speed command to station 1 inverter



4.7.4 Programming example for monitoring the output frequency

The following explains a program to read monitor functions of the inverter.

The following program reads the output frequency of station 1 inverter to D1.

Output frequency reading code number: H0001 (hexadecimal)

Refer to page 66 for the monitor code numbers.

(Example) The output frequency of 60Hz is indicated as H1770 (6000).

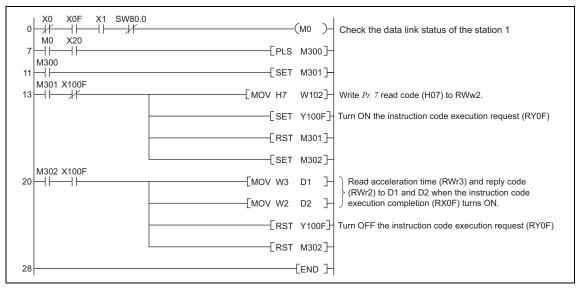
```
X0F
                 X1 SW80.0
    X0
0
                                                                  (M0
    -14
                                                                            Check the data link status of the station 1
    M0
          X20
                                                                            Set monitor code (H01) of output frequency
                                                     - MOV H1
                                                                  W100]
                                                                           to RWw0.
                                                                            Turn ON the monitor command (RY0C)
                                                                  (Y100C)
                             X100C
                                                                            Read output frequency (RWr0) to D1
                                                     √MOV W0
                                                                 D1
                                                                            when the monitoring (RX0C) turns ON.
                                                                 FEND 7
15
```



4.7.5 Programming example for parameter reading

The following program reads *Pr. 7 Acceleration time* of station 1 inverter to D1.

- · Pr. 7 Acceleration time reading code number: H07 (hexadecimal)
- · Refer to the parameter list on page 84 to find out the code number of each parameter.
- The reply code at the time of instruction code execution is set to D2. (Refer to page 63)



• REMARKS

• For parameters having numbers 100 and later, change their link parameter extended settings (set them to other than H0000). Refer to the parameter list on *page 84* for the setting values.

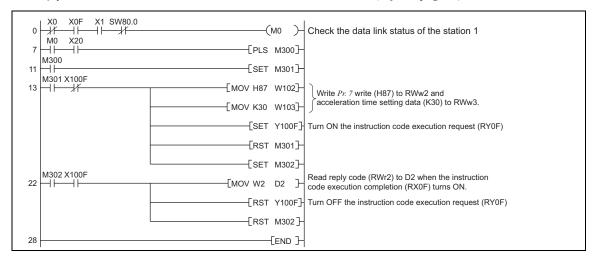
4.7.6 Programming example for parameter writing

The following program changes the setting of *Pr.7 Acceleration time* of station 1 inverter to 3.0s.

- · Acceleration time writing code number: H87 (hexadecimal)
- · Acceleration time set data: K30 (decimal)

Refer to the parameter list on page 84 to find out the code number of each parameter.

The reply code at the time of instruction code execution is set to D2. (Refer to page 63)



REMARKS

- For parameters having numbers 100 and later, change their link parameter extended settings (set them to other than H0000) Refer to the parameter list on *page 84* for the setting values.
- For other functions, refer to the instruction codes (page 64).

4.7.7 Programming example for setting the running frequency

1) The following program example changes the running frequency of <u>station 1</u> inverter to 50.00Hz Set frequency: K5000_decimal

The reply code at the time of instruction code execution is set to D2. (Refer to page 63)

```
X1 SW80.0
          X0F
                                                                        Check the data link status of the station 1
    #
    M0
          X20
    \dashv
                                                         -[PLS
                                                               M300 ]
   M300
    \dashv
                                                         [SET M301]
   M301 X100D
                                                   MOV K5000 W101
    \dashv\vdash
          -1/
                                                                        Write set frequency to RWw1.
                                                                        Turn ON the frequency setting
                                                         SET Y100D
                                                                        command RAM (RY0D)
                                                         [RST M301]
                                                         SET M302
   M302 X100D
                                                                        Read reply code (RWr2) to D2 when the
MOV W2
                                                               D2
                                                                     }
                                                                        frequency setting completion (RX0D) turns ON.
                                                                        Turn OFF the frequency setting command RAM
                                                         [RST Y100D]
                                                                        (RY0D)
                                                         [RST M302]
26
                                                               END }
```

2) To continuously change the running frequency from the programmable controller

When the frequency (speed) setting completion (example: X100D) switches ON, make sure that the reply code in the remote register is 0000H and change the set data (example: W101) continuously.

3) Program example for writing data to EEPROM

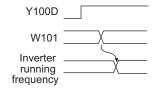
Change the following points in the program shown above.

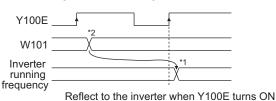
Frequency setting command Y100D → Y100E

Frequency setting completion X100D → X100E

<Timing chart when writing to RAM>

<Timing chart when writing to EEPROM>





- *1 For EEPROM, write is made only once when Y100E is switched ON.
- *2 If the set data is changed with Y100E ON, it is not reflected on the inverter.



4.7.8 Programming example for fault record reading

The following program reads fault records of station 1 inverter to D1.

· Faults history No. 1, No. 2 reading code number: H74 (hexadecimal)

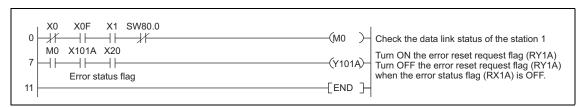
For the error code numbers, refer to page 65.

The reply code at the time of instruction code execution is set to D2. (Refer to page 63)

```
X1 SW80.0
           X0F
                                                                     (MO )-
 0
                                                                               Check the data link status of the station 1
    #
           \dashv\vdash
                        -#
    M0
          X20
                                                              FPLS M300 7
    \dashv
   M300
                                                              [SET M301]
    \dashv\vdash
   M301 X100F
                                                                               Write error history No.1 and No.2 read
    \dashv\vdash
                                                        [MOV H74 W102]
                                                                               code (H74) to RWw2.
                                                                               Turn ON the instruction code execution request
                                                              SET Y100F
                                                                               (RY0F)
                                                              [RST M301]
                                                              [SET M302]
   M302 X100F
20
                                                        -FMOV W3
    \dashv \vdash
                                                                     D1
                                                                           }
                                                                                 Read alarm data (RWr3) and reply code
                                                                                 (RWr2) to D1 and D2 when the instruction
                                                        MOV W2
                                                                      D2
                                                                                 code execution completion (RX0F) turns ON.
                                                                               Turn OFF the instruction code execution request
                                                              -[RST Y100F]
                                                              -{RST M302}
                                                                    FEND ]
28
```

4.7.9 Programming example for resetting the inverter at inverter error

The following is a program example for resetting station 1 inverter at inverter error.



> REMARKS

- The above inverter reset using RY1A is available only when an inverter error occurs.
 - When Pr. 349 Communication reset selection = "0", inverter reset is available independently of the operation mode.
 - Select Network operation mode to reset the inverter by setting data (H9696) in the instruction code (HFD) and then turn ON the instruction code execution request (RYF). (*Refer to page 69* for programming examples.)
- · Refer to page 110 for operation conditions of inverter reset.

4.7.10 Instructions

(1) Programming instructions

- Since the buffer memory data of the master station is kept transferred (refreshed) to/from the inverters, the TO instruction need not be executed every scan in response to data write or read requests.
 - The execution of the TO instruction every scan does not pose any problem.
- If the FROM/TO instruction is executed frequently, data may not be written reliably.
 - When transferring data between the inverter and sequence program via the buffer memory, perform the handshake to confirm that data has been written without error.



(2) Operating and handling instructions

- Commands only from the programmable controller can be accepted during operation from CC-Link communication.

 Operation commands from the operation panel are ignored.
- If different devices have the same station number, data is transmitted improperly, and the communication cannot be performed properly.
- The inverter trips with the fault "E.OP1" if data communication stops for more than the time set in *Pr. 500 Communication error execution waiting time* due to a programmable controller fault, an open CC-Link dedicated cable, etc. during CC-Link operation.
- If the programmable controller (master station) is reset during CC-Link operation or if the programmable controller is powered OFF, data communication stops and the inverter trips with fault "E.OP1".
 - To reset the programmable controller (master station), choose the operation mode other than Network operation mode beforehand.

(3) Troubleshooting

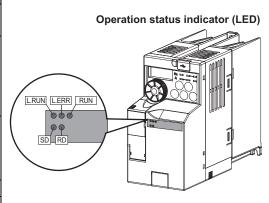
- 1) Operation mode does not switch to the Network operation mode
- · Check that CC-Link dedicated cable is fitted properly. (Check for contact fault, break in the cable, etc.)
- Check that *Pr.542 Communication station number (CC-Link)* is set correctly. (Check that the station number matches the program, the station numbers are not repeated, and the station number is not outside the range.)
- Check that the operation mode switching program is running.
- Check that the operation mode switching program has been written correctly.
- 2) Inverter does not start in the Network operation mode
- · Check that the inverter starting program has been written correctly.
- Check that the inverter starting program is running.



4.8 How to check for error using the LEDs

4.8.1 Operation status indication LEDs

LED	Description
L.RUN	Lit when refresh data is properly received. Turns OFF when a data
L.KON	transmission is stopped for a certain period of time.
	· Lit when a communication error occurs in the own station and flickers
	when settings of switch, etc. are changed while power is ON.
L.ERR	· Flickers when the <i>Pr. 542</i> or <i>Pr. 543</i> setting is changed.
	Reset the inverter by turning the power OFF then back ON, or through
	CC-Link communication. (Refer to page 232.)
	Lit during normal operation (5V is supplied in the board) (Lit even in the
RUN	noncommunication status.)
KON	Flickers when the master station is CC-Link Ver.1 and FR-E700-NC is
	CC-Link Ver. 2 compatible. (Refer to page 48.)
SD	Turns OFF when no data is transmitted.
RD	Lit when the received data carrier is detected.



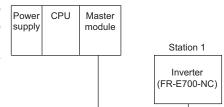
• REMARKS

• Set the station number with *Pr. 542 Communication station number (CC-Link)*, the transmission baud rate with *Pr.543 Baud rate selection (CC-Link)*. (*Refer to page 105.*)

4.8.2 When one inverter is connected

The following table shows how the cause of a fault can be determined with the inverter's (FR-E700-NC) LED statuses in a system configuration that has one inverter.

(In this example, assume SW, M/S, and PRM LEDs of the master module are OFF (master module is in normal operation).)



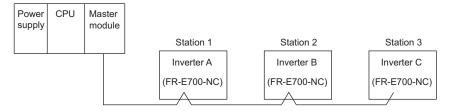
	LI	ED statu	s		Cause
RUN	L.RUN	SD	RD	L.ERR	Cause
•	•	0	0	0	Normal communication is made but CRC error has occurred due to noise.
•	•	0	0	0	Normal communication
•	•	0	0	0	Hardware fault
•	•	0	0	0	Hardware fault
•	•	0	0	0	Cannot answer due to CRC error of receive data.
•	•	0	0	0	Data sent to the host station does not reach destination.
•	•	0	0	0	Hardware fault
•	•	0	0	0	Hardware fault
•	0	0	0	0	Polling response is made but refresh receive is in CRC error.
•	0	0	0	0	Hardware fault
•	0	0	0	0	Hardware fault
•	0	0	0	0	Hardware fault
•	0	0	0	0	Data sent to the host station is in CRC error.
•	0	0	0	0	There is no data sent to the host station, or data sent to the host station cannot be received due to noise.
•	0	0	0	0	Hardware fault
•	0	0	0	0	Cannot receive data due to break in the cable, etc.
•	0	0	@0	•	Invalid baud rate or station number setting
•	•	0	0	0	Baud rate or station number changed during operation.
0	0	0	0	0	Watchdog fault (hardware fault), power disconnection, faulty power supply area
0	_	=		_	Master station is connected to CC-Link Ver. 1 and FR-E700-NC is connected to CC-Link Ver. 2.

●: ON, O: OFF, @: Flicker

4.8.3 When two or more inverters are connected

The following table shows how the cause of a fault can be determined with the inverter's (FR-E700-NC) LED statuses in the system configuration shown below.

(In this example, assume SW, M/S, PRM LEDs of the master module are OFF. (The master module is in normal operation.))



		L	ED :	Status					
Mast	er	lı	nver	ters (FR	-E70	0-NC)		Cause	Corrective Action
Modu	ıle	Statio	n1	Statio	n2	Statio	n3		
		RUN L.RUN SD RD L.ERR	•	RUN L.RUN SD RD L.ERR	•	RUN L.RUN SD RD L.ERR	•	Normal	
		RUN L.RUN SD RD L.ERR	00000	RUN L.RUN SD RD L.ERR	•	RUN L.RUN SD RD L.ERR	• • • • •	CC-Link communication circuit in the inverter is faulty.	Please contact your sales representative.
TIME LINE or TIME LINE	000	RUN L.RUN SD RD L.ERR	•	RUN L.RUN SD RD L.ERR	• O * *	RUN L.RUN SD RD L.ERR	• O * *	L.RUN is OFF at the station 2 inverter and the subsequent inverters. This indicates that the CC-Link dedicated cable has a break between the inverters A and B, or the CC-Link communication connector has come off from the inverter A or B.	Referring to the LED "ON" condition, search for an open point and repair.
		RUN L.RUN SD RD L.ERR	• • * *	RUN L.RUN SD RD L.ERR	• 0 * *	RUN L.RUN SD RD L.ERR	• O * *	The CC-Link dedicated cable is shorted.	Identify the shorted wire out of the three wires (blue, white, yellow) of the CC-Link dedicated cable, and repair the wire.
		RUN L.RUN SD RD L.ERR	• O * *	RUN L.RUN SD RD L.ERR	• • • * *	RUN L.RUN SD RD L.ERR	• • • * * *	The CC-Link dedicated cable is connected incorrectly.	Check if the three wires (blue, white, yellow) of the CC-Link dedicated cable are correctly inserted to the one-touch communication connector plug. If any improper connection is found, correct the connection. (Refer to page 51.)

●: ON, O: OFF, @: Flicker, *: Any of ON, flicker or OFF



4.8.4 Communication stops during operation

- Check that CC-Link dedicated cable is fitted properly. (Check for contact fault, break in the cable, etc.)
- Check that the programmable controller program is executed properly.
- Check that data communication has not stopped due to an instantaneous power failure, etc.

		L	.ED	States					
Mast	ter	I	nver	ters (FR	-E70	0-NC)		Cause	Corrective Action
Mod	Module		n 1	1 Station 2 Statio		Station	3		
		RUN L.RUN SD RD L.ERR	• • • • •	RUN L.RUN SD RD L.ERR	•	RUN C L.RUN C SD RD C L.ERR C	*	Since the L.RUN LEDs of the inverter on station 1 and the inverter on station 3 are OFF, the station numbers of the inverters set as stations 1 and 3 are the same.	After correcting the repeated station numbers of the inverters using <i>Pr. 542 Communication station number (CC-Link)</i> , switch power ON again.
TIME LINE or TIME LINE	0 0	RUN L.RUN SD RD L.ERR	•	RUN L.RUN SD RD L.ERR	•	L.RUN SD		Since the L.RUN and SD LEDs of the inverter on station 2 are OFF, the transmission speed setting of the inverter on station 2 is wrong within the setting range (0 to 4).	After correcting the transmission speed setting using <i>Pr. 543 Baud rate selection</i> (<i>CC-Link</i>), switch power on again.
LIIVL	O	RUN L.RUN SD RD L.ERR	•	RUN L.RUN SD RD L.ERR	•			Since the L.ERR LED on the inverter on station 3 flickers, the station number setting of the inverter on station 3 is changed during normal operation, or the transmission speed is changed during normal operation.	After setting back <i>Pr.542 Communication</i> station number (CC-Link) and <i>Pr.543 Baud</i> rate selection (CC-Link) to their original settings, power ON the inverter again.
		RUN L.RUN SD RD L.ERR	• • • • • •	RUN L.RUN SD RD L.ERR	•		•	Since the L.ERR LED of the inverter on station 2 is ON, the inverter itself on station 1 is affected by noise. (L.RUN may go OFF.)	Securely earth (ground) each inverter and the master module.
TIME LINE or TIME LINE	•	RUN L.RUN SD RD L.ERR	•	RUN L.RUN SD RD L.ERR	•	L.RUN SD RD	•	Since the L.ERR LEDs of the inverter on station 2 and later are ON, the transmission cable between the inverters of stations 2 and 3 is affected by noise. (L.RUN may go OFF.)	Check if shielding wires of the CC-Link dedicated cable are properly inserted to the one-touch communication connector plug. (<i>Refer to page 51</i> .) Place the CC-Link dedicated cable as far as possible from the power cable. (100mm or more)
		RUN L.RUN SD RD L.ERR	• • •	RUN L.RUN SD RD L.ERR	•	L.RUN SD RD	•	The plug-in terminating resistor selection switch (SW1) has been left unset, or the one-touch connector plug with terminating resistor has been left unfitted. (L.RUN may go OFF.)	Check the setting of the terminating resistor selection switch (SW1). (<i>Refer to page 50</i> .) Use the one-touch connector plug with terminating resistor. (<i>Refer to page 53</i> .) Flicker * Any of ON flicker or OFF

●: ON, O: OFF, @: Flicker, *: Any of ON, flicker or OFF

MEMO

5 / PARAMETERS

This chapter explains the "PARAMETERS" for use of this product.

Always read the instructions before using the equipment.

The following marks are used to indicate the controls as below.

W/FV/F control

ADMINICALAdvanced magnetic flux vector control

GPMFVCGeneral-purpose magnetic flux vector control

(Parameters without any mark are valid for all controls.)

1

2

3

4

7

•

7

8

5.1 Operation panel

5.1.1 Names and functions of the operation panel

The operation panel cannot be removed from the inverter.

Operation mode indicator

PU: Lit to indicate PU operation mode. EXT: Not used.

NET: Lit to indicate Network operation mode. (Lit at power-ON at initial setting.)

Unit indicator

Hz: Lit to indicate frequency.
(Flickers when the set frequency monitor is displayed.)

A: Lit to indicate current.

(Both "Hz" and "A" turn OFF when other than the above is displayed.)

Monitor (4-digit LED)

Shows the frequency, parameter number, etc.

Setting dial

(Setting dial: Mitsubishi inverter dial)
Used to change the frequency setting and
parameter settings.

Press to display the following.

- Displays the set frequency in the monitor mode
- Displays the order in the faults history mode

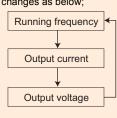
Mode switchover

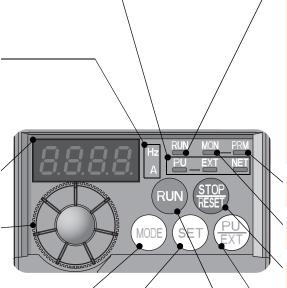
Used to change each setting mode. Pressing for a while (2s) can lock operation.

(Refer to page 224)

Determination of each setting

If pressed during operation, monitor changes as below;





Operating status indicator

Lit or flicker during inverter operation. *

* Lit: When the forward rotation operation is being performed.

Slow flickering (1.4s cycle):

When the reverse operation is being performed.

Fast flickering (0.2s cycle):

When RUN was pressed or the

start command was given, but the operation cannot be made.

- •When the frequency command is less than the starting frequency.
- •When the MRS signal is input.

Parameter setting mode

Lit to indicate parameter setting mode.

Monitor indicator

Lit to indicate monitoring mode.

Stop operation

Used to stop Run command. Fault can be reset when protective function is activated (fault).

Operation mode switchover

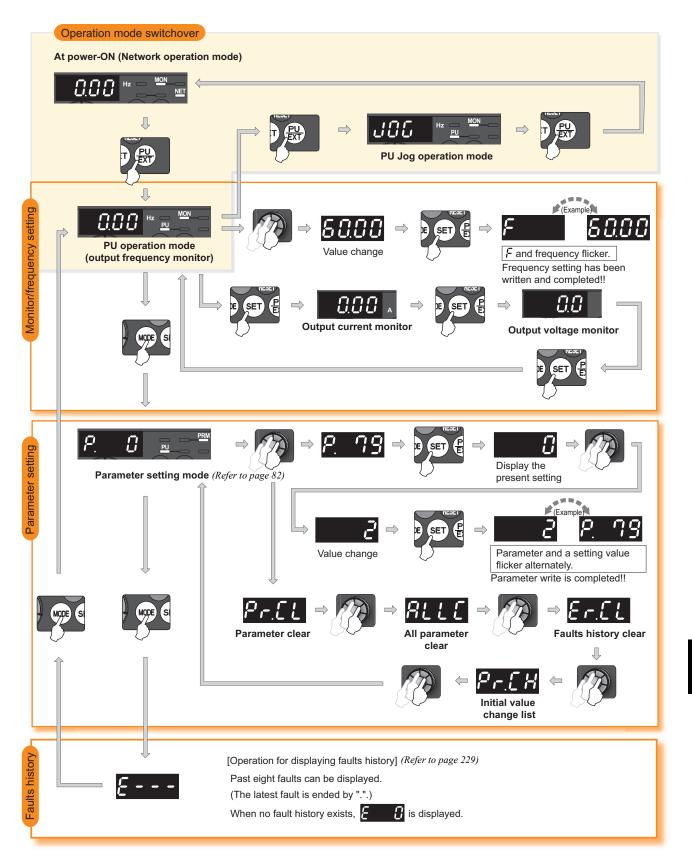
Used to switch between the NET and PU operation modes (valid when Pr.79 = "0") It also cancels the PU stop.

(Refer to page 194)

Start command

The rotation direction can be selected by setting Pr.~40.

5.1.2 Basic operation (factory setting)



5.1.3 Changing the parameter setting value

Changing example

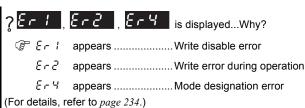
Change the Pr. 1 Maximum frequency setting.

Operation – Display -1. Screen at power-ON The inverter starts up in Network operation mode. The monitor display appears. PU indicator is lit. 2. Press $\frac{PU}{FYT}$ to choose the PU operation mode. PRM indicator is lit. 3. Press (MODE) to choose the parameter setting mode. (The parameter number read previously appears.) 4. Turn until P 5. Press (SET) to read the currently set value. " ;; (120.0Hz (initial value)) appears. 6. Turn to change the set value to " **5** [] [] " (60.00Hz). 7. Press (SET) to set. SET

Flicker...Parameter setting complete!!

- Turn to read another parameter.
- Press (SET) to show the setting again.
- Press (SET) twice to show the next parameter.
- Press (MODE) twice to return the monitor to frequency monitor.

• REMARKS



• The number of digits displayed on the operation panel is four. Only the upper four digits of values can be displayed and set. If the values to be displayed have five digits or more including decimal places, the fifth or later numerals cannot be displayed nor set. (Example) For *Pr. 1*

When 60Hz is set, 60.00 is displayed.

When 120Hz is set, 120.0 is displayed and second decimal place is not displayed nor set.

5.1.4 Setting dial push

Push the setting dial () to display the set frequency* currently set.

* Appears when PU operation mode is selected.

5.2 Parameter list

Parameter list 5.2.1

For simple variable-speed operation of the inverter, the initial setting of the parameters may be used as they are. Set the necessary parameters to meet the load and operational specifications. Parameter setting, change and check are available from the operation panel.

• REMARKS

- lindicates simple mode parameters. (Initially set to extended mode)
- The parameters surrounded by a black border in the table allow their settings to be changed during operation even if "0" (initial value) is set in Pr. 77 Parameter write selection. (Note that the Pr. 77 setting cannot be changed through the CC-Link communication.)

Func- tion	Parameter	Name	Setting Range	Minimum Setting Increments	Initial Value	Refer to Page	Customer Setting
	© 0	Torque boost	0 to 30%	0.1%	6/4/3/2% *1	113	
	© 1	Maximum frequency	0 to 120Hz	0.01Hz	120Hz	124	
	@ 2	Minimum frequency	0 to 120Hz	0.01Hz	0Hz	124	
w	© 3	Base frequency	0 to 400Hz	0.01Hz	60Hz	126	
ion	© 4	Multi-speed setting (high speed)	0 to 400Hz	0.01Hz	60Hz	130	
Basic functions	© 5	Multi-speed setting (middle speed)	0 to 400Hz	0.01Hz	30Hz	130	
ic fu	© 6	Multi-speed setting (low speed)	0 to 400Hz	0.01Hz	10Hz	130	
Sasi	© 7	Acceleration time	0 to 3600/360s	0.1/0.01s	5/10/15s *2	135	
ш	® 8	Deceleration time	0 to 3600/360s	0.1/0.01s	5/10/15s *2	135	
	© 9	Electronic thermal O/L relay	0 to 500A	0.01A	Rated inverter current	142	
tion	10	DC injection brake operation frequency	0 to 120Hz	0.01Hz	3Hz	154	
DC injection brake	11	DC injection brake operation time	0 to 10s	0.1s	0.5s	154	
DC	12	DC injection brake operation voltage	0 to 30%	0.1%	6/4/2% *3	154	
_	13	Starting frequency	0 to 60Hz	0.01Hz	0.5Hz	138	
_	14	Load pattern selection	0 to 3	1	0	128	
ıG ation	15	Jog frequency	0 to 400Hz	0.01Hz	5Hz	201	
JOG operation	16	Jog acceleration/deceleration time	0 to 3600/360s	0.1/0.01s	0.5s	201	
_	17	MRS input selection	0, 2, 4	1	0	166	
_	18	High speed maximum frequency	120 to 400Hz	0.01Hz	120Hz	124	
_	19	Base frequency voltage	0 to 1000V, 8888, 9999	0.1V	9999	126	
Acceleration/ deceleration time	20	Acceleration/deceleration reference frequency	1 to 400Hz	0.01Hz	60Hz	135	
Accele	21	Acceleration/deceleration time increments	0, 1	1	0	135	
all ntion	22	Stall prevention operation level	0 to 200%	0.1%	150%	120	
Stall prevention	23	Stall prevention operation level compensation factor at double speed	0 to 200%, 9999	0.1%	9999	120	
pa	24	Multi-speed setting (speed 4)	0 to 400Hz, 9999	0.01Hz	9999	130	
Multi-speed setting	25	Multi-speed setting (speed 5)	0 to 400Hz, 9999	0.01Hz	9999	130	
ulti-s sett	26	Multi-speed setting (speed 6)	0 to 400Hz, 9999	0.01Hz	9999	130	
ML	27	Multi-speed setting (speed 7)	0 to 400Hz, 9999	0.01Hz	9999	130	

- These instruction codes are used for parameter read and write by using CC-Link communication. (Refer to the Chapter 4 for CC-Link communication)
- "O" indicates valid and "x" indicates invalid of "control mode-based correspondence", "parameter clear", and "all parameter clear".

	Ins	struction Co	de	Control Mo	de-based Corre	spondence	Parai	meter
Parameter	Read	Write	Extended	-V/F -	AD MFVC	GP-MFVC	Clear	All clear
⊚ 0	00	80	0	0	×	×	0	0
© 1	01	81	0	0	0	0	0	0
⊚ 2	02	82	0	0	0	0	0	0
⊚ 3	03	83	0	0	×	×	0	0
© 4	04	84	0	0	0	0	0	0
© 5	05	85	0	0	0	0	0	0
© 6	06	86	0	0	0	0	0	0
© 7	07	87	0	0	0	0	0	0
® 8	08	88	0	0	0	0	0	0
© 9	09	89	0	0	0	0	0	0
10	0A	8A	0	0	0	0	0	0
11	0B	8B	0	0	0	0	0	0
12	0C	8C	0	0	0	0	0	0
13	0D	8D	0	0	0	0	0	0
14	0E	8E	0	0	×	×	0	0
15	0F	8F	0	0	0	0	0	0
16	10	90	0	0	0	0	0	0
17	11	91	0	0	0	0	0	0
18	12	92	0	0	0	0	0	0
19	13	93	0	0	×	×	0	0
20	14	94	0	0	0	0	0	0
21	15	95	0	0	0	0	0	0
22	16	96	0	0	0	0	0	0
23	17	97	0	0	0	0	0	0
24	18	98	0	0	0	0	0	0
25	19	99	0	0	0	0	0	0
26	1A	9A	0	0	0	0	0	0
27	1B	9B	0	0	0	0	0	0
	<u>. </u>	1	1	1	1	l	l	1

Func- tion	Parameter	Name	Setting Range	Minimum Setting Increments	Initial Value	Refer to Page	Customer Setting	
_	29	Acceleration/deceleration pattern selection	0, 1, 2	1	0	139		
-	30	Regenerative function selection	0, 1, 2	1	0	155, 180		
р	31	Frequency jump 1A	0 to 400Hz, 9999	0.01Hz	9999	125		
Frequency jump	32	Frequency jump 1B	0 to 400Hz, 9999	0.01Hz	9999	125		
cy j	33	Frequency jump 2A	0 to 400Hz, 9999	0.01Hz	9999	125		
nen	34	Frequency jump 2B	0 to 400Hz, 9999	0.01Hz	9999	125		
nbe.	35	Frequency jump 3A	0 to 400Hz, 9999	0.01Hz	9999	125		
Ē.	36	Frequency jump 3B	0 to 400Hz, 9999	0.01Hz	9999	125		
_	37	Speed display	0, 0.01 to 9998	0.001	0	175		
_	40	RUN key rotation direction selection	0, 1	1	0	223		
> -	41	Up-to-frequency sensitivity	0 to 100%	0.1%	10%	171		
enc.	42	Output frequency detection	0 to 400Hz	0.01Hz	6Hz	171		
Frequency	43	Output frequency detection for reverse rotation	0 to 400Hz, 9999	0.01Hz	9999	171		
	44	Second acceleration/deceleration time	0 to 3600/360s	0.1/0.01s	5/10/15s *2	135		
SU	45	Second deceleration time	0 to 3600/360s, 9999	0.1/0.01s	9999	135		
ctio	46	Second torque boost	0 to 30%, 9999	0.1%	9999	113		
fun	47	Second V/F (base frequency)	0 to 400Hz, 9999	0.01Hz	9999	126		
Second functions	48	Second stall prevention operation current	0 to 200%, 9999	0.1%	9999	120		
S	51	Second electronic thermal O/L relay	0 to 500A, 9999	0.01A	9999	142		
_	52	DU/PU main display data selection	0, 5, 7 to 12, 14, 20, 23 to 25, 52 to 57, 61, 62, 100	1	0	176		
_	54		1,			<u> </u>	<u> </u>	
_	55	Parameter for manufacturer setting. Do	not set					
_	56	The area of the ar						
restart	57	Restart coasting time	0, 0.1 to 5s, 9999	0.1s	9999	180		
Automatic restart functions	58	Restart cushion time	0 to 60s	0.1s	1s	180		
_	59	Remote function selection	0, 1, 2, 3	1	0	132		
_	60	Energy saving control selection	0, 9	1	0	191		
ration n	61	Reference current	0 to 500A, 9999	0.01A	9999	140		
matic acceler /deceleration	62	Reference value at acceleration	0 to 200%, 9999	1%	9999	140		
Automatic acceleration /deceleration	63	Reference value at deceleration	0 to 200%, 9999	1%	9999	140		
_	65	Retry selection	0 to 5	1	0	188		
_	66	Stall prevention operation reduction starting frequency	0 to 400Hz	0.01Hz	60Hz	120		
	67	Number of retries at fault occurrence	0 to 10, 101 to 110	1	0	188		
Retry	68	Retry waiting time	0.1 to 360s	0.1s	1s	188		
ď	69	Retry count display erase	0	1	0	188		
_	70	Special regenerative brake duty	0 to 30%	0.1%	0%	155		
_	71	Applied motor	0, 1, 3 to 6, 13 to 16, 23, 24, 40, 43, 44, 50, 53, 54	1	0	114, 117, 144, 146,		
_	72	PWM frequency selection	0 to 15	1	1	192		
	12	1 TTW HOQUENCY SCIECTION	1 0 10 10	<u>'</u>	•	174		
	73							
_	73 74	Parameter for manufacturer setting. Do	not set.					

	Ir	struction C	ode	Control Mo	de-based Corre	spondence	Para	meter
Parameter	Read	Write	Extended		AD MFVC	GP MFVC	Clear	All clear
29	1D	9D	0	0	0	0	0	0
30	1E	9E	0	0	0	0	0	0
31	1F	9F	0	0	0	0	0	0
32	20	A0	0	0	0	0	0	0
33	21	A1	0	0	0	0	0	0
34	22	A2	0	0	0	0	0	0
35	23	A3	0	0	0	0	0	0
36	24	A4	0	0	0	0	0	0
37	25	A5	0	0	0	0	0	0
40	28	A8	0	0	0	0	0	0
41	29	A9	0	0	0	0	0	0
42	2A	AA	0	0	0	0	0	0
43	2B	AB	0	0	0	0	0	0
44	2C	AC	0	0	0	0	0	0
45	2D	AD	0	0	0	0	0	0
46	2E	AE	0	0	×	×	0	0
47	2F	AF	0	0	×	×	0	0
48	30	В0	0	0	0	0	0	0
51	33	В3	0	0	0	0	0	0
52	34	B4	0	0	0	0	0	0
54								
55	Parameter	for manufactu	rer setting. Do	not set				
56								
57	39	В9	0	0	0	0	0	0
58	3A	ВА	0	0	0	0	0	0
59	3B	BB	0	0	0	0	0	0
60	3C	BC	0	0	×	×	0	0
61	3D	BD	0	0	0	0	0	0
62	3E	BE	0	0	0	0	0	0
63	3F	BF	0	0	0	0	0	0
65	41	C1	0	0	0	0	0	0
66	42	C2	0	0	0	0	0	0
67	43	C3	0	0	0	0	0	0
68	44	C4	0	0	0	0	0	0
69	45	C5	0	0	0	0	0	0
70	46	C6	0	0	0	0	0	0
71	47	C7	0	0	0	0	0	0
72	48	C8	0	0	0	0	0	0
73 74			rer setting. Do					
75	4B	СВ	0	0	0	0	×	×
				-	-	<u>-</u>		

5
RS
₹

Func- tion	Parameter	Name	Setting Range	Minimum Setting Increments	Initial Value	Refer to Page	Customer Setting
_	77	Parameter write selection	0, 1, 2	1	0	196	
	78	Reverse rotation prevention selection	0, 1, 2	1	0	197	
_	© 79	Operation mode selection	0, 1, 2, 3, 4, 6, 7	1	0	103	
						112,	
	00	Madagasasas	0.4.4- 45144/ 0000	0.04130/	0000	114,	
	80	Motor capacity	0.1 to 15kW, 9999	0.01kW	9999	117,	
						146	
						112,	
						114,	
	81	Number of motor poles	2, 4, 6, 8, 10, 9999	1	9999	117,	
						146	
			0 to 500A (0 to ****),			140	
	82	Motor excitation current	9999 *5	0.01A (1) *5	9999	146	
			0000 +3		200V/400V		
ts	83	Rated motor voltage	0 to 1000V	0.1V	*4	146	
tan	84	Rated motor frequency	10 to 120Hz	0.01Hz	60Hz	146	
ons	0-1	Speed control gain (Advanced			30112	170	
Motor constants	89	magnetic flux vector)	0 to 200%, 9999	0.1%	9999	114	
lotc		-	0 to 50Ω (0 to ****),				
≥	90	Motor constant (R1)	9999 *5	0.001Ω (1) *5	9999	146	
			0 to 50Ω (0 to ****),				
	91	Motor constant (R2)	9999 *5	0.001Ω (1) *5	9999	146	
				0.1mH			
	92	Motor constant (L1)	0 to 1000mH (0 to 50Ω,		9999	146	
			0 to ****), 9999 *5 (0.001Ω, 1) *5				
	93	Motor constant (L2)	0 to 1000mH (0 to 50Ω ,	0.1mH	9999	146	
		, ,	0 to ****) , 9999 *5	(0.001Ω, 1) *5			
	94	Motor constant (X)	0 to 100% (0 to 500Ω, 0	0.1%	9999	146	
		motor constant (71)	to ****), 9999 *5	(0.01Ω, 1) *5		1,0	
	96	Auto tuning setting/status	0, 1, 11, 21	1	0	146,	
		Tato taring coungrotates	0, 1, 11, 21		Ŭ	180	
						1	
_	117		1				
	117 118						
						•	
 - - -	118	Parameter for manufacturer setting. Do	not set				
	118 119	Parameter for manufacturer setting. Do	not set.				
	118 119 120	Parameter for manufacturer setting. Do	not set.			,	
	118 119 120 121	Parameter for manufacturer setting. Do	not set.				
- - - - - -	118 119 120 121 122	Parameter for manufacturer setting. Do	not set.				
	118 119 120 121 122 123	Parameter for manufacturer setting. Do Frequency setting gain	not set. 0 to 400Hz	0.01Hz	60Hz	203	
	118 119 120 121 122 123 124		0 to 400Hz	0.01Hz	60Hz	203	
	118 119 120 121 122 123 124 @125 126	Frequency setting gain	0 to 400Hz not set.				
	118 119 120 121 122 123 124 ©125	Frequency setting gain Parameter for manufacturer setting. Do	0 to 400Hz	0.01Hz 0.01Hz	60Hz 9999	203	
	118 119 120 121 122 123 124 ©125 126 127	Frequency setting gain Parameter for manufacturer setting. Do PID control automatic switchover frequency	0 to 400Hz not set.	0.01Hz	9999	203	
ration	118 119 120 121 122 123 124 @125 126	Frequency setting gain Parameter for manufacturer setting. Do PID control automatic switchover	0 to 400Hz not set. 0 to 400Hz, 9999				
operation	118 119 120 121 122 123 124 ©125 126 127	Frequency setting gain Parameter for manufacturer setting. Do PID control automatic switchover frequency	0 to 400Hz not set. 0 to 400Hz, 9999 0, 20, 21, 40 to 43,	0.01Hz	9999	203	
1D operation	118 119 120 121 122 123 124 ©125 126 127 128	Frequency setting gain Parameter for manufacturer setting. Do PID control automatic switchover frequency PID action selection PID proportional band	0 to 400Hz not set. 0 to 400Hz, 9999 0, 20, 21, 40 to 43, 50, 51, 60, 61 0.1 to 1000%, 9999	0.01Hz	9999	203 203 203	
PID operation	118 119 120 121 122 123 124 ©125 126 127	Frequency setting gain Parameter for manufacturer setting. Do PID control automatic switchover frequency PID action selection PID proportional band PID integral time	0 to 400Hz not set. 0 to 400Hz, 9999 0, 20, 21, 40 to 43, 50, 51, 60, 61 0.1 to 1000%, 9999 0.1 to 3600s, 9999	0.01Hz 1 0.1% 0.1s	9999	203 203 203 203	
PID operation	118 119 120 121 122 123 124	Frequency setting gain Parameter for manufacturer setting. Do PID control automatic switchover frequency PID action selection PID proportional band PID integral time PID upper limit	0 to 400Hz not set. 0 to 400Hz, 9999 0, 20, 21, 40 to 43, 50, 51, 60, 61 0.1 to 1000%, 9999 0.1 to 3600s, 9999 0 to 100%, 9999	0.01Hz 1 0.1% 0.1s 0.1%	9999 0 100% 1s 9999	203 203 203 203 203 203	
PID operation	118 119 120 121 122 123 124 @125 126 127 128 129 130 131 132	Frequency setting gain Parameter for manufacturer setting. Do PID control automatic switchover frequency PID action selection PID proportional band PID integral time PID upper limit PID lower limit	0 to 400Hz not set. 0 to 400Hz, 9999 0, 20, 21, 40 to 43, 50, 51, 60, 61 0.1 to 1000%, 9999 0 to 100%, 9999 0 to 100%, 9999 0 to 100%, 9999	0.01Hz 1 0.1% 0.1s	9999 0 100% 1s	203 203 203 203	
PID operation	118 119 120 121 122 123 124 @125 126 127 128 129 130 131 132 133	Frequency setting gain Parameter for manufacturer setting. Do PID control automatic switchover frequency PID action selection PID proportional band PID integral time PID upper limit PID lower limit Parameter for manufacturer setting. Do	0 to 400Hz not set. 0 to 400Hz, 9999 0, 20, 21, 40 to 43, 50, 51, 60, 61 0.1 to 1000%, 9999 0 to 100%, 9999 0 to 100%, 9999 not set.	0.01Hz 1 0.1% 0.1s 0.1% 0.1%	9999 0 100% 1s 9999 9999	203 203 203 203 203 203 203	
PID operation	118 119 120 121 122 123 124 ©125 126 127 128 129 130 131 132 133 134	Frequency setting gain Parameter for manufacturer setting. Do PID control automatic switchover frequency PID action selection PID proportional band PID integral time PID upper limit PID lower limit	0 to 400Hz not set. 0 to 400Hz, 9999 0, 20, 21, 40 to 43, 50, 51, 60, 61 0.1 to 1000%, 9999 0 to 100%, 9999 0 to 100%, 9999 0 to 100%, 9999	0.01Hz 1 0.1% 0.1s 0.1%	9999 0 100% 1s 9999	203 203 203 203 203 203	
PID operation	118 119 120 121 122 123 124 ©125 126 127 128 129 130 131 132 133 134 145	Frequency setting gain Parameter for manufacturer setting. Do PID control automatic switchover frequency PID action selection PID proportional band PID integral time PID upper limit PID lower limit Parameter for manufacturer setting. Do	0 to 400Hz not set. 0 to 400Hz, 9999 0, 20, 21, 40 to 43, 50, 51, 60, 61 0.1 to 1000%, 9999 0 to 100%, 9999 0 to 100%, 9999 not set. 0.01 to 10.00s, 9999	0.01Hz 1 0.1% 0.1s 0.1% 0.1%	9999 0 100% 1s 9999 9999	203 203 203 203 203 203 203	
	118 119 120 121 122 123 124 ©125 126 127 128 129 130 131 132 133 134	Frequency setting gain Parameter for manufacturer setting. Do PID control automatic switchover frequency PID action selection PID proportional band PID integral time PID upper limit PID lower limit Parameter for manufacturer setting. Do PID differential time Parameter for manufacturer setting. Do	0 to 400Hz not set. 0 to 400Hz, 9999 0, 20, 21, 40 to 43, 50, 51, 60, 61 0.1 to 1000%, 9999 0 to 100%, 9999 0 to 100%, 9999 not set. 0.01 to 10.00s, 9999	0.01Hz 1 0.1% 0.1s 0.1% 0.1%	9999 0 100% 1s 9999 9999	203 203 203 203 203 203 203	
	118 119 120 121 122 123 124 ©125 126 127 128 129 130 131 132 133 134 145	Frequency setting gain Parameter for manufacturer setting. Do PID control automatic switchover frequency PID action selection PID proportional band PID integral time PID upper limit PID lower limit Parameter for manufacturer setting. Do PID differential time Parameter for manufacturer setting. Do Acceleration/deceleration time	0 to 400Hz not set. 0 to 400Hz, 9999 0, 20, 21, 40 to 43, 50, 51, 60, 61 0.1 to 1000%, 9999 0 to 100%, 9999 0 to 100%, 9999 not set. 0.01 to 10.00s, 9999	0.01Hz 1 0.1% 0.1s 0.1% 0.1%	9999 0 100% 1s 9999 9999	203 203 203 203 203 203 203	
	118 119 120 121 122 123 124 ®125 126 127 128 129 130 131 132 133 134 145 146 147	Frequency setting gain Parameter for manufacturer setting. Do PID control automatic switchover frequency PID action selection PID proportional band PID integral time PID upper limit PID lower limit Parameter for manufacturer setting. Do PID differential time Parameter for manufacturer setting. Do Acceleration/deceleration time switching frequency	0 to 400Hz not set. 0 to 400Hz, 9999 0, 20, 21, 40 to 43, 50, 51, 60, 61 0.1 to 1000%, 9999 0 to 100%, 9999 0 to 100%, 9999 not set. 0.01 to 10.00s, 9999 not set. 0 to 400Hz, 9999	0.01Hz 1 0.1% 0.1s 0.1% 0.1% 0.01% 0.01Hz	9999 0 100% 1s 9999 9999	203 203 203 203 203 203 203 203	
	118 119 120 121 122 123 124 ©125 126 127 128 129 130 131 132 133 134 145 146	Frequency setting gain Parameter for manufacturer setting. Do PID control automatic switchover frequency PID action selection PID proportional band PID integral time PID upper limit Parameter for manufacturer setting. Do PID differential time Parameter for manufacturer setting. Do Acceleration/deceleration time switching frequency Output current detection level	0 to 400Hz not set. 0 to 400Hz, 9999 0, 20, 21, 40 to 43, 50, 51, 60, 61 0.1 to 1000%, 9999 0 to 100%, 9999 0 to 100%, 9999 not set. 0.01 to 10.00s, 9999 not set.	0.01Hz 1 0.1% 0.1s 0.1% 0.1% 0.01%	9999 0 100% 1s 9999 9999	203 203 203 203 203 203 203 203	
	118 119 120 121 122 123 124 ®125 126 127 128 129 130 131 132 133 134 145 146 147	Frequency setting gain Parameter for manufacturer setting. Do PID control automatic switchover frequency PID action selection PID proportional band PID integral time PID upper limit PID lower limit Parameter for manufacturer setting. Do PID differential time Parameter for manufacturer setting. Do Acceleration/deceleration time switching frequency Output current detection level Output current detection signal delay	0 to 400Hz not set. 0 to 400Hz, 9999 0, 20, 21, 40 to 43, 50, 51, 60, 61 0.1 to 1000%, 9999 0 to 100%, 9999 0 to 100%, 9999 not set. 0.01 to 10.00s, 9999 not set. 0 to 400Hz, 9999	0.01Hz 1 0.1% 0.1s 0.1% 0.1% 0.01% 0.01Hz	9999 0 100% 1s 9999 9999	203 203 203 203 203 203 203 203	
	118 119 120 121 122 123 124 ©125 126 127 128 129 130 131 132 133 134 145 146 147 150 151	Frequency setting gain Parameter for manufacturer setting. Do PID control automatic switchover frequency PID action selection PID proportional band PID integral time PID upper limit PID lower limit Parameter for manufacturer setting. Do PID differential time Parameter for manufacturer setting. Do Acceleration/deceleration time switching frequency Output current detection level Output current detection signal delay time	0 to 400Hz not set. 0 to 400Hz, 9999 0, 20, 21, 40 to 43, 50, 51, 60, 61 0.1 to 1000%, 9999 0 to 100%, 9999 0 to 100%, 9999 not set. 0.01 to 10.00s, 9999 not set. 0 to 400Hz, 9999 0 to 200% 0 to 10s	0.01Hz 1 0.1% 0.1s 0.19 0.19 0.01s 0.01s 0.01s	9999 0 100% 1s 9999 9999 9999 150% 0s	203 203 203 203 203 203 203 203 135 172 172	
Current detection I	118 119 120 121 122 123 124	Frequency setting gain Parameter for manufacturer setting. Do PID control automatic switchover frequency PID action selection PID proportional band PID integral time PID upper limit PID lower limit Parameter for manufacturer setting. Do PID differential time Parameter for manufacturer setting. Do Acceleration/deceleration time switching frequency Output current detection level Output current detection signal delay	0 to 400Hz not set. 0 to 400Hz, 9999 0, 20, 21, 40 to 43, 50, 51, 60, 61 0.1 to 1000%, 9999 0 to 100%, 9999 0 to 100%, 9999 not set. 0.01 to 10.00s, 9999 not set. 0 to 400Hz, 9999 0 to 200%	0.01Hz 1 0.1% 0.1s 0.19 0.19 0.01s 0.01Hz 0.01Hz	9999 0 100% 1s 9999 9999 9999 150%	203 203 203 203 203 203 203 203 135 172	

	Ins	struction Co	de	Control Mo	Control Mode-based Corres		Para	meter
Parameter	Read	Write	Extended	_ V/F _	AD-MFVC	GP MFVC	Clear	All clear
77	4D	— *9	0	0	0	0	0	0
78	4E	CE	0	0	0	0	0	0
© 79	4F	— *9	0	0	0	0	0	0
80	50	D0	0	Х	0	0	0	0
81	51	D1	0	×	0	0	0	0
82	52	D2	0	×	0	0	×	0
83	53	D3	0	×	0	0	0	0
84	54	D4	0	×	0	0	0	0
89	59	D9	0	×	0	×	×	0
90	5A	DA	0	0	0	0	×	0
91	5B	DB	0	×	0	0	×	0
92	5C	DC	0	×	0	0	×	0
93	5D	DD	0	×	0	0	×	0
94	5E	DE	0	×	0	0	×	0
96	60	E0	0	0	0	0	×	0
117		·					l.	
118								
119								
120	Parameter f	or manufactui	rer setting. Do	not set.				
121								
122								
123								
124 © 125	19	99	1	0	0	0		0
126			rer setting. Do		0	U	×	U
127	1B	9B	1	0	0	0	0	0
128	1C	9C	1	0	0	0	0	0
129	1D	9D	1	0	0	0	0	0
130	1E	9E	1	0	0	0	0	0
131	1F	9F	1	0	0	0	0	0
132	20	A0	1	0	0	0	0	0
133			rer setting. Do					
134	22	A2	1	0	0	0	0	0
145			ron oction D				1	
146	rarameter f	oi manufactul	rer setting. Do	not set.				
147	2F	AF	1	0	0	0	0	0
150	32	B2	1	0	0	0	0	0
151	33	В3	1	0	0	0	0	0
152	34	B4	1	0	0	0	0	0
153	35	B5	1	0	0	0	0	0

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Func- tion	Parameter	Name	Setting Range	Minimum Setting Increments	Initial Value	Refer to Page	Customer Setting
_	156	Stall prevention operation selection	0 to 31, 100, 101	1	0	120	
_	157	OL signal output timer	0 to 25s, 9999	0.1s	0s	120	
_	© 160	User group read selection	0, 1, 9999	1	0	197	
_	161	Frequency setting/key lock operation selection	0, 1, 10, 11	1	0	224	
ic restart ions	162	Automatic restart after instantaneous power failure selection	0, 1, 10, 11	1	1	180	
Automatic restart functions	165	Stall prevention operation level for restart	0 to 200%	0.1%	150%	180	
_	168 169	Parameter for manufacturer setting. Do	not set.				
lative r clear	170	Watt-hour meter clear	0, 10, 9999	1	9999	176	
Cumulative monitor clear	171	Operation hour meter clear	0, 9999	1	9999	176	
dn e	172	User group registered display/batch clear	9999, (0 to 16)	1	0	197	
User group	173	User group registration	0 to 999, 9999	1	9999	197	
	174	User group clear	0 to 999, 9999	1	9999	197	
_	178 179	Parameter for manufacturer setting. Do	not set.			•	
Б Б	180	RY4 function selection		1	0	163	
uncti	181	RY3 function selection		1	1	163	
terminal fun assignment	182	RY2 function selection	0 to 5, 7, 8, 10, 12, 14 to 16, 18, 24, 25,	1	2	163	
ermi	183	RY9 function selection	62, 65 to 67, 9999	1	24	163	
Input terminal function assignment	184	RYB function selection		1	62	163	
	190	RX2 (terminal Y0) function selection	0, 1, 3, 4, 7, 8, 11 to 16, 20, 25, 26, 46, 47, 64, 68, 80, 81, 90, 91, 93, 95, 96, 98, 99, 100, 101,	1	0	167	
Output terminal function assignment	191	RX6 function selection	103, 104, 107, 108, 111 to 116, 120, 125, 126, 146, 147, 164, 168, 180, 181, 190, 191, 193, 195, 196, 198, 199, 9999	1	4	167	
Output terminal fu	192	RX7 function selection	0, 1, 3, 4, 7, 8, 11 to 16, 20, 25, 26, 46, 47, 64, 68, 80, 81, 90, 91, 95, 96, 98, 99, 100, 101, 103, 104, 107, 108, 111 to 116, 120, 125, 126, 146, 147, 164, 168, 180, 181, 190, 191, 195, 196, 198, 199, 9999	1	99	167	
	232	Multi-speed setting (speed 8)	0 to 400Hz, 9999	0.01Hz	9999	130	
ng	233	Multi-speed setting (speed 9)	0 to 400Hz, 9999	0.01Hz	9999	130	
Multi-speed setting	234	Multi-speed setting (speed 10)	0 to 400Hz, 9999	0.01Hz	9999	130	
s p	235	Multi-speed setting (speed 11)	0 to 400Hz, 9999	0.01Hz	9999	130	
bee	236	Multi-speed setting (speed 12)	0 to 400Hz, 9999	0.01Hz	9999	130	
ti-s	237	Multi-speed setting (speed 13)	0 to 400Hz, 9999	0.01Hz	9999	130	
Mul	238	Multi-speed setting (speed 14)	0 to 400Hz, 9999	0.01Hz	9999	130	
_	239	Multi-speed setting (speed 15)	0 to 400Hz, 9999	0.01Hz	9999	130	
	240	Soft-PWM operation selection	0, 1	1	1	192	
	241	Parameter for manufacturer setting. Do			,	1/2	

	Ins	struction Co	de	Control Mo	de-based Corre	spondence	Para	meter
Parameter	Read	Write	Extended	≻V/F -⟨	AD-MFVC	GP MFVC	Clear	All clear
156	38	B8	1	0	0	0	0	0
157	39	B9	1	0	0	0	0	0
160	00	80	2	0	0	0	0	0
161	01	81	2	0	0	0	×	0
162	02	82	2	0	0	0	0	0
165	05	85	2	0	0	0	0	0
168	Parameter f	or manufactu	er setting. Do	not set.				
169		1					1	
170	0A	8A	2	0	0	0	×	0
171	0B	8B	2	0	0	0	×	×
172	0C	8C	2	0	0	0	×	×
173	0D	8D	2	0	0	0	×	×
174	0E	8E	2	0	0	0	×	×
178	Parameter f	or manufactu	er setting. Do	not set.				
179							1	
180	14	94	2	0	0	0	×	0
181	15	95	2	0	0	0	×	0
182	16	96	2	0	0	0	×	0
183	17	97	2	0	0	0	×	0
184	18	98	2	0	0	0	×	0
190	1E	9E	2	0	0	0	×	0
191	1F	9F	2	0	0	0	×	0
192	20	A0	2	0	0	0	×	0
232	28	A8	2	0	0	0	0	0
233	29	A9	2	0	0	0	0	0
234	2A	AA	2	0	0	0	0	0
235	2B	AB	2	0	0	0	0	0
236	2C	AC	2	0	0	0	0	0
237	2D	AD	2	0	0	0	0	0
238	2E	AE	2	0	0	0	0	0
239	2F	AF	2	0	0	0	0	0
240	30	B0	2	0	0	0	0	0
241	Parameter f	or manufactu	er setting. Do	not set.				
	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·				·	

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Func- tion	Parameter	Name	Setting Range	Minimum Setting Increments	Initial Value	Refer to Page	Customer Setting
_	244	Cooling fan operation selection	0, 1	1	1	213	
ıtion	245	Rated slip	0 to 50%, 9999	0.01%	9999	119	
Slip compensation	246	Slip compensation time constant	0.01 to 10s	0.01s	0.5s	119	
com	247	Constant-power range slip compensation selection	0, 9999	1	9999	119	
_	249	Earth (ground) fault detection at start	0, 1	1	0	190	
_	250	Stop selection	0 to 100s, 1000 to 1100s, 8888, 9999	0.1s	9999	157	
_	251	Output phase loss protection selection	0, 1	1	1	190	
S	255	Life alarm status display	(0 to 15)	1	0	214	
Life diagnosis	256	Inrush current limit circuit life display	(0 to 100%)	1%	100%	214	
agr	257	Control circuit capacitor life display	(0 to 100%)	1%	100%	214	
e di	258	Main circuit capacitor life display	(0 to 100%)	1%	100%	214	
Life	259	Main circuit capacitor life measuring	0, 1 (2, 3, 8, 9)	1	0	214	
Power failure stop	261	Power failure stop selection	0, 1, 2	1	0	186	
1	267	Parameter for manufacturer setting. Do	not set.				
_	268	Monitor decimal digits selection	0, 1, 9999	1	9999	176	
_	269	Parameter for manufacturer setting. Do	not set.				
	270	Stop-on contact control selection	0, 1	1	0	158	
act rol	275	Stop-on contact excitation current low- speed multiplying factor	0 to 300%, 9999	0.1%	9999	158	
Stop-on contact control	276	PWM carrier frequency at stop-on contact	0 to 9, 9999	1	9999	158	
_	277	Stall prevention operation current switchover	0, 1	1	0	120	
(I)	278	Brake opening frequency	0 to 30Hz	0.01Hz	3Hz	160	
ce sequence function	279	Brake opening current	0 to 200%	0.1%	130%	160	
ce seque function	280	Brake opening current detection time	0 to 2s	0.1s	0.3s	160	
se	281	Brake operation time at start	0 to 5s	0.1s	0.3s	160	
	282	Brake operation frequency	0 to 30Hz	0.01Hz	6Hz	160	
Bral	283	Brake operation time at stop	0 to 5s	0.1s	0.3s	160	
	286	Droop gain	0 to 100%	0.1%	0%	210	
Droop control	287	Droop filter time constant	0 to 1s	0.1% 0.01s	0.3s	210	
	292	Automatic acceleration/deceleration	0, 1, 7, 8, 11	1	0	140	
_	293	Acceleration/deceleration separate	0 to 2	1	0	140	
		selection		0.04	^	22.	
p u	295 296	Magnitude of frequency change setting Password lock level	0, 0.01, 0.1, 1, 10 0 to 6, 99, 100 to 106,	0.01	9999	226 199	
Password function	297	Password lock/unlock	199, 9999 (0 to 5), 1000 to 9998,	1	9999	199	
ц.			9999				
_	298	Frequency search gain	0 to 32767, 9999	1	9999	180	
_	299	Rotation direction detection selection at restarting	0, 1, 9999	1	0	180	
Digital output	⊚ 313	RX9 function selection	0, 1, 3, 4, 7, 8, 11 to 16, 20, 25, 26, 46, 47, 64, 68, 80, 81, 90, 91, 93,	1	9999	167	
	⊚ 314	RXA function selection	95, 96, 98, 99, 100, 101, 103, 104, 107, 108, 111 to 116, 120, 125,	1	9999	167	
Digi	© 315	RXB function selection	126, 146, 147, 164, 168, 180, 181, 190, 191, 193, 195, 196, 198, 199, 9999	1	9999	167	

Perameter Read Write Extended SUF ADMISS SPIRIS Clear All clear	_	Ins	struction Co	de	Control Mo	de-based Corre	spondence	Parai	neter
245	Parameter	Read	Write	Extended	-V/F-	AD MFVC	GP MFVC	Clear	All clear
246 36 B6 2 O × O O O 247 37 B7 2 O × O	244	34	B4	2	0	0	0	0	0
247 37 B7 2 O X O O O O O O O O	245	35	B5	2	0	×	0	0	0
249 39 B9 2	246	36	B6	2	0	×	0	0	0
250 3A BA 2 0 0 0 0 0 0 0 0 0	247	37	B7	2	0	×	0	0	0
251 3B BB 2	249	39	B9	2	0	0	0	0	0
255 3F	250	3A	ВА	2	0	0	0	0	0
256	251	3B	BB	2	0	0	0	0	0
257	255	3F	BF	2	0	0	0	×	×
258	256	40	C0	2	0	0	0	×	×
259	257	41	C1	2	0	0	0	×	×
261 45 C5 2 O O O O O 267 Parameter for manufacturer setting. Do not set. 288 4C CC 2 O	258	42	C2	2	0	0	0	×	×
287	259	43	C3	2	0	0	0	0	0
268 4C CC 2 O <td>261</td> <td>45</td> <td>C5</td> <td>2</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td>	261	45	C5	2	0	0	0	0	0
269 Parameter for manufacturer setting. Do not set. 270 4E CE 2 × O O O O 275 53 D3 2 × O O O O 276 54 D4 2 × O O O O 277 55 D5 2 O O O O O 278 56 D6 2 × O O O O 279 57 D7 2 × O O O O 280 58 D8 2 × O O O O 281 59 D9 2 × O O O O 282 5A DA 2 × O O O O 283 5B DB 2 × O O O O	267	Parameter f	or manufactur	er setting. Do	not set.				
270						0	0	0	0
275 53 D3 2 x O O O O 276 54 D4 2 x O O O O 277 55 D5 2 O O O O O 278 56 D6 2 x O O O O 279 57 D7 2 x O O O O 280 58 D8 2 x O O O O 281 59 D9 2 x O O O O 282 5A DA 2 x O O O O 283 5B DB 2 x O O O O 286 5E DE 2 x O X O O 287 5F DF 2 x O X O O 293 65 E5 2 O	269	Parameter f	or manufactur	er setting. Do	not set.				
276 54 D4 2	270	4E	CE	2	×	0	0	0	0
277 55 D5 2 O O O O O O O O O O O O O O O O O O	275	53	D3	2	×	0	0	0	0
278 56 D6 2 × O <td>276</td> <td>54</td> <td>D4</td> <td>2</td> <td>×</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td>	276	54	D4	2	×	0	0	0	0
279 57 D7 2 × O <td>277</td> <td>55</td> <td>D5</td> <td>2</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td>	277	55	D5	2	0	0	0	0	0
280 58 D8 2 x O <td>278</td> <td>56</td> <td>D6</td> <td>2</td> <td>×</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td>	278	56	D6	2	×	0	0	0	0
281 59 D9 2 × O <td>279</td> <td>57</td> <td>D7</td> <td>2</td> <td>×</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td>	279	57	D7	2	×	0	0	0	0
282 5A DA 2 × O <td>280</td> <td>58</td> <td>D8</td> <td>2</td> <td>×</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td>	280	58	D8	2	×	0	0	0	0
283 5B DB 2 x O <td>281</td> <td>59</td> <td>D9</td> <td>2</td> <td>×</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td>	281	59	D9	2	×	0	0	0	0
286 5E DE 2 × O × O O 287 5F DF 2 × O × O O 292 64 E4 2 O O O O O 293 65 E5 2 O O O O O 295 67 E7 2 O O O O O 296 68 E8 2 O O O × O 297 69 E9 2 O O O × O 298 6A EA 2 O O O X O 299 6B EB 2 O O O O O O © 313 OD 8D 3 O O O O O O	282	5A		2	×	0	0	0	0
287 5F DF 2 x O x O O 292 64 E4 2 O O O O O 293 65 E5 2 O O O O O 295 67 E7 2 O O O O O 296 68 E8 2 O O O X O 297 69 E9 2 O O O X O 298 6A EA 2 O O O X O 299 6B EB 2 O O O O O © 313 0D 8D 3 O O O O O	283	5B	DB	2	×	0	0	0	0
292 64 E4 2 O <td></td> <td></td> <td>DE</td> <td>2</td> <td>×</td> <td>0</td> <td>×</td> <td>0</td> <td>0</td>			DE	2	×	0	×	0	0
293 65 E5 2 O <td>287</td> <td></td> <td>DF</td> <td>2</td> <td>×</td> <td>0</td> <td>×</td> <td>0</td> <td>0</td>	287		DF	2	×	0	×	0	0
295 67 E7 2 O <td>292</td> <td>64</td> <td>E4</td> <td>2</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td>	292	64	E4	2	0	0	0	0	0
296 68 E8 2 O O A O 297 69 E9 2 O O O X +8 O 298 6A EA 2 O O O X O 299 6B EB 2 O O O O O © 313 OD 8D 3 O O O O O © 314 OE 8E 3 O O O O O	293	65	E5	2	0	0	0	0	0
297 69 E9 2 O O O ×*8 O 298 6A EA 2 O O O × O 299 6B EB 2 O O O O O © 313 OD 8D 3 O O O O O © 314 OE 8E 3 O O O O O	295	67	E7	2	0	0	0	0	0
298 6A EA 2 O O O X O 299 6B EB 2 O O O O O © 313 0D 8D 3 O O O O O © 314 0E 8E 3 O O O O O	296					0		×	0
299 6B EB 2 O O O O O © 313 0D 8D 3 O O O O O © 314 0E 8E 3 O O O O O	297	69	E9	2	0	0	0	× *8	0
© 313	298	6A	EA	2	0	0	0	×	0
© 314 OE 8E 3 O O O O	299	6B	ЕВ	2	0	0	0	0	0
	© 313	0D	8D	3	0	0	0	0	0
® 315 OF 8F 3 O O O O	© 314	0E	8E	3	0	0	0	0	0
	© 315	0F	8F	3	0	0	0	0	0

Func- tion	Parameter	Name	Setting Range	Minimum Setting Increments	Initial Value	Refer to Page	Customer Setting
_	338						
	339 340	Parameter for manufacturer setting. Do	not set.				
_	342	Communication EEPROM write selection	0, 1	1	0	110	
_	343	Parameter for manufacturer setting. Do	not set.				l
_	© 349	Communication reset selection	0, 1	1	0	110	
Second motor constant	450	Second applied motor	0, 1, 9999	1	9999	144	
ont	495	Remote output selection	0, 1, 10, 11	1	0	174	
Output	496	Remote output data 1	0 to 4095	1	0	174	
_	497	Parameter for manufacturer setting. Do	not set.				
ıtion	© 500	Communication error execution waiting time	0 to 999.8s	0.1s	0	107	
Communication error	© 501	Communication error occurrence count display	0	1	0	107	
ပိ	502	Stop mode selection at communication error	0, 1, 2, 3	1	0	107	
Maintenance	503	Maintenance timer	0 (1 to 9998)	1	0	217	
Mainte	504	Maintenance timer alarm output set time	0 to 9998, 9999	1	9999	217	
~	© 541	Frequency command sign selection (CC-Link)	0, 1	1	0	105	
CC-Link	© 542	Communication station number (CC-Link)	1 to 64	1	1	105	
	© 543	Baud rate selection (CC-Link)	0 to 4	1	0	105	
	© 544 547	CC-Link extended setting USB communication station number	0, 1, 12, 14, 18 0 to 31	1	0	105 220	
USB	548	USB communication check time interval	0 to 999.8s, 9999	0.1s	9999	220	
_	549	Parameter for manufacturer setting. Do	not set.				
_	550	_	T	 		1	I
_	551	PU mode operation command source selection	2 to 4, 9999	1	9999	220	
age	555	Current average time	0.1 to 1.0s	0.1s	1s	218	
Current average time monitor	556	Data output mask time	0 to 20s	0.1s	0s	218	
Curre	557	Current average value monitor signal output reference current	0 to 500A	0.01A	Rated inverter current	218	

	In	struction Co	de	Control Mo	de-based Corre	spondence	Parameter	
Parameter	Read	Write	Extended	>-∨/F- ⟨	AD MFVC	GP MFVC	Clear	All clear
338								
339	Parameter f	or manufactu	rer setting. Do	not set.				
340								
342	2A	AA	3	0	0	0	0	0
343			rer setting. Do					
© 349	31	B1	3	0	0	0	O *7	O *7
450	32	B2	4	0	0	0	0	0
495	5F	DF	4	0	0	0	0	0
496	60	E0	4	0	0	0	×	×
497	Parameter f	or manufactu	rer setting. Do	not set.				
© 500	00	80	5	0	0	0	0	0
© 501	01	81	5	0	0	0	0	0
502	02	82	5	0	0	0	0	0
503	03	83	5	0	0	0	×	×
504	04	84	5	0	0	0	×	0
© 541	29	A9	5	0	0	0	O *7	O *7
© 542	2A	AA	5	0	0	0	O *7	O *7
© 543	2B	AB	5	0	0	0	O *7	O *7
© 544	2C	AC	5	0	0	0	O *7	O *7
547	2F	AF	5	0	0	0	O *7	O *7
548	30	В0	5	0	0	0	O *7	O *7
549 550	Parameter f	or manufactu	rer setting. Do	not set.				
551	33	В3	5	0	0	0	O *7	O *7
555	37	B7	5	0	0	0	0	0
556	38	B8	5	0	0	0	0	0
557	39	B9	5	0	0	0	0	0

Func- tion	Parameter	Name	Setting Range	Minimum Setting Increments	Initial Value	Refer to Page	Customer Setting
_	563	Energization time carrying-over times	(0 to 65535)	1	0	176	
_	564	Operating time carrying-over times	(0 to 65535)	1	0	176	
	571	Holding time at a start	0 to 10s, 9999	0.1s	9999	138	
_	611	Acceleration time at a restart	0 to 3600s, 9999	0.1s	9999	180	
_	653	Speed smoothing control	0 to 200%	0.1%	0	193	
_	665	Regeneration avoidance frequency gain	0 to 200%	0.1%	100	211	
_	800	Control method selection	20, 30	1	20	112, 114, 117	
_	859	Torque current	0 to 500A (0 to ****), 9999 *5	0.01A (1) *5	9999	146	
Protective functions	872 *6	Input phase loss protection selection	0, 1	1	1	190	
ance	882	Regeneration avoidance operation selection	0, 1, 2	1	0	211	
n avoida ion	883	Regeneration avoidance operation level	300 to 800V	0.1V	400VDC/ 780VDC *4	211	
Regeneration avoidance function	885	Regeneration avoidance compensation frequency limit value	0 to 10Hz, 9999	0.01Hz	6Hz	211	
Regen	886	Regeneration avoidance voltage gain	0 to 200%	0.1%	100%	211	
Free parameter	888	Free parameter 1	0 to 9999	1	9999	222	
Fr	889	Free parameter 2	0 to 9999	1	9999	222	
_	C0	Parameter for manufacturer setting. Do					
_	C2	Frequency setting bias	0 to 400Hz	0.01Hz	0Hz	203	
_	C3						
	C4						
_	C5						
_	C6						
_	C7						
_	C22	Parameter for manufacturer setting. Do	not set.				
	C23						
_	C24						
	C25						
_	990						
_	991						



	In	struction Co	ode	Control Mo	de-based Corre	spondence	Parameter		
Parameter	Read	Write	Extended		AD-MFVC	GP MFVC	Clear	All clear	
563	3F	BF	5	0	0	0	×	×	
564	40	C0	5	0	0	0	×	×	
571	47	C7	5	0	0	0	0	0	
611	0B	8B	6	0	0	0	0	0	
653	35	B5	6	0	0	0	0	0	
665	41	C1	6	0	0	0	0	0	
800	00	80	8	×	0	0	0	0	
859	3B	ВВ	8	×	0	0	×	0	
872	48	C8	8	0	0	0	0	0	
882	52	D2	8	0	0	0	0	0	
883	53	D3	8	0	0	0	0	0	
885	55	D5	8	0	0	0	0	0	
886	56	D6	8	0	0	0	0	0	
888	58	D8	8	0	0	0	×	×	
889	59	D9	8	0	0	0	×	×	
C0			rer setting. Do			T		1	
C2	5E	DE	1	0	0	0	×	0	
C3									
C4									
C5									
C6									
C7			w =						
C22	Parameter f	or manutactu	rer setting. Do	not set.					
C23									
C24									
C25									
990 991									
991									

PARAMETERS

Func- tion	Parameter	Name	Setting Range	Minimum Setting Increments	Initial Value	Refer to Page	Customer Setting
rs e list	Pr.CL	Parameter clear	0, 1	1	0	227	
parameters ue change	ALLC	All parameter clear	0, 1	1	0	227	
	Er.CL	Faults history clear	0, 1	1	0	229	
Clear Initial val	Pr.CH	Initial value change list	_	_	_	228	

*1 Differ according to capacities.

6%: 0.75K or lower

4%: 1.5K to 3.7K

3%: 5.5K, 7.5K

2%: 11K, 15K

*2 Differ according to capacities.

5s: 3.7K or lower 10s: 5.5K, 7.5K

15s: 11K, 15K

*3 Differ according to capacities.

6%: 0.1K, 0.2K

4%: 0.4K to 7.5K

2%: 11K, 15K

- *4 The initial value differs according to the voltage class. (200V class/400V class)
- *5 The range differs according to the *Pr. 71* setting.
- *6 Available only for the three-phase power input model.
- *7 These parameters are communication parameters that are not cleared when parameter clear (all clear) is executed from CC-Link communication. (Refer to page 64 for parameter clear (all parameter clear) from CC-Link communication).
- *8 If a password has been registered (Pr.297 ≠ "9999"), the parameter setting can be cleared (the password lock can be unlocked) only via CC-Link
- *9 Settings cannot be written during CC-Link communication (under Network operation mode).

	Instruction Code			Control Mo	Control Mode-based Correspondence			Parameter	
Parameter	Read	Write	Extended	_ V/F _	AD MFVC	GP MFVC	Clear	All clear	
Pr.CL	_	FC	_	_	_	_	_	_	
ALLC	_	FC	_	_	_	_	_	_	
Er.CL	_	F4	_	_	_	_	_	_	
Pr.CH	_	_	_	_	_	_	_	_	

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F 40 0	(Pr. 7, Pr. 8, Pr. 20, Pr. 21, Pr. 44, Pr. 45, Pr. 147)	
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5.3 Selection of operation mode

5.3.1 Operation mode selection (Pr. 79)

Select the operation mode of the inverter.

The operation mode can be selected between the CC-Link communication operation (Network operation) and the operation panel operation (PU operation). At power-ON or power restoration after instantaneous power failure, the inverter always starts in the Network operation mode.

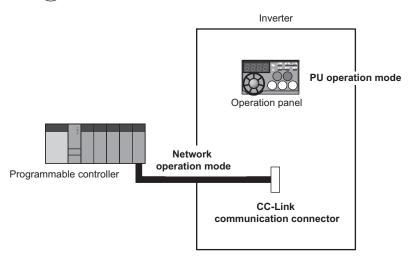
After the inverter starts up in Network operation mode, parameter writing and operation can be commanded from programs.

Parameter Number	Name	Initial Value	Setting Range	Description	LED Indication :Off :On
			0	Using PU on the operation panel , you can switch the operation mode between NET and PU . At power ON, the inverter is in the NET operation mode.	NET operation mode PU operation mode PU
	Operation		1	Fixed to PU operation mode	PU operation mode
79	mode selection	0	2	Fixed to Network operation mode	NET operation mode
			3,4	For manufacturer setting. Do not set.	
		6		Switchover mode Switchover between PU operation and NET operation is available while keeping the same operation status.	PU operation mode PU NET operation mode
			7	For manufacturer setting. Do not set.	

The above parameter can be changed during a stop in any operation mode. It cannot be set via CC-Link communication.

(1) Operation mode basics

- The operation mode specifies the source of the start command and the frequency command for the inverter.
- · Basically, there are following operation modes.
 - Network operation mode (NET operation mode): Start and frequency commands are input via CC-Link communication
 - PU operation mode: Start operation and frequency commands are input with the operation panel.
- Use $\frac{PU}{EXT}$ on the operation panel or the instruction code of CC-Link communication to switch between the operation modes.



• REMARKS

• The stop function (PU stop selection) activated by pressing (STOP) of the operation panel is valid even in other than the PU operation mode in the initial setting. (Refer to Pr. 75 Reset selection/PU stop selection (page 194))

7

(2) Network operation mode (Pr. 79 setting "0" (initial value), "2")

- •Select the Network operation mode to give start and frequency commands via CC-Link communication.
- •Generally, parameter change cannot be performed from the operation panel in the Network operation mode. (Some parameters can be changed. Refer to the detailed description of each parameter.)
- When "0" (initial value) is selected for Pr. 79, the inverter enters the Network operation mode at power-ON.
- •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 (PU) of the operation panel. When you switched to the PU operation mode, always return to the Network operation mode.
- Pr. 79 = "2" sets the Network operation mode to be always selected at power-ON and disables the operation mode change.

(3) PU operation mode (Pr. 79 setting "1")



- •Select the PU operation mode when applying start and frequency command by only the key operation of the operation panel. Also select the PU operation mode when making communication using the PU connector.
- •When "1" is selected for *Pr. 79*, the inverter enters the PU operation mode at power ON. You cannot change to the other operation mode.
- •The setting dial of the operation panel can be used for setting like a potentiometer. (Refer to Pr. 161 Frequency setting/key lock operation selection (page 224))

(4) Switch-over mode (Pr. 79 setting "6")

•While continuing operation, you can switch between the PU operation and the Network operation (CC-Link communication).

Operation Mode Switching	Switching Operation/Operating Status		
PU operation → NET operation	Send the mode change command to the Network operation mode through CC-Link communication. (Rotation direction and set frequency are the same as those of PU operation.)		
NET operation → PU operation	Select the PU operation mode with the operation panel. (The rotation direction and frequency command in the Network operation mode are used unchanged.)		

(5) Valid command in each operation mode

•The following table lists valid and invalid commands in each operation mode.

Monitoring and parameter reading are valid in any operation mode.

Command source	Operation mode	PU operation	NET operation
	Operation (start) command	0	×
	Operation (stop) command	0	$\Delta*3$
Operation panel	Running frequency	0	×
	Parameter writing	O *1	× *2
	Inverter reset	0	×
	Operation (start) command	×	0
	Operation (stop) command	×	0
CC-Link communication	Running frequency	×	0
	Parameter writing	× *2	O *1
	Inverter reset	×	0

O: Valid ×: Invalid Δ: Partially valid

- Writing of some parameters may be disabled by the Pr.77 Parameter write selection setting and the operating condition. (Refer to page 196)
- *2 Writing of some parameters is enabled regardless of the operation mode and the command source. Writing is also enabled when Pr.77 = "2." (Refer to the parameter list on page 84.) Parameters cannot be cleared.
- *3 Only the PU stop is enabled. PS is displayed on the operation panel during PU stop. The inverter operates according to the *Pr.75 Reset selection/PU stop selection* setting. (*Refer to page 194.*)



Parameters referred to

Pr. 75 Reset selection/PU stop selection T Refer to page 194

Pr. 77 Parameter write selection Tage Refer to page 196

Pr. 161 Frequency setting/key lock operation selection Refer to page 224



5.4 Operation via CC-Link communication and its settings

Purpose	rpose Parameter that should be Set		Refer to Page
To make CC-Link communication settings	Communication station number setting Baud rate setting Frequency command sign selection Extended CC-Link setting	Pr.541 to Pr.544	105
To select the operation at CC-Link communication error occurrence	Communication error execution waiting time Communication error occurrence count display Stop method at communication error	Pr.500 to Pr.502	107
To select the error reset operation at inverter failure	Communication reset selection	Pr.349	110
To limit parameter writing via CC-Link communication	Communication EEPROM write selection	Pr.342	110

5.4.1 CC-Link communication setting (Pr.541 to Pr.544)

Set the CC-Link communication details such as station number and baud rate.

Parameter Number	Name	Initial Value	Setting Range		Description
	Frequency command sign selection (CC-Link)	0	0	Without sign	A plus/minus sign added to the frequency command inverts the forward and reverse
541			1	With sign	start commands. Make selection of sign for the frequency command from RWw1.
542	Communication station number (CC-Link)	1	1 to 64	Sets the station number.	
	Baud rate selection (CC-Link)		0	156kbps	
			1	625kbps	
543		0	2	2.5Mbps	Sets the transmission speed.
			3	5Mbps	
			4	10Mbps	
544	CC-Link extended setting	0	0, 1, 12, 14, 18	Extends the	remote register function.

(1) Station number setting (Pr. 542)

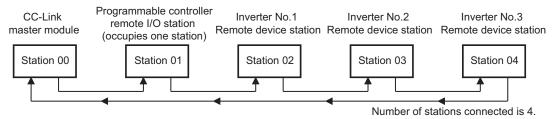
•Use *Pr. 542 Communication station number (CC-Link)* to set station number of the inverter. Set this parameter within the range of 1 to 64.



NOTE

 Use different station numbers for different devices. (If different devices have the same station number, the communication cannot be performed properly.)

Connection example



() R

REMARKS

- Set consecutive numbers for the station numbers. (Do not skip a number in sequence like "station number 1 station number 2-station number 4".)
- The station number does not have to match with the physical connection sequence. (There is no problem with having the physical connection sequence like "station number 1 station number 3 station number 4 station number 2".)
- · One inverter occupies one station. (One remote device station)
- "L.ERR" LED flickers if the setting is changed. When power is switched ON again, the setting value is applied and the LED turns OFF.

(2) Baud rate setting (Pr. 543)

•Set the transmission speed. (Refer to the manual of the CC-Link master module for details of transmission speed.)



REMARKS

• "L.ERR" LED flickers when a setting is changed. Power OFF-ON the inverter (inverter reset) to apply the setting and to turn OFF the LED.

(3) Frequency command with sign (Pr. 541)

•By frequency command with sign, start command (forward rotation/reverse rotation) can be inversed to operate. Make selection of sign for the frequency command from RWw1.

Pr.541 Setting	Sign	Setting Range	Actual Frequency Command
0	Not used	0 to 40000	0 to 400.00Hz
1	With	-32768 to 32767 (two's complement)	-327.68 to 327.67Hz

Relationship between the start command and sign (Pr.541 = "1")

Start Command	Actual Run Command	
Forward rotation	+	Forward rotation
1 Of Ward Totation	-	Reverse rotation
Reverse rotation	+	Reverse rotation
ixeverse rotation	-	Forward rotation



REMARKS

- When Pr.541 = 1 (with sign)
- When EEPROM write is specified with the RYE, write mode error (error code H01) will occur.
- When concurrent execution of both RYD and RYE is enabled (when a value other than 0 is set in *Pr.544*) and both RYD and RYE are turned ON, RYD has precedence.
- When power is turned ON (inverter reset), the initial setting status of the sign bit is "positive" and the set frequency is "0Hz". (EEPROM value is not reflected.)
 - The frequency saved in EEPROM becomes valid when the PU operation mode has been selected as the operation mode at power-ON (inverter reset) (*Pr.* 79 = "1").
- · When set frequency is written with the instruction code of HED and HEE, the sign of the frequency command is not changed.

(4) CC-Link extended setting (Pr. 544)

•Remote register function can be extended.

Pr.544			
Setting	CC-Link Ver.	Description	Refer to page
0 (initial value)	1	Occupies one station (FR-E500 series compatible) *1	56
1	'	Occupies one station	57
12 *2		Occupies one station double	57
14 *2	2	Occupies one station quadruple	58
18 *2	1	Occupies one station octuple	59

- *1 The program used for conventional series inverter (FR-E500 series) can be used.
 - When RYD, RYE, and RYF turn ON simultaneously, only one of them is executed.
 - The upper 8 bits of RWw2 are not link parameter extended setting.
- *2 When using double, quadruple and octuple settings of the CC-Link Ver. 2, station data of the master station must be set to double, quadruple and octuple also. (If the master station is CC-Link Ver. 1 compatible station, the above setting cannot be made.)



REMARKS

• The setting change is reflected after an inverter reset. (Refer to page 110 for inverter reset.)



5.4.2 Operation selection at CC-Link communication error occurrence (Pr. 500 to Pr. 502)

The inverter operation after an error occurs in the CC-Link communication can be selected.

Parameter	Name	Initial	Setting	Description
Number	Name	Value	Range	Description
500	Communication error	0	0 to 999.8s	Sets the waiting time from the communication error
300	execution waiting time			occurrence to the communication error activation.
501	Communication error	0	0	Displays the communication error occurrence count.
501	occurrence count display	U	U	Writing "0" in this parameter clears the cumulative count.
	Stop mode selection at			Sets the inverter operation at a fault occurred in the
502 *	communication error	0	0 to 3	communication line or in the CC-Link communication
				circuit in the inverter.

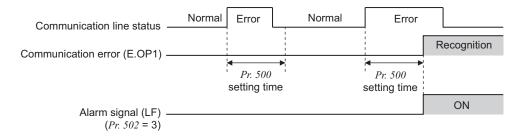
^{*} The parameter can be set when Pr. 160 User group read selection = "0." (Refer to page 197)

(1) Waiting time for the communication line error output after a communication error (Pr.500)

•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.

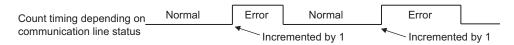


(2) Displaying and clearing the communication error count (Pr.501)

•The cumulative count of communication error occurrences can be displayed.

Write "0" to clear this cumulative count.

At the point of communication line error occurrence, *Pr. 501 Communication error occurrence count display* is incremented by 1.





NOTE

Communication error count is temporarily stored in the RAM. 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.

(3) Inverter operation at a communication error occurrence (Pr.502)

- •The inverter operation after a fault occurs in the communication line or in the CC-Link communication circuit can be selected.
- About setting
- Operation at an error occurrence

Error Definition	Pr. 502 Setting	Operation	Indication	Fault Output	
	0 (initial value)				
Communication line	1	Continued *	Normal indication *	Not provided *	
Communication line	2	Continued *			
	3				
CC-Link	0 (initial value), 3	Coast to stop	E. 1 lit	Provided	
communication circuit in inverter	1, 2	Decelerated to stop	E. 1 lit after stop	Provided after stop	

^{*} When the communication returns to normal within the time period set in Pr. 500, the communication option error (E.OP1) does not occur.

•Operation at error recognition after elapse of Pr. 500 time

Error Definition	Pr. 502 Setting	Operation Indication		Fault Output	
	0 (initial value)	Coast to stop	E.OP1 lit	Provided	
Communication line	1	Decelerated to stop	E.OP1 lit after stop	Provided after stop	
Communication line	2	Decelerated to stop	E.OF I III allei stop	Not provided	
	3	Continued	Normal indication	Not provided	
CC-Link	0 (initial value), 3	Coast to stop	E. 1 lit	Provided	
communication circuit in inverter	1, 2	Decelerated to stop	E. 1 lit after stop	Provided after stop	

Operation at error removal

Error Definition	Pr. 502 Setting	Operation	Indication	Fault Output	
	0 (initial value)	Kept stopped	E.OP1 kept lit	Kept provided	
Communication line	1	Rept Stopped	E.OF I Kept III		
Communication line	2	Restart Normal indication		Not provided	
	3	Continued	Normal indication	rvot provided	
CC-Link	0 (initial value), 3				
communication circuit	1, 2	Kept stopped	E. 1 kept lit	Kept provided	
in inverter	1, 2				

REMARKS

- The communication line error [E.OP1 (fault data HA1)] appears after an error occurrence on the CC-Link communication line.
- · Fault output indicates the fault output signal (ALM signal) and fault bit output.
- When the fault output setting is active, fault records are stored in the faults history. (A fault record is written to the faults history at fault output.)

When the fault output setting is not active, fault record is overwritten to the faults history temporarily but not stored.

After the error is removed, the fault indication is reset, changing the display back to normal, and the last fault is displayed in the faults history.

- When the Pr. 502 setting is "1" or "2", the deceleration time is the normal deceleration time setting (e.g. Pr. 8, Pr. 44, Pr. 45).
- The acceleration time at a restart is the normal acceleration time setting (e.g. Pr. 7, Pr. 44).
- \bullet When the Pr. 502 setting is "2", the operation/speed command at a restart is the one given before the error occurrence.
- When a communication line error occurs at the *Pr. 502* setting of "2", removing the error during deceleration causes acceleration to restart at that point. (Acceleration does not restart at a CC-Link communication line error of the inverter.)



(4) Faults and measures

•The following table shows how the inverter operates at a fault occurrence in each operation mode.

Fault Location	Fault Indication	Status	Operation Mode		
Tault Location	i auit ilidication:	Otatus	Network operation	PU operation	
Communication	E.OP1	Inverter operation	Inverter trip*	Continued	
line	L.OF I	Data communication	Stop	Stop	
	Faults other than E.1 and	Inverter operation	Inverter trip	Inverter trip	
Inverter	E.OP1	Data operation	Continued	Continued	
inverter	E.1	Inverter operation	Inverter trip*	Continued	
	L. I	Data communication	Stop	Stop	

^{*} Depends on the Pr.502 setting.

• Measures at fault occurrences

Fault Indication	Fault Definition	Measures
	Communication line	Check the LED status of the inverter and remove the cause of the fault.
E.OP1		(Refer to page 75 for LED indication status)
	error	Inspect the master.
	CC-Link	Check for excessive noise around the inverter. Check that the switch for
E.1	communication circuit	manufacturer setting has not been changed and is in the initial status. Remove
	fault in inverter	the fault cause.

^{*} When faults other than the above are displayed, refer to Appendix 6 and remove the cause of the error.



Parameters referred to

Pr. 7 Acceleration time, Pr. 8 Deceleration time, Pr. 44 Second acceleration/deceleration time, Pr. 45 Second deceleration time Refer to page 135

5.4.3 CC-Link communication reset selection (Pr.349)

The RY1A error reset command (on page 60) transmitted via CC-Link communication in PU operation mode can be disabled

Parameter Number	Name	Initial Value	Setting Range	Function
349	Communication	0	0	Error reset is enabled independently of operation mode
349	reset selection	U	1	Error reset is enabled only in the Network operation mode

(1) Operation conditions of inverter reset

•The following table shows the availability of the inverter reset in each operation mode.

			Operat	ion Mode
	Resetting Method	Network	PU Operation	
			Operation	1 0 Operation
Reset via CC-Link	Inverter reset (Refer to page 65) *1	Inverter reset (Refer to page 65) *1		Disallowed
	Error reset (RY1A) at inverter fault	Pr.349 = 0	Allowed	Allowed
communication	(Refer to page 60) *2	<i>Pr.349</i> = 1	Allowed	Disallowed
Switch OFF inverter powe	r	Allowed	Allowed	
Reset from the operation p	panel (Reset at inverter fault) *2	Allowed	Allowed	

^{*1} Inverter reset can be made any time.

^{*2} Reset can be made only when the protective function of the inverter is activated.



REMARKS

• Refer to page 73 for the programming example of an inverter reset.



NOTE

- When a communication line error has occurred, reset cannot be made from the network.
- Communication continues during inverter reset. (The inverter cannot be controlled for about 1s after release of a reset command.)

5.4.4 Communication EEPROM write selection (Pr. 342)

Storage device can be changed to RAM only from EEPROM+RAM for the parameter settings written through the CC-Link communication. Use this function if parameter settings are changed frequently.

Parameter	News	Initial	Setting	Description
Number	Name	Value	Range	Description
	Communication EEPROM		0	Parameter values written via CC-Link communication are written to the EEPROM and RAM.
342	write selection	0	1	Parameter values written via CC-Link communication are
				written to the RAM.

The above parameters can be set when Pr. 160 User group read selection = "0." (Refer to page 197)

•When changing the parameter values frequently, set "1" in *Pr. 342* to write them to the RAM.

Performing frequent parameter write with "0 (initial value)" (EEPROM write) set will shorten the life of the EEPROM.



> REMARKS

• When "1" (write to RAM only) is set in *Pr. 342*, powering OFF the inverter will erase the changed parameter values. Therefore, the parameter values available when power is switched ON again are the values stored in EEPROM previously.



5.5 Control mode

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

(1) V/F Control

•It controls frequency and voltage so that the ratio of frequency (F) to voltage (V) is constant when changing frequency.

(2) Advanced (General-purpose) magnetic flux vector control

- •This control divides the inverter output current into an excitation current and a torque current by vector calculation and makes voltage compensation to flow a motor current which meets the load torque.
- •General-purpose magnetic flux vector control is the same function as the FR-E500 series. For other cases, select Advanced magnetic flux vector control.



POINT

If the following conditions are not satisfied, select V/F control since malfunction such as insufficient torque and uneven rotation may occur.

- The motor capacity should be equal to or one rank lower than the inverter capacity. (note that the capacity should be 0.1kW or higher)
- Motor to be used is any of Mitsubishi standard motor (SF-JR 0.2kW or higher), high efficiency motor (SF-HR 0.2kW or higher) or Mitsubishi constant-torque motor (SF-JRCA four-pole, SF-HRCA 0.2kW to 15kW). When using a motor other than the above (other manufacturer's motor), perform offline auto tuning without fail.
- Single-motor operation (one motor run by one inverter) should be performed.
- Wiring length from inverter to motor should be within 30m. (Perform offline auto tuning in the state where wiring work is performed when the wiring length exceeds 30m.)



5.5.1 Changing the control method (Pr. 80, Pr. 81, Pr. 800)

Set when selecting the control method for Advanced magnetic flux vector control and General-purpose magnetic flux vector control. The initial value is V/F control.

•Select a control mode using Pr. 800 Control method selection.

Parameter Number	Name	Initial Value	Setting Range		Description
80	Motor capacity 9999		0.1 to 15kW	Set the applied motor capacity.	
OU IVI	Motor capacity	9999	9999	V/F control	
81	Number of motor poles	9999	2, 4, 6, 8, 10	Set the number of motor poles.	
01	i Number of motor poles		9999	V/F control	
900	Control method	20	20	V/F	Advanced magnetic flux vector control *
000	800 selection	20	30	control	General-purpose magnetic flux vector control *

^{*} Set a value other than "9999" in Pr. 80 and Pr. 81.

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

- •Motor specifications (motor capacity and number of motor poles) must be set to select Advanced magnetic flux vector control or General-purpose magnetic flux vector 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.

(2) Selection of control method

•Select the inverter control method for V/F control, Advanced magnetic flux vector control, and General-purpose magnetic flux vector control.

Pr. 80, 81	Pr. 800 Setting	Control Method
Other than 9999	20 (<i>Pr. 800</i> initial value)	Advanced magnetic flux vector control
	30	General-purpose magnetic flux vector control
9999 (<i>Pr. 80, Pr. 81</i> initial value)	*	V/F control

^{*} Control method is V/F control regardless of the setting value of Pr. 800 when "9999" is set in Pr. 80 Motor capacity or Pr. 81 Number of motor poles.

(3) Control method switching by CC-Link communication (X18 signal)

- •Use the V/F switchover signal (X18) to change the control method (between V/F control and Advanced magnetic flux vector control (General-purpose magnetic flux vector control)) with CC-Link communication.
- •Turn the X18 signal ON to change the currently selected control method (Advanced magnetic flux vector control or General-purpose magnetic flux vector control) to V/F control.

To input the X18 signal to a virtual terminal of CC-Link communication, set "18" in one of *Pr. 180 to Pr. 184 (input terminal function selection)*.



> REMARKS

Switch the control method using X18 signal during an inverter stop. If control method between V/F control and Advanced (General-purpose) magnetic flux vector control is switched during the operation, the actual switchover does not take place until the inverter stops. In addition, if control method is switched to V/F control during the operation, only second function becomes valid as V/F control and second function are selected simultaneously in V/F control.



NOTE

• Changing the assignment of a virtual terminal of CC-Link communication with *Pr. 180 to Pr. 184 (input terminal function selection)* may affect other functions. Set parameters after confirming the function of each virtual terminal.



Parameters referred to

Advanced magnetic flux vector control Refer to page 114

General-purpose magnetic flux vector control Refer to page 117

Pr. 180 to Pr. 184 (input terminal function selection) Refer to page 163

Pr. 450 Second applied motor Refer to page 144

Pr. 44 Second acceleration/deceleration time, Pr. 45 Second deceleration time Refer to page 135

Pr. 46 Second torque boost Refer to page 113

Pr. 47 Second V/F (base frequency) Refer to page 126

Pr. 48 Second stall prevention operation current Refer to page 120

Pr. 51 Second electronic thermal O/L relay Refer to page 142



5.6 Adjustment of the output torque (current) of the motor

Purpose	Parameter that	Refer to Page	
Set starting torque manually	Manual torque boost	Pr. 0, Pr. 46	113
Automatically control output current according to load	Advanced magnetic flux vector control, General-purpose magnetic flux vector control	Pr. 71, Pr. 80, Pr. 81, Pr. 89, Pr. 90, Pr. 450, Pr. 800	114, 117
Compensate for motor slip to secure low-speed torque	Slip compensation (V/F control and General-purpose magnetic flux vector control only)	Pr. 245 to Pr. 247	119
Limit output current to prevent inverter trip	Stall prevention operation	Pr. 22, Pr. 23, Pr. 66, Pr. 156, Pr. 157	120

5.6.1 Manual torque boost (Pr. 0, Pr. 46)

You can compensate for a voltage drop in the low-frequency range to improve motor torque reduction in the low-speed range.

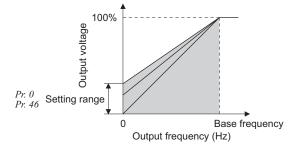
- Motor torque in the low-frequency range can be adjusted to the load to increase the starting motor torque.
- ●Two kinds of start torque boosts can be changed by switching the RT signal.

Parameter Number	Name	Initial Value		Setting Range	Description
		0.1K to 0.75K	6%		
	Torque boost	1.5K to 3.7K	4%	0 to 30%	Set the output voltage at 0Hz as %.
0		5.5K, 7.5K	3%	0 10 30%	
		11K, 15K	2%		
	Second torque			0.4- 200/	Set the torque boost when the RT
46 *	boost	9999		0 to 30%	signal is ON.
				9999	Without second torque boost

^{*} The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)

(1) Starting torque adjustment

- •On the assumption that *Pr. 19 Base frequency voltage* is 100%, set the output voltage at 0Hz in % to *Pr. 0 (Pr. 46)*.
- •Adjust the parameter little by little (about 0.5%), and check the motor status each time. If the setting is too large, the motor will overheat. The guideline is about 10% at the greatest.



(2) Set two kinds of torque boosts (RT signal, Pr. 46)

- •When you want to change torque boost according to applications, switch multiple motors with one inverter, etc., use Second torque boost.
- •Pr. 46 Second torque boost is valid when the RT signal is ON.
- •To input the RT signal to a virtual terminal of CC-Link communication, set "3" in one of *Pr. 180 to Pr. 184 (input terminal function selection)*.



REMARKS

• The RT signal acts as the second function selection signal and makes the other second functions valid. (Refer to page 165)



NOTE

- The amount of current flows in the motor may become large according to the conditions such as the motor characteristics, load, acceleration/deceleration time, wiring length, etc., resulting in an overcurrent trip (OL (overcurrent alarm) then E.OC1 (overcurrent trip during acceleration), overload trip (E.THM (motor overload trip), or E.THT (inverter overload trip).
- (When a fault occurs, release the start command, and decrease the Pr. 0 setting 1% by 1% to reset.) (Refer to page 232.)
- The Pr. 0, Pr. 46 settings are valid only when V/F control is selected.
- When using the inverter dedicated motor (constant-torque motor) with the 5.5K(SC), 7.5K(SC), set torque boost value to 2%.
- When $Pr.~\theta$ = "3%"(initial value), if Pr.~71 value is changed to the setting for use with a constant-torque motor, the $Pr.~\theta$ setting changes to 2%.
- Changing the assignment of a virtual terminal of CC-Link communication with Pr. 180 to Pr. 184 (input terminal function selection) may affect other functions. Set parameters after confirming the function of each virtual terminal.



Parameters referred to

Pr. 3 Base frequency, Pr. 19 Base frequency voltage 😘 Refer to page 126 Pr. 71 Applied motor 😭 Refer to page 144

Pr. 180 to Pr. 184 (input terminal function selection) Refer to page 163

5.6.2 Advanced magnetic flux vector control (Pr. 71, Pr. 80, Pr. 81, Pr.89, Pr. 800)

Advanced magnetic flux vector control can be selected by setting the capacity, poles and type of the motor used in *Pr.* 80 and *Pr.* 81.

• Advanced magnetic flux vector control?

The low speed torque can be improved by providing voltage compensation to flow a motor current which meets the load torque. Output frequency compensation (slip compensation) is made so that the motor actual speed approximates a speed command value. Effective when load fluctuates drastically, etc.

When the FR-E500 series used for General-purpose magnetic flux vector control was replaced, select General-purpose magnetic flux vector control only when the same operation characteristic is necessary. (*Refer to page 117*)

Parameter Number	Name	Initial Value	Setting Range	Description
71	Applied motor	0	0,1, 3 to 6, 13 to 16, 23, 24 40, 43, 44 50, 53, 54	By selecting a standard motor or constant-torque motor, thermal characteristic and motor constants of each motor are set.
80	Motor capacity	9999	0.1 to 15kW 9999	Set the applied motor capacity. V/F control
81	Number of motor poles	9999	2, 4, 6, 8, 10 9999	Set the number of motor poles. V/F control
89	Speed control gain (Advanced magnetic flux	9999	0 to 200%	Motor speed fluctuation due to load fluctuation is adjusted during Advanced magnetic flux vector control. 100% is a referenced value.
	vector)		9999	Gain matching with the motor set in Pr.71.
	Control method		20	Advanced magnetic flux vector control *
800	selection	20	30	General-purpose magnetic flux vector control * (Refer to page 117)

The above parameters can be set when Pr. 160 User group read selection = "0".(Refer to page 197)

^{*} Set a value other than "9999" in $Pr.\ 80$ and $Pr.\ 81$.



POINT

If the following conditions are not satisfied, select V/F control since malfunction such as insufficient torque and uneven rotation may occur.

- The motor capacity should be equal to or one rank lower than the inverter capacity. (Note that the capacity should be 0.1kW or higher.)
- Motor to be used is any of Mitsubishi standard motor (SF-JR 0.2kW or higher), high efficiency motor (SF-HR 0.2kW or higher) or Mitsubishi constant-torque motor (SF-JRCA four-pole, SF-HRCA 0.2kW to 15kW). When using a motor other than the above (other manufacturer's motor), perform offline auto tuning without fail.
- Single-motor operation (one motor run by one inverter) should be performed.
- The wiring length from inverter to motor should be within 30m. (Perform offline auto tuning in the state where wiring work is performed when the wiring length exceeds 30m.)
- Permissible wiring length between inverter and motor differs according to the inverter capacity and setting value of *Pr. 72 PWM frequency selection* (carrier frequency). *Refer to page 19* for the permissible wiring length.



<Selection method of Advanced magnetic flux vector control>

Perform secure wiring.

(Refer to page 14)



Set the motor. (Pr. 71)

	Motor	Pr. 71 Setting *1	Remarks
Mitsubishi standard	SF-JR	0 (initial value)	
motor	SF-HR	40	
Mitsubishi high efficiency motor	Others	3	Offline auto tuning is necessary. *2
Mitsubishi constant-	SF-JRCA 4P	1	
torque motor	SF-HRCA	50	
torque motor	Others (SF-JRC, etc.)	13	Offline auto tuning is necessary. *2
Other manufacturer's		3	Offline auto tuning is necessary. *2
standard motor	_		Offilitie auto turning is frecessary. *2
Other manufacturer's			
constant-torque	_	13	Offline auto tuning is necessary. *2
motor			

- Refer to page 144, for other settings of Pr. 71.
- Refer to page 146 for offline auto tuning.



Set the motor capacity and the number of motor poles.

(Pr. 80, Pr. 81) (Refer to page 114)



Set motor capacity (kW) in Pr. 80 Motor capacity and

the number of motor poles (number of poles) in Pr. 81 Number of motor poles.

(V/F control is performed when the setting is "9999" (initial value).

Select the control method. (Pr. 800) (Refer to page 114)



Set "20" (initial value) in Pr. 800 to make Advanced magnetic flux vector control valid.

Set the operation command. (Refer to page 103)

Select the start command and speed command.

(1)Start command

- 1)Operation panel: Setting by pressing (RUN) on the operation panel
- 2)Command via CC-Link communication: Setting with the forward or reverse rotation command (STF or STR signal)
- (2)Speed command
 - 1)Frequency command via CC-Link communication
 - 2)Operation panel: Setting by turning on the operation panel



3)Multi-speed command:

The RH, RM, and RL signals transmitted via CC-Link communication can be also used as speed commands.

Test run

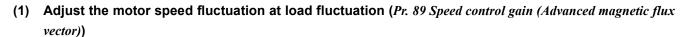
As required

• Perform offline auto tuning. (Pr. 96) (Refer to page 146)

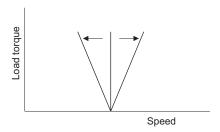


NOTE

- Uneven rotation slightly increases as compared to the V/F control. (It is not suitable for machines such as grinding machine and wrapping machine which requires less uneven rotation at low speed.)
- When a surge voltage suppression filter (FR-ASF-H/FR-BMF-H) is connected between the inverter and motor, output torque may decrease.



The motor speed fluctuation at load fluctuation can be adjusted using $Pr.\,89$. (It is useful when the speed command does not match the motor speed after the FR-E500 series inverter is replaced with the FR-E700 series inverter, etc.)





Parameters referred to

Pr. 71, Pr. 450 Applied motor Refer to page 144
Pr. 800 Control method selection Refer to page 112



5.6.3 General-purpose magnetic flux vector control (Pr. 71, Pr. 80, Pr. 81, Pr. 800)

General-purpose magnetic flux vector control is the same function as the FR-E500 series. Select this control when the same operation characteristic is necessary. For other cases, select Advanced magnetic flux vector control. (*Refer to page 114*)

Parameter Number	Name	Initial Value	Setting Range	Description
71	Applied motor	0	0,1, 3 to 6, 13 to 16, 23, 24 40, 43, 44 50, 53, 54	By selecting a standard motor or constant-torque motor, thermal characteristic and motor constants of each motor are set.
80	Motor capacity	9999	0.1 to 15kW	Applied motor capacity.
00	ou Motor Capacity	3333	9999	V/F control
81	Number of motor	9999	2, 4, 6, 8, 10	Number of motor poles.
01	poles	9999	9999	V/F control
800	Control method	20	20	Advanced magnetic flux vector control * (Refer to page 114)
800	selection	20	30	General-purpose magnetic flux vector control *

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)

^{*} Set a value other than "9999" in Pr. 80 and Pr. 81.



POINT

If the following conditions are not satisfied, select V/F control since malfunction such as insufficient torque and uneven rotation may occur.

- The motor capacity should be equal to or one rank lower than the inverter capacity. (Note that the capacity should be 0.1kW or higher.)
- Motor to be used is any of Mitsubishi standard motor (SF-JR 0.2kW or higher), high efficiency motor (SF-HR 0.2kW or higher) or Mitsubishi constant-torque motor (SF-JRCA four-pole, SF-HRCA 0.2kW to 15kW). When using a motor other than the above (other manufacturer's motor), perform offline auto tuning without fail.
- Single-motor operation (one motor run by one inverter) should be performed.
- The wiring length from inverter to motor should be within 30m. (Perform offline auto tuning in the state where wiring is performed when the wiring length exceeds 30m.)
- Permissible wiring length between inverter and motor differs according to the inverter capacity and setting value of *Pr. 72 PWM frequency selection* (carrier frequency). *Refer to page 19* for the permissible wiring length.

<Selection method of General-purpose magnetic flux vector control>

Perform secure wiring. (Refer to page 14)

Set the motor.(Pr. 71)

	Motor	Pr. 71 Setting *1	Remarks
Mitsubishi standard	SF-JR	0 (initial value)	
motor	SF-HR	40	
Mitsubishi high efficiency motor	Others	3	Offline auto tuning is necessary. *2
Mitsubishi constant-	SF-JRCA 4P	1	
torque motor	SF-HRCA	50	
torque motor	Others (SF-JRC, etc.)	13	Offline auto tuning is necessary. *2
Other manufacturer's	_	3	Offline auto tuning is necessary. *2
standard motor	<u>—</u>	J	Offinite auto turning is freeessary. *2
Other manufacturer's			
constant-torque	_	13	Offline auto tuning is necessary. *2
motor			

- Refer to page 144, for other settings of Pr. 71.
- Refer to page 146 for offline auto tuning



Set the motor capacity and the number of motor poles.

(Pr. 80, Pr. 81) (Refer to page 117)



Set motor capacity (kW) in Pr. 80 Motor capacity and

the number of motor poles (number of poles) in Pr. 81 Number of motor poles.

(V/F control is performed when the setting is "9999" (initial value).

Select the control method.(Pr. 800) (Refer to page 117)



Set "30" in Pr. 800 to make General-purpose magnetic flux vector control valid.

Set the operation command. (Refer to page 103)

Select the start command and speed command.

(1)Start command

- 1)Operation panel: Setting by pressing (RUN) on the operation panel
- 2)Command via CC-Link communication: Setting with the forward or reverse rotation command (STF or STR signal)
- (2)Speed command
 - 1)Frequency command via CC-Link communication
 - 2)Operation panel: Setting by turning on the operation panel



- 3)Multi-speed command:

The RH, RM, and RL signals transmitted via CC-Link communication can be also used as speed commands.

Test run

As required

- Perform offline auto tuning. (Pr. 96) (Refer to page 146)
- Set slip compensation. (Pr. 245, Pr. 246, Pr. 247) (Refer to page 119)



NOTE

- Uneven rotation slightly increases as compared to the V/F control. (It is not suitable for machines such as grinding machine and wrapping machine which requires less uneven rotation at low speed.
- When a surge voltage suppression filter (FR-ASF-H/FR-BMF-H) is connected between the inverter and motor, output torque may decrease.)



Parameters referred to

Pr.3 Base frequency, Pr.19 Base frequency voltage Refer to page 126

Pr.71 Applied motor Refer to page 144

Pr.77 Parameter write selection Refer to page 196



5.6.4 Slip compensation (Pr. 245 to Pr. 247) V/F/GP MFVC

When V/F control or General-purpose magnetic flux vector control is performed, the inverter output current may be used to assume motor slip to keep the motor speed constant.

Parameter Number	Name	Initial Value	Setting Range	Description
245	Rated slip	9999	0.01 to 50%	Rated motor slip.
245	Rated Slip	9999	0, 9999	No slip compensation
246	Slip compensation time constant	0.5s	0.01 to 10s	Slip compensation response time. When the value is made smaller, response will be faster. However, as load inertia is greater, a regenerative overvoltage fault (E.OV□) is more liable to occur.
247	Constant-power range slip compensation selection	9999	9999	Slip compensation is not made in the constant power range (frequency range above the frequency set in <i>Pr. 3</i>) Slip compensation is made in the constant power range.

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)

• Slip compensation is validated when the motor rated slip calculated by the following formula is set in Pr. 245. Slip compensation is not made when Pr. 245 = "0" or "9999".



• REMARKS

- When performing slip compensation, the output frequency may become greater than the set frequency. Set the Pr. 1 Maximum frequency value a little higher than the set frequency.
- Slip compensation is always valid when Advanced magnetic flux vector control is selected, the Pr. 245 to Pr. 247 settings are invalid.



Parameters referred to

Pr. 1 Maximum frequency Refer to page 124 Pr. 3 Base frequency Refer to page 126

5.6.5 Stall prevention operation (Pr. 22, Pr. 23, Pr. 48, Pr. 66, Pr. 156, Pr. 157, Pr. 277)

This function monitors the output current and automatically changes the output frequency to prevent the inverter from coming to trip due to overcurrent, overvoltage, etc. In addition, simple torque limit which limits the output torque to the predetermined value can be selected.

It can also limit stall prevention and fast-response current limit operation during acceleration/deceleration, driving or regeneration.

Stall prevention

If the output current exceeds the stall prevention operation level, the output frequency of the inverter is automatically varied to reduce the output current.

•Fast-response current limit

If the current exceeds the limit value, the output of the inverter is shut off to prevent an overcurrent.

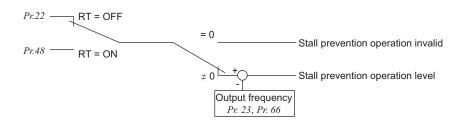
Torque limit

The inverter output frequency is controlled so that the output torque (torque current) will not exceed the stall prevention operation level (motor rated torque is referenced).

Parameter Number	Name	Initial Value	Setting Range	Description
	Stall prevention operation		0	Stall prevention operation invalid
22*	level	150%	0.1 to 200%	Set the current value to start the stall
	10.101		0.1 to 20070	prevention operation.
	Stall prevention			The stall operation level can be reduced
	operation level		0 to 200%	when operating at a high speed above the
23	compensation factor	9999		rated frequency.
	at double speed		9999	Constant according to Pr. 22.
	Second stall prevention	9999	0	Stall prevention operation invalid
48	operation current		0.1 to 200%	Second stall prevention operation level
			9999	Same level as Pr. 22.
	Stall prevention	60Hz	0 to 400Hz	Set the frequency at which the stall
66	operation reduction			prevention operation level starts being
	starting frequency			reduced.
	Stall prevention operation	0	0 to 31, 100, 101	Select whether stall prevention operation
156	selection			and fast-response current limit operation
				will be performed or not.
			0 to 25s	Output start time of the OL signal output
157	OL signal output timer	0s	0 10 233	when stall prevention is activated.
			9999	Without the OL signal output
	Stall prevention operation		0	Output current is the limit level
277	current switchover	0	1	Output torque (torque current) is the limit
	current switchover	1 1 1 - 101 (D.C	1	level

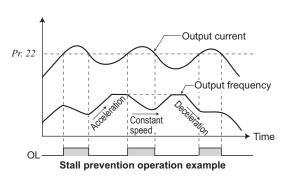
The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)

(1) Block diagram



^{*} This parameter allows its setting to be changed during operation in any operation mode even if "0 (initial value) or 1" is set in Pr. 77 Parameter write selection.

(2) Setting of stall prevention operation level (Pr. 22)



- •Set in Pr. 22 the percentage of the output current to the rated inverter current at which stall prevention operation will be performed. Normally set this parameter to 150% (initial value).
- •Stall prevention operation stops acceleration (makes deceleration) during acceleration, makes deceleration during constant speed, and stops deceleration (makes acceleration) during deceleration.
- •When stall prevention operation is performed, the OL signal is



• If an overload status lasts long, an inverter trip (e.g. electronic thermal O/L relay (E.THM)) may occur.

(3) A machine protection and load limit by torque limit (Pr. 277)

- •When Pr. 277 Stall prevention current switchover = "1", torque limit can be set.
- . When output torque (torque current) exceeds the stall prevention operation level, the output frequency is controlled to limit the output torque. For the stall prevention operation level at this time, the motor rated torque is defined as reference.



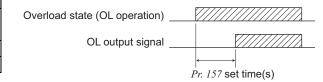
> REMARKS

- When driving multiple motors with one inverter, torque limit does not function properly.
- Since magnetic flux decreases in the constant output range (Pr. 3 Base frequency or more), the inverter operate with lower torque than the stall prevention operation level.
- · When torque limit is activated during regeneration, the output frequency is increased up to the maximum frequency.
- Torque limit does not function at 5Hz or less during deceleration.
- Note the following when using torque limit under V/F control.
 - (a) Capacity of the inverter and motor should be the same.
 - (b) Stall prevention operation level (torque limit level) is the rated torque reference of the motor whose capacity is equivalent to
 - (c) When Pr. 0 Torque boost setting is large, torque limit is likely to occur in the low speed range.
- (d) Use the Advanced magnetic flux vector control when more appropriate torque limit is necessary.

(4) Stall prevention operation signal output and output timing adjustment (OL signal, Pr. 157)

- •When the output current exceeds the stall prevention operation level and stall prevention is activated, the stall prevention operation signal (OL signal) turns ON for longer than 100ms. When the output current falls to or below the stall prevention operation level, the output signal turns OFF.
- •Use Pr. 157 OL signal output timer to set whether the OL signal is output immediately or after a preset period of time.
- •This operation is also performed when the regeneration avoidance function or σ_{i} (overvoltage stall) is executed.
- •To assign the OL signal to the terminal Y0 or a virtual terminal of CC-Link communication, set "3 (positive logic) or 103 (negative logic)" in one of Pr. 190 to Pr. 192 and Pr. 313 to Pr. 315 (output terminal function selection).

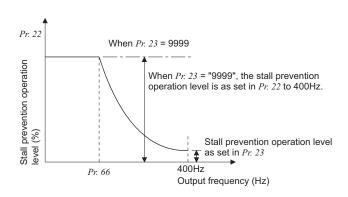
Pr. 157 Setting	Description		
0 (initial value)	Output immediately.		
0.1 to 25	Output after the set time (s) has elapsed.		
9999	Not output.		

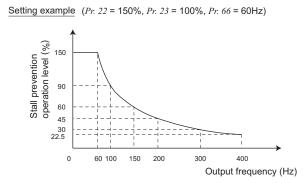




- If the frequency has fallen to 1Hz by stall prevention operation and remains for 3s, a fault (E.OLT) appears to trip the
- Changing the assignment of the terminal Y0 or a virtual terminal of CC-Link communication with one of Pr. 190 to Pr. 192, and Pr. 313 to Pr. 315 (output terminal function selection) may affect other functions. Set parameters after confirming the function of the terminal Y0 and virtual terminals.

(5) Setting of stall prevention operation in high frequency range (Pr. 22, Pr. 23, Pr. 66)





- •During high-speed operation above the rated motor frequency, acceleration may not be made because the motor current does not increase. If operation is performed in a high frequency range, the current at motor lockup becomes smaller than the rated output current of the inverter, and the protective function (OL) is not executed even if the motor is at a stop. To improve the operating characteristics of the motor in this case, the stall prevention level can be reduced in the high frequency range. This function is effective for performing operation up to the high-speed range on a centrifugal separator etc. Normally, set 60Hz in *Pr.* 66 and 100% in *Pr.* 23.
- •Formula for stall prevention operation level

Stall prevention operation level in high frequency range (%) = A + B
$$\times \left[\frac{Pr.\ 22 - A}{Pr.\ 22 - B}\right] \times \left[\frac{Pr.\ 23 - 100}{100}\right]$$
 However, A = $\frac{Pr.\ 66\ (Hz) \times Pr.\ 22\ (\%)}{Output\ frequency\ (Hz)}$, B = $\frac{Pr.\ 66\ (Hz) \times Pr.\ 22\ (\%)}{400Hz}$

•By setting "9999" (initial value) in *Pr. 23 Stall prevention operation level compensation factor at double speed*, the stall prevention operation level is constant at the *Pr. 22* setting up to 400Hz.

(6) Set two types of stall prevention operation levels (Pr. 48)

- •Turning RT signal ON makes Pr. 48 Second stall prevention operation current valid.
- •To input the RT signal to a virtual terminal of CC-Link communication, set "3" in one of *Pr. 180 to Pr. 184 (input terminal function selection)*.



NOTE

- Changing the assignment of a virtual terminal of CC-Link communication with *Pr. 180 to Pr. 184 (input terminal function selection)* may affect other functions. Set parameters after confirming the function of each virtual terminal.
- The RT signal acts as the second function selection signal and makes the other second functions valid. (Refer to page 165)



(7) Limit the stall prevention operation and fast-response current limit operation according to the operating status (Pr. 156)

•Refer to the following table and select whether stall prevention operation and fast-response current limit operation will be performed or not and the operation to be performed at OL signal output.

Pr. 1	156	Fast-Response Current Limit*4	Operat	reventio tion Sele tivated activate	ction	OL Signal Output O: Operation	Pr. 156	Foot Boomens	Stall Prevention Operation Selection O: Activated •: Not activated		OL Signal Output O: Operation	
Sett	ing	O: Activated ●: Not activated	Acceleration	Constant	Deceleration	4: d		O: Activated •: Not activated	Acceleration	Constant	Deceleration	•: Operation not continued *1
0 (in valu		0	0	0	0	0	16	0	0	0	0	•
1		•	0	0	0	0	17	•	0	0	0	•
2		0	•	0	0	0	18	0	•	0	0	•
3		•	•	0	0	0	19	•	•	0	0	•
4		0	0	•	0	0	20	0	0	•	0	•
5		•	0	•	0	0	21	•	0	•	0	•
6		0	•	•	0	0	22	0	•	•	0	•
7		•	•	•	0	0	23	•	•	•	0	•
8		0	0	0	•	0	24	0	0	0	•	•
9		•	0	0	•	0	25	•	0	0	•	•
10		0	•	0	•	0	26	0	•	0	•	•
11		•	•	0	•	0	27	•	•	0	•	•
12		0	0	•	•	0	28	0	0	•	•	•
13	-	•	0	•	•	0	29	•	0	•	•	•
14		0	•	•	•	— *2	30	0	•	•	•	— *2
15	5	•	•	•	•	— *2	31	•	•	•	•	— *2
100	Power driving	0	0	0	0	0	Power driving	•	0	0	0	0
*3	Regeneration	•	•	•	•	- *2	*3 Regeneration	•	•	•	•	 *2

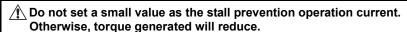
- When "Operation not continued for OL signal output" is selected, the Lill fault (stopped by stall prevention) is displayed and operation stopped. *1
- *2
- Since stall prevention is not activated, OL signal and E.OLT are not output.

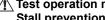
 The settings "100" and "101" allow operations to be performed in the driving and regeneration modes, respectively. The setting "101" disables the fast-*3 response current limit in the driving mode.
- OL signal is not output at fast-response current limit operation.



- When the load is heavy or the acceleration/deceleration time is short, stall prevention is activated and acceleration/ deceleration may not be made according to the preset acceleration/deceleration time. Set Pr. 156 and stall prevention operation level to the optimum values.
- In vertical lift applications, make setting so that the fast-response current limit is not activated. Torque may not be produced, causing a load drop due to gravity.







Test operation must be performed.

Stall prevention operation during acceleration may increase the acceleration time.

Stall prevention operation performed during constant speed may cause sudden speed changes.

Stall prevention operation during deceleration may increase the deceleration time, increasing the deceleration distance.



Parameters referred to

- Pr. 3 Base frequency Refer to page 126
 Pr. 180 to Pr. 184 (input terminal function selection) Refer to page 163
 Pr. 190 to Pr. 192, Pr. 313 to Pr. 315 (output terminal function selection) Refer to page 167

5.7 Limiting the output frequency

Purpose	Parameter	Refer to Page	
Set upper limit and lower limit of output frequency	Maximum/minimum frequency	Pr. 1, Pr. 2, Pr. 18	124
Perform operation by avoiding mechanical resonance points	Frequency jump	Pr. 31 to Pr. 36	125

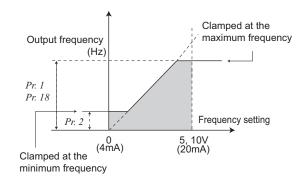
5.7.1 Maximum/minimum frequency (Pr. 1, Pr. 2, Pr. 18)

Motor speed can be limited.

Clamp the upper and lower limits of the output frequency.

Parameter Number	Name	Initial Value	Setting Range	Description
1	Maximum frequency	120Hz	0 to 120Hz	Upper limit of the output frequency.
2	Minimum frequency	0Hz	0 to 120Hz	Lower limit of the output frequency.
18 *	High speed maximum	40011-	120 to 400Hz	Set when performing the operation at 120Hz
10 *	frequency	120Hz	120 (0 40002	or more.

^{*} The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)



(1) Set maximum frequency

- Use *Pr. 1 Maximum frequency* to set the maximum frequency. If the value of the frequency command entered is higher than the setting, the output frequency is clamped at the maximum frequency.
- When you want to perform operation above 120Hz, set the upper limit of the output frequency to Pr. 18 High speed maximum frequency. (When Pr. 18 is set, Pr. 1 automatically switches to the frequency of Pr. 18. Also, when Pr. 1 is set, Pr. 18 is automatically changed to the frequency set in Pr. 1.

(2) Set minimum frequency

- Use Pr. 2 Minimum frequency to set the minimum frequency.
- If the set frequency is less than Pr. 2, the output frequency is clamped at Pr. 2 (will not fall below Pr. 2).

▶ REMARKS

- When Pr. 15 Jog frequency is equal to or less than Pr. 2, the Pr. 15 setting has precedence over the Pr. 2 setting.
- 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 more than *Pr. 13 Starting frequency*, simply turning ON the start signal will run the motor at the preset frequency according to the set acceleration time even if the command frequency is not input.



Parameters referred to

Pr. 13 Starting frequency Refer to page 138 Pr. 15 Jog frequency Refer to page 201

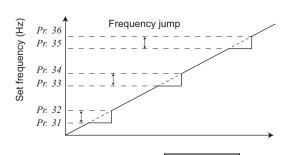


5.7.2 Avoiding mechanical resonance points (frequency jumps) (Pr. 31 to Pr. 36)

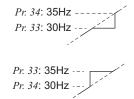
When avoiding resonance arisen from the natural frequency of a mechanical system, use these parameters to jump the resonant frequencies.

Parameter Number	Name	Initial Value	Setting Range	Description
31	Frequency jump 1A	9999	0 to 400Hz, 9999	
32	Frequency jump 1B	9999	0 to 400Hz, 9999	44. 45.04.45.05.4
33	Frequency jump 2A	9999	0 to 400Hz, 9999	1A to 1B, 2A to 2B, 3A to 3B is frequency
34	Frequency jump 2B	9999	0 to 400Hz, 9999	9999: Function invalid
35	Frequency jump 3A	9999	0 to 400Hz, 9999	a a a a a a a a a a a a a a a a a a a
36	Frequency jump 3B	9999	0 to 400Hz, 9999	

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)



- Up to three areas can be set, with the jump frequencies set to either the top or bottom point of each area.
- The value set to 1A, 2A or 3A is a jump point and operation in the jump zone is performed at these frequencies.



Example 1

To fix the frequency to 30Hz in the range 30Hz to 35Hz, set 35Hz in Pr.~34 and 30Hz in Pr.~33.

Example 2

To jump the frequency to 35Hz in the range 30Hz to 35Hz, set 35Hz in Pr. 33 and 30Hz in Pr. 34.



NOTE

During acceleration/deceleration, the running frequency within the set area is valid.

5.8 V/F pattern

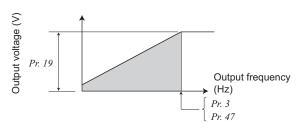
Purpose	Parameter	Refer to Page	
Set motor ratings	Base frequency, Base frequency voltage	Pr. 3, Pr. 19, Pr. 47	126
Select a V/F pattern according to applications.	Load pattern selection	Pr. 14	128

5.8.1 Base frequency, voltage (Pr. 3, Pr. 19, Pr. 47)

Use this function to adjust the inverter outputs (voltage, frequency) to match with the motor rating.

Parameter Number	Name	Initial Value	Setting Range	Description
3	Base frequency	60Hz	0 to 400Hz	Rated motor frequency. (50Hz/60Hz)
			0 to 1000V	Base voltage.
19 *	Base frequency voltage	9999	8888	95% of power supply voltage
			9999	Same as power supply voltage
47 :	Second V/F (base	0000	0 to 400Hz	Base frequency when the RT signal is ON.
47 *	frequency)	9999	9999	Second V/F invalid

^{*} The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)



(1) Base frequency setting (Pr. 3)

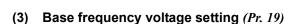
- When operating a standard motor, generally set the rated frequency of the motor to *Pr. 3 Base frequency*. When running the motor using commercial power supply-inverter switch-over operation, set *Pr. 3* to the same value as the power supply frequency.
- If the frequency given on the motor rating plate is "50Hz" only, always set to "50Hz". Leaving the base frequency unchanged from "60Hz" may make the voltage too low and the torque insufficient. It may result in an inverter trip due to overload.
- Special care must be taken when "1" (variable torque load) is set in *Pr. 14 Load pattern selection* .
- When using the Mitsubishi constant-torque motor, set *Pr. 3* to 60Hz.

(2) Set two kinds of base frequencies (Pr. 47)

- When you want to change the base frequency when switching two types of motors with one inverter, use the *Pr. 47 Second V/F* (base frequency).
- *Pr. 47 Second V/F (base frequency)* is valid when the RT signal is ON. Set "3" in any of *Pr. 180 to Pr. 184 (input terminal function selection)* and assign the RT signal.

• REMARKS

• The RT signal acts as the second function selection signal and makes the other second functions valid. (Refer to page 165)



- •Use Pr. 19 Base frequency voltage to set the base voltage (e.g. rated motor voltage).
- •If the setting is less than the power supply voltage, the maximum output voltage of the inverter is as set in Pr. 19.
- •Pr. 19 can be utilized in the following cases.
 - (a) When regeneration is high (e.g. continuous regeneration)During regeneration, the output voltage becomes higher than the reference and may cause an overcurrent trip (E.OC□) due to an increased motor current.
 - (b) When power supply voltage variation is large

 When the power supply voltage exceeds the rated voltage of the motor, speed variation or motor overheat may be caused by excessive torque or increased motor current.



NOTE

• When Advanced magnetic flux vector control or General-purpose magnetic flux vector control is selected, *Pr. 3, Pr. 47* and *Pr. 19* are invalid and *Pr. 83* and *Pr. 84* are valid.

Note that Pr.~3 or Pr.~47 value is made valid as inflection points of S-pattern when Pr.~29 Acceleration/deceleration pattern selection = "1" (S-pattern acceleration/deceleration A).

• Changing the assignment of a virtual terminal of CC-Link communication with *Pr. 180 to Pr. 184 (input terminal function selection)* may affect other functions. Set parameters after confirming the function of each virtual terminal.



Parameters referred to

Pr. 14 Load pattern selection Refer to page 128

Pr. 29 Acceleration/deceleration pattern selection Refer to page 139

Pr. 83 Rated motor voltage, Pr. 84 Rated motor frequency Refer to page 146

Pr. 180 to Pr. 184 (input terminal function selection) Refer to page 163

General-purpose magnetic flux vector control Refer to page 117

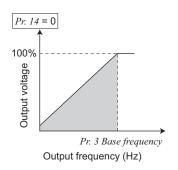
Advanced magnetic flux vector control Refer to page 114

5.8.2 Load pattern selection (Pr. 14)

You can select the optimum output characteristic (V/F characteristic) for the application and load characteristics.

Parameter Number	Name	Initial Value	Setting Range	Description
			0	For constant-torque load
	Load pattern selection		1	For variable torque load
14			2	For constant-torque elevators
14		U	2	(at reverse rotation boost of 0%)
			2	For constant-torque elevators
			3	(at forward rotation boost of 0%)

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)



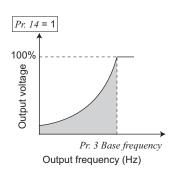
(1) Constant-torque load application (setting "0", initial value)

- At or less than the base frequency, the output voltage varies linearly with the output frequency.
- Set this value when driving the load whose load torque is constant even if the speed varies, e.g. conveyor, cart or roll drive.

POINT

If the load is a fan or pump, select for constant-torque load (setting "0") in any of the following cases.

- · When a blower of large inertia moment (J) is accelerated in a short time
- · For constant-torque load such as rotary pump or gear pump
- · When load torque increases at low speed, e.g. screw pump



(2) Variable-torque load application (setting "1")

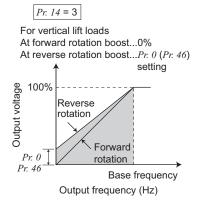
- At or less than the base frequency, the output voltage varies with the output frequency in a square curve.
- Set this value when driving the load whose load torque varies in proportion to the square of the speed, e.g. fan or pump.

Pr. 14 = 2

For vertical lift loads
At forward rotation boost...Pr. 0 (Pr. 46)
setting
At reverse rotation boost...0%

Pr. 0
Forward rotation
Reverse rotation
Pr. 46

Base frequency
Output frequency (Hz)



(3) Constant-torque load application (setting "2, 3")

- Set "2" when a vertical lift load is fixed as power driving load at forward rotation and regenerative load at reverse rotation.
- Pr. 0 Torque boost is valid during forward rotation and torque boost is automatically changed to "0%" during reverse rotation. Pr. 46 Second torque boost is valid when the RT signal turns ON.
- Set "3" for an elevated load that is in the driving mode during reverse rotation and in the regenerative load mode during forward rotation according to the load weight, e.g. counterweight system.
- For the RT signal, set "3" in any of *Pr. 180 to Pr. 184 (input terminal function selection)* to assign the function.



> REMARKS

- When torque is continuously regenerated as vertical lift load, it is effective to set the rated voltage in *Pr. 19 Base frequency voltage* to prevent trip due to current at regeneration.
- In addition, when the RT signal is ON, the other second functions are also valid.



NOTE

- Load pattern selection does not function under Advanced magnetic flux vector control and General-purpose magnetic flux vector control.
- Changing the assignment of a virtual terminal of CC-Link communication with *Pr. 180 to Pr. 184 (input terminal function selection)* may affect other functions. Set parameters after confirming the function of each virtual terminal.



Parameters referred to

Pr. 0, Pr. 46 (Torque boost) Refer to page 113

Pr. 3 Base frequency Refer to page 126

Pr. 180 to Pr. 184 (input terminal function selection) Refer to page 163

General-purpose magnetic flux vector control Refer to page 114

Advanced magnetic flux vector control Refer to page 114

5.9 Frequency setting with input signals

Purpose	Parameter	Refer to Page	
To control the frequency with combinations of input signals	Multi-speed operation	Pr. 4 to Pr. 6, Pr. 24 to Pr. 27, Pr. 232 to Pr. 239	130
To command smooth speed transition with input signals	Remote setting function	Pr. 59	132

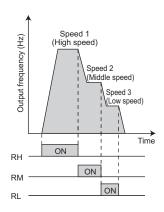
5.9.1 Operation by multi-speed operation (Pr. 4 to Pr. 6, Pr. 24 to Pr. 27, Pr. 232 to Pr. 239)

Use the virtual terminals of CC-Link communication to switch among the pre-set operation speeds set in parameters. Any speed can be selected by simply turning ON/OFF the RH, RM, RL and REX signals.

Parameter Number	Name	Initial Value	Setting Range	Description
4	Multi-speed setting (high speed)	60Hz	0 to 400Hz	Frequency when RH turns ON
5	Multi-speed setting (middle speed)	30Hz	0 to 400Hz	Frequency when RM turns ON
6	Multi-speed setting (low speed)	10Hz	0 to 400Hz	Frequency when RL turns ON
24 *	Multi-speed setting (speed 4)	9999	0 to 400Hz, 9999	
25 *	Multi-speed setting (speed 5)	9999	0 to 400Hz, 9999	
26 *	Multi-speed setting (speed 6)	9999	0 to 400Hz, 9999	
27 *	Multi-speed setting (speed 7)	9999	0 to 400Hz, 9999	1
232 *	Multi-speed setting (speed 8)	9999	0 to 400Hz, 9999	Frequency from 4 speed to 15 speed can
233 *	Multi-speed setting (speed 9)	9999	0 to 400Hz, 9999	be set according to the combination of
234 *	Multi-speed setting (speed 10)	9999	0 to 400Hz, 9999	the RH, RM, RL and REX signals.
235 *	Multi-speed setting (speed 11)	9999	0 to 400Hz, 9999	9999: not selected
236 *	Multi-speed setting (speed 12)	9999	0 to 400Hz, 9999	
237 *	Multi-speed setting (speed 13)	9999	0 to 400Hz, 9999	
238 *	Multi-speed setting (speed 14)	9999	0 to 400Hz, 9999	
239 *	Multi-speed setting (speed 15)	9999	0 to 400Hz, 9999	

The above parameters allow its setting to be changed during operation in any operation mode even if "0" (initial value) is set in Pr. 77 Parameter write selection.

^{*} This parameter can be set when Pr. 160 User group read selection = "0". (Refer to page 197)



(1) Multi speed setting for 3 speeds (Pr. 4 to Pr. 6)

•The inverter operates at frequencies set in *Pr. 4* when RH signal is ON, *Pr. 5* when RM signal is ON and *Pr. 6* when RL signal is ON.

• REMARKS

• For multi-speed setting, if two or three speeds are simultaneously selected, priority is given to the set frequency of the lower signal.

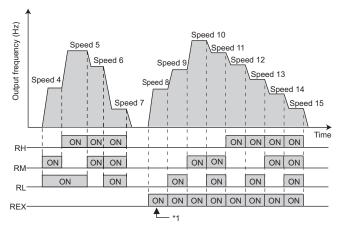
For example, when the RH and RM signals turn ON, the RM signal (Pr. 5) has a higher priority.

• The RH, RM, RL signals are assigned to the virtual terminals of CC-Link communication in the initial setting. By setting "0 (RL)", "1 (RM)", "2 (RH)" in *Pr. 183 or Pr. 184 (input terminal function selection)*, you can assign the signals to other virtual terminals.



(2) Multi-speed setting for 4 or more speeds (Pr. 24 to Pr. 27, Pr. 232 to Pr. 239)

- •Frequency from 4 speed to 15 speed can be set according to the combination of the RH, RM, RL and REX signals. Set the running frequencies in *Pr. 24 to Pr. 27, Pr. 232 to Pr. 239*. (In the initial value setting, speed 4 to speed 15 are invalid.)
- •To input the REX signal to a virtual terminal of CC-Link communication, set "8" in one of *Pr.180 to Pr.184 (input terminal function selection)*.



*1 When "9999" is set in *Pr. 232 Multi-speed setting (speed 8)*, operation is performed at frequency set in *Pr. 6* when RH, RM and RL are turned OFF and REX is turned ON.



> REMARKS

- Multi-speed parameters can also be set in the PU operation mode.
- Pr. 24 to Pr. 27 and Pr. 232 to Pr. 239 settings have no priority between them.
- When Pr. 59 Remote function selection ≠ "0", multi-speed setting is invalid as RH, RM and RL signals are remote setting signals.



NOTE

Changing the assignment of a virtual terminal of CC-Link communication with *Pr. 180 to Pr. 184 (input terminal function selection)* may affect other functions. Set parameters after confirming the function of each virtual terminal.



Parameters referred to

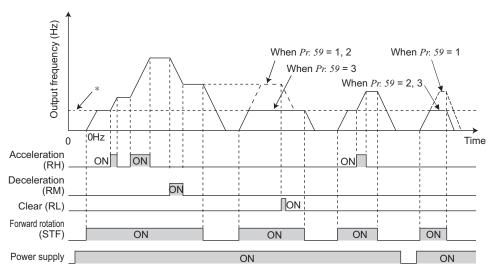
Pr. 59 Remote function selection Refer to page 132
Pr. 180 to Pr. 184 (input terminal function selection) Refer to page 163

5.9.2 Remote setting function (Pr. 59)

- •Continuous variable-speed operation can be performed with acceleration and deceleration signals.
- •By simply setting this parameter, you can use the acceleration, deceleration and setting clear functions of the remote speed setter (FR-FK).

Parameter			Setting	Description		
Number	Name	Initial Value	Range	RH, RM, RL signal function	Frequency setting storage function	
			0	Multi-speed setting	_	
			1	Remote setting	With	
			2	Remote setting	Not used	
59	Remote function selection	0			Not used	
			3	Remote setting (Turning STF/s	(Turning STF/STR OFF	
			3	rtemote setting	clears remotely-set	
					frequency.)	

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 156)



* CC-Link communication running frequency (other than multi-speed) or PU running frequency



(1) Remote setting function

- •Use *Pr. 59* to select whether the remote setting function is used or not and whether the frequency setting storage function in the remote setting mode is used or not.
- When *Pr.* 59 is set to any of "1 to 3" (remote setting function valid), the functions of the RH, RM and RL signals are changed to acceleration (RH), deceleration (RM) and clear (RL).
- •When using the remote setting function, following frequencies can be compensated to the frequency set by RH and RM operation according to the operation mode.
- During CC-Link communication operationCC-Link communication frequency command other than multi-speed settings

During PU operation......PU frequency command

(2) Frequency setting storage

•The frequency setting storage function stores the remotely-set frequency (frequency set by RH/RM operation) into the memory (EEPROM). When power is switched OFF once, then ON, operation is resumed with that output frequency value. (*Pr.* 59 = 1)

<Frequency setting storage conditions>

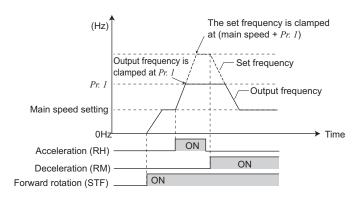
Remotely-set frequency is stored in the following timings.

- · When the start signal (STF or STR) turns OFF.
- Every minute after both the RH (acceleration) and RM (deceleration) signals turn OFF (ON). (The frequency is overwritten if the latest frequency is different from the previous frequency when comparing the two. The state of the RL signal does not affect writing.)
- When the power supply switches to the 24V external power supply while the start signal (STF or STR) is ON. ("EV" appears on the operation panel.)



NOTE

 The range of frequency changeable by RH (acceleration) and RM (deceleration) is 0 to maximum frequency (Pr. 1 or Pr. 18 setting). Note that the maximum value of set frequency is (main speed + maximum frequency).



- When the acceleration or deceleration signal switches ON, acceleration/deceleration time is as set in *Pr. 44 Second acceleration/deceleration time* and *Pr. 45 Second deceleration time*. Note that when the time set in *Pr. 7* or *Pr. 8* is longer than the time set in *Pr. 44* or *Pr. 45*, the acceleration/deceleration time is as set in *Pr. 7* or *Pr. 8*. (when RT signal is OFF) When the RT signal is ON, acceleration/deceleration is made in the time set in *Pr. 44* and *Pr. 45*, regardless of the *Pr. 7* or *Pr. 8* setting.
- Even if the start signal (STF or STR) is OFF, turning ON the acceleration (RH) or deceleration (RM) signal varies the preset frequency.
- 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"). If set valid (Pr. 59 = "1"), frequency is written to EEPROM frequently, this will shorten the life of the EEPROM.
- To assign the RH, RM, or RL signal to a virtual terminal of CC-Link communication, use one of *Pr. 180 to Pr. 184 (input terminal function selection)*. Changing the assignment of a virtual terminal may affect other functions. Set parameters after confirming the function of each virtual terminal.



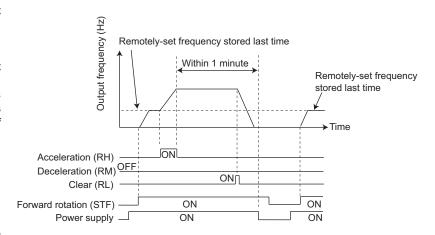


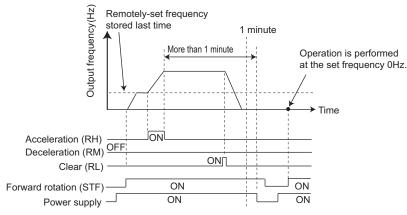
> REMARKS

During Jog operation or PID control operation, the remote setting function is invalid.

Setting frequency is "0"

- Even when the remotely-set frequency is cleared by turning ON the RL (clear) signal after turn OFF (ON) of 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 turn OFF (ON) of both the RH and RM signals
- When the remotely-set frequency is cleared by turning ON the RL (clear) signal after turn OFF (ON) of both the RH and RM signals, the inverter operates at the frequency in the remotely-set frequency cleared state if power is reapplied after one minute has elapsed since turn OFF (ON) of both the RH and RM signals.







🅦 When selecting this function, re-set the maximum frequency according to the machine.



Parameters referred to

Pr. 1 Maximum frequency, Pr. 18 High speed maximum frequency Refer to page 124

Pr. 7 Acceleration time, Pr. 8 Deceleration time, Pr. 44 Second acceleration/deceleration time, Pr. 45 Second deceleration time The Refer to page 135

Pr. 180 to Pr. 184 (input terminal function selection) The Refer to page 163



5.10 Setting of acceleration/deceleration time and acceleration/deceleration pattern

Purpose	Parameter t	Refer to Page	
Motor acceleration/deceleration	Acceleration/deceleration	Pr. 7, Pr. 8, Pr. 20, Pr. 21, Pr. 44,	125
time setting	times	Pr. 45, Pr. 147	135
Starting frequency	Starting frequency and start-time hold	Pr. 13, Pr. 571	138
Set acceleration/deceleration pattern suitable for application	Acceleration/deceleration pattern	Pr. 29	139
Automatically set optimum acceleration/deceleration time.	Automatic acceleration/ deceleration	Pr. 61 to Pr. 63, Pr. 292	140

5.10.1 Setting of the acceleration and deceleration time (Pr. 7, Pr. 8, Pr. 20, Pr. 21, Pr. 44, Pr. 45, Pr. 147)

Used to set motor acceleration/deceleration time.

Set a larger value for a slower speed increase/decrease or a smaller value for a faster speed increase/decrease.

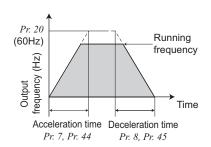
For the acceleration time at automatic restart after instantaneous power failure, refer to *Pr. 611 Acceleration time at a restart (page 180)*.

Parameter Number	Name	Initial Value		Setting Range	Description	
7	Acceleration time	3.7K or lower 5.5K, 7.5K 11K, 15K	5s 10s 15s	0 to 3600/ 360s *2	Motor acceleration time.	
8	Deceleration time	3.7K or lower 5.5K, 7.5K 11K, 15K	5s 10s 15s	0 to 3600/ 360s *2	Motor deceleration time.	
20 *1	Acceleration/ deceleration reference frequency	60Hz		1 to 400Hz	Frequency that will be the basis of acceleration/deceleration time. As acceleration/deceleration time, set the frequency change time from stop to <i>Pr. 20</i> .	
21 *1	Acceleration/ deceleration time increments	0		0	Increments: 0.1s Range: 0 to 3600s Increments: 0.01s Range: 0 to 360s	Increments and setting range of acceleration/ deceleration time setting can be changed.
44 *1	Second acceleration/ deceleration time	3.7K or lower 5.5K, 7.5K 11K, 15K	5s 10s 15s	0 to 3600/ 360s *2	Acceleration/deceleration time when the RT signal is ON.	
45 *1	Second deceleration time	9999		0 to 3600/ 360s *2 9999	Deceleration time when the RT signal is ON. Acceleration time = deceleration time	
147 *1	Acceleration/ deceleration time switching frequency	9999		0 to 400Hz 9999	Frequency when automatically switching to the acceleration/deceleration time of <i>Pr. 44</i> and <i>Pr. 45</i> . No function	

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)

^{*2} Depends on the Pr. 21 Acceleration/deceleration time increments setting. The initial value for the setting range is "0 to 3600s" and the setting increments is "0.1s".

Setting of acceleration/deceleration time and acceleration/ deceleration pattern



(1) Acceleration time setting (Pr. 7, Pr. 20)

- •Use *Pr. 7 Acceleration time* to set the acceleration time required to reach *Pr. 20 Acceleration/deceleration reference frequency* from 0Hz.
- •Set the acceleration time according to the following formula.

Acceleration time setting
$$= \frac{Pr. 20}{\text{Maximum operating frequency - } Pr. 13} \times \text{Acceleration time from a stop to the maximum operating frequency}$$

Example) How to find the setting value for Pr. 7 when increasing the output frequency to the maximum frequency of 50Hz in 10s with Pr. 20 = "60Hz (initial setting)" and Pr. 13 = "0.5Hz (initial setting)".

$$Pr. 7 = \frac{60\text{Hz}}{50\text{Hz} - 0.5\text{Hz}} \times 10\text{s} = 12.1\text{s}$$

(2) Deceleration time setting (Pr. 8, Pr. 20)

- •Use *Pr. 8 Deceleration time* to set the deceleration time required to reach 0Hz from *Pr. 20 Acceleration/deceleration reference frequency*.
- •Set the deceleration time according to the following expression.

Deceleration _	Pr. 20	Deceleration time from the maximum operating frequency to a stop
time setting	Maximum operating frequency - Pr. 10	Deceleration time from the maximum operating frequency to a stop

Example) How to find the setting value for Pr.~8 when decreasing the output frequency from the maximum frequency of 50Hz in 10s with Pr.~20 = "120Hz" and Pr.~10 = "3Hz (initial setting)".

$$Pr. 8 = \frac{120 \text{Hz}}{50 \text{Hz} - 3 \text{Hz}} \times 10 \text{s} = 25.5 \text{s}$$

(3) Change the setting range and increments of the acceleration/deceleration time (Pr. 21)

•Use Pr. 21 to set the acceleration/deceleration time and minimum setting range.



NOTE

• Changing the *Pr. 21* setting changes the acceleration/deceleration time setting (*Pr. 7, Pr. 8, Pr. 16, Pr. 44, Pr. 45*). (It does not influence the setting of *Pr. 611 Acceleration time at a restart*.)

When Pr. 7 is set to "5.0s" at Pr. 21 setting of "0", and then Pr. 21 is changed to "1", the Pr. 7 setting automatically changes to "0.5s".

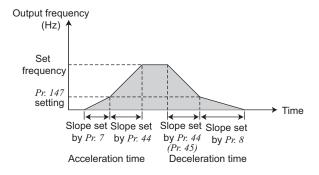


(4) Set two kinds of acceleration/deceleration times (RT signal, Pr. 44, Pr. 45, Pr. 147)

- Pr. 44 and Pr. 45 are valid when the RT signal is ON, or the output frequency reaches or exceeds the setting of Pr. 147.
- •When "9999" is set to Pr. 45, the deceleration time becomes equal to the acceleration time (Pr. 44).
- •For the RT signal, set "3" in any of Pr. 180 to Pr. 184 (input terminal function selection) to assign the function.
- Acceleration/deceleration time changes when the RT signal turns ON or the output frequency reaches the Pr.147 setting or higher.

Pr. 147 Setting Acceleration/Deceleration Time		Description	
9999 (initial value)	Pr. 7. Pr. 8	No automatic switching of the acceleration/deceleration	
9999 (Illitial value)	F1. /, F1. 0	time	
0.00Hz	Pr. 44, Pr. 45	Second acceleration/deceleration time from a start	
0.00 Hz $\leq Pr. 147 \leq$ Set frequency	Output frequency < Pr. 147: Pr. 7, Pr. 8	Acceleration/deceleration time automatic switching *	
0.00112 ≤ F7. 147 ≤ Set frequency	Pr. 147 ≤ Output frequency: Pr. 44, Pr. 45	Acceleration/deceleration time automatic switching *	
Set frequency < Pr. 147	Pr. 7, Pr. 8	No automatic switching, since output frequency will not	
Set frequency < Pr. 147	F1. /, F7. 0	reach the switching frequency	

* When the RT signal turns on, the acceleration/deceleration time switches to the second acceleration/deceleration time even when the output frequency is not reached to Pr. 147 setting.





NOTE

- When the acceleration/deceleration pattern is S-pattern acceleration/deceleration A (refer to page 139), the acceleration/ deceleration time is the time required to reach ${\it Pr.\,3\,Base\,frequency}$.
- Acceleration/deceleration time formula when the set frequency is the base frequency or higher

$$t = \frac{4}{9} \times \frac{T}{(Pr. 3)^2} \times f^2 + \frac{5}{9} T$$

- T: Acceleration/deceleration time setting (s)
- f: Set frequency (Hz)
- Guideline for acceleration/deceleration time at the Pr. 3 Base frequency of 60Hz (0Hz to set frequency)

Frequency setting (Hz) Acceleration/ deceleration time (s)	60	120	200	400
5	5	12	27	102
15	15	35	82	305

Changing the assignment of a virtual terminal of CC-Link communication may affect other functions. Set parameters after confirming the function of each virtual terminal.



• REMARKS

- The RT signal acts as the second function selection signal and makes the other second functions valid. (Refer to page 165)
- When the Pr. 7, Pr. 8, Pr. 44 and Pr. 45 settings are 0.03s or less, the acceleration/deceleration time is 0.04s. At that time, set Pr. 20 to "120Hz" or less.
- Any value can be set to the acceleration/deceleration time but 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



Parameters referred to

Pr. 3 Base frequency Refer to page 126

Pr. 10 DC injection brake operation frequency Refer to page 154

Pr. 29 Acceleration/deceleration pattern selection 👺 Refer to page 139

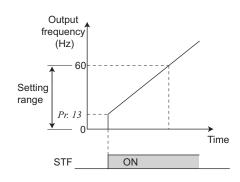
Pr. 180 to Pr. 184 (input terminal function selection) Refer to page 163

5.10.2 Starting frequency and start-time hold function (Pr. 13, Pr. 571)

You can set the starting frequency and hold the set starting frequency for a certain period of time. Set these functions when you need the starting torque or want to smooth motor drive at a start.

Parameter Number	Name	Initial Value	Setting Range	Description
13	Starting frequency	0.5Hz	0 to 60Hz	Frequency at start can be set in the range 0 to 60Hz. Starting frequency at which the start signal is turned ON.
571	Holding time at a start	9999	0.0 to 10.0s 9999	Holding time of <i>Pr. 13 Starting frequency</i> . Holding function at a start is invalid

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)



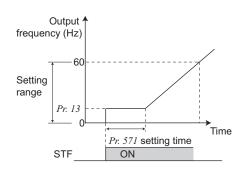
(1) Starting frequency setting (Pr. 13)

- •Frequency at start can be set in the range 0 to 60Hz.
- You can set the starting frequency at which the start signal is turned ON.



NOTE

The inverter will not start if the frequency setting signal is less than the value set in Pr. 13. For example, when 5Hz is set in Pr. 13, the motor will not start running until the frequency setting signal reaches 5Hz.



(2) 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.



REMARKS

When Pr. 13 = "OHz", the starting frequency is held at 0.01Hz.



NOTE

- 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 invalid.

⚠ CAUTION

Note that when *Pr. 13* is set to any value equal to or lower than *Pr. 2 Minimum frequency*, simply turning ON the start signal will run the motor at the preset frequency even if the command frequency is not input.



Parameters referred to

Pr. 2 Minimum frequency Refer to page 124

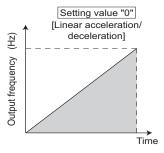


5.10.3 Acceleration/deceleration pattern (Pr. 29)

You can set the acceleration/deceleration pattern suitable for application.

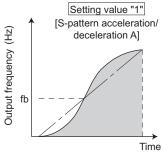
Parameter Number	Name	Initial Value	Setting Range	Description
	Acceleration/deceleration	0	0	Linear acceleration/ deceleration
29	pattern selection		1	S-pattern acceleration/deceleration A
			2	S-pattern acceleration/deceleration B

The above parameters can be set when Pr. 160 User group read selection ="0". (Refer to page 197)



(1) Linear acceleration/deceleration (Pr. 29 = "0", initial value)

•For the inverter operation, the output frequency is made to change linearly (linear acceleration/deceleration) to prevent the motor and inverter from excessive stress to reach the set frequency during acceleration, deceleration, etc. when frequency changes. Linear acceleration/deceleration has a uniform frequency/time slope.



(2) S-pattern acceleration/deceleration A (Pr. 29 = "1")

•For machine tool spindle applications, etc.

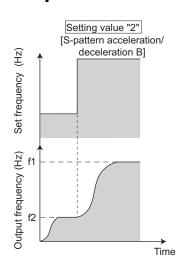
Used when acceleration/deceleration must be made in a short time to a highspeed range of not lower than the base frequency.

In this acceleration/deceleration pattern, *Pr. 3 Base frequency* (fb) is the inflection point of the S pattern and you can set the acceleration/deceleration time appropriate for motor torque reduction in a constant-power operation range of base frequency (fb) or higher.



NOTE

As the acceleration/deceleration time of S-pattern acceleration/deceleration A, set the time taken until Pr. 3 Base frequency is reached, not Pr. 20 Acceleration/deceleration reference frequency.



(3) S-pattern acceleration/deceleration B (Pr. 29 = "2")

•For prevention of load shifting in conveyor and other applications.

Since acceleration/deceleration is always made in an S shape from current frequency (f2) to target frequency (f1), this function eases shock produced at acceleration/deceleration and is effective for load collapse prevention, etc.



Parameters referred to

Pr. 3 Base frequency Refer to page 126

Pr. 7 Acceleration time, Pr. 8 Deceleration time, Pr. 20 Acceleration/deceleration reference frequency Refer to page 135

5.10.4 Shortest acceleration/deceleration (automatic acceleration/deceleration) (Pr. 61 to Pr. 63, Pr. 292, Pr. 293)

The inverter operates in the same conditions as when appropriate values are set in each parameter even if acceleration/deceleration time and V/F pattern are not set. This function is useful when you just want to operate, etc. without fine parameter setting.

Parameter	Nama	Initial	Setting	Do a cuinti cu	
Number	Name	Value	Range	Description	
	Reference current	9999	0 to 500A	Set the reference current during shortest	
61				acceleration/deceleration.	
			9999	Rated inverter output current value is reference	
62	Reference value at	9999	0 to 200%	Set the limit value during shortest acceleration.	
02	acceleration	9999	9999	150% is a limit value	
63	Reference value at	9999	0 to 200%	Set the limit value during shortest deceleration.	
03	deceleration		9999	150% is a limit value	
	Automatic acceleration/ deceleration	0	0	Normal mode	
			1	Shortest acceleration/deceleration (without brake)	
292			11	Shortest acceleration/deceleration (with brake)	
			7, 8	Brake sequence mode 1, 2	
				(Refer to page 160)	
	Acceleration/deceleration separate selection	0	0	Both acceleration and deceleration are made in the	
293				shortest acceleration/deceleration mode	
			1	Only acceleration is made in the shortest	
			<u>'</u>	acceleration/deceleration mode	
			2	Only deceleration is made in the shortest	
				acceleration/deceleration mode	

The above parameters can be set when Pr. 160 User group read selection ="0". (Refer to page 197)

(1) Shortest acceleration/deceleration mode (Pr. 292 = "1, 11", Pr. 293)

- •Set when you want to accelerate/decelerate the motor for the shortest time. It is desired to make acceleration/deceleration in a shorter time for a machine tool etc. but the design values of machine constants are unknown.
- •Acceleration/deceleration speed is automatically adjusted at a start of acceleration/deceleration from the value of the setting value of *Pr. 7 Acceleration time* and *Pr. 8 Deceleration time* so that acceleration/deceleration is made with the maximum torque the inverter can output. (The setting values of *Pr. 7* and *Pr. 8* are not changed.)
- •Either acceleration or deceleration can be made in the shortest time using *Pr. 293 Acceleration/deceleration separate selection*. When the setting value is "0" (initial value), both acceleration and deceleration can be made in the shortest time.
- •Set "11" when an optional MRS type, MYS type brake resistor, high-duty brake resistor or brake unit is connected. Deceleration time can be further shortened.
- •When the shortest/acceleration mode is selected, the stall prevention operation level during acceleration/deceleration from the value of becomes 150% (adjustable using *Pr. 61* to *Pr. 63*). Setting of *Pr. 22 Stall prevention operation level* is used only during a constant speed operation.
- •It is inappropriate to use for the following applications.
 - a) Machine with a large inertia such as a fan (more than 10 times). Since stall prevention operation will be activated for a long time, this type of machine may be brought to an alarm stop due to motor overloading, etc.
 - b) To perform operation with a constant acceleration/deceleration time.

> REMARKS

- Even if automatic acceleration/deceleration mode has been selected, inputting the RT signal (second function selection) during
 an inverter stop will switch to the normal operation and give priority to second function selection. Note that RT signal input is
 invalid even if RT signal are input during operation in automatic acceleration/deceleration mode.
- Since acceleration/deceleration is made with the stall prevention operation being activated, the acceleration/deceleration speed always varies according to the load conditions.
- Note that when proper values are set in Pr. 7 and Pr. 8, acceleration/deceleration time may be shorter than selecting shortest
 acceleration/deceleration mode.



(2) Adjustment of shortest acceleration/deceleration mode (Pr. 61 to Pr. 63)

•By setting the adjustment parameters Pr. 61 and Pr. 63, the application range can be made wider.

Parameter Number	Name	Setting Range	Description
61	Reference current	0 to 500A	For example, when the motor and inverter are different in capacity, set the rated motor current value. Set reference current (A) of the stall prevention operation level during acceleration/deceleration.
		9999 (initial value)	The rated inverter current is defined as reference.
62	Reference value at acceleration Reference value at	0 to 200%	Set when it is desired to change the reference level of acceleration and deceleration. Set the stall prevention operation level (ratio to the current value of <i>Pr. 61</i>) during acceleration/deceleration.
63	deceleration	9999 (initial value)	Stall prevention operation level is 150% for the shortest acceleration/deceleration.

• REMARKS

Since the Pr. 61 to Pr. 63 settings automatically return to the initial value (9999) if the Pr. 292 setting is changed, set Pr. 292 first when you need to set Pr. 61 to Pr. 63.



Parameters referred to

Pr. 0 Torque boost Refer to page 113
Pr. 7 Acceleration time, Pr. 8 Deceleration time Refer to page 135

Pr. 22 Stall prevention operation level Refer to page 120

5.11 Selection and protection of a motor

Purpose	Parameter that	should be Set	Refer to Page
Motor protection from overheat	Electronic thermal O/L relay	Pr. 9, Pr. 51	142
Use the constant-torque motor	Applied motor	Pr. 71	144
The motor performance can be maximized for operation in magnetic flux vector control method.	Offline auto tuning	Pr. 71, Pr. 80 to Pr. 84, Pr. 90 to Pr. 94, Pr. 96, Pr. 859	146

5.11.1 Motor overheat protection (Electronic thermal O/L relay) (Pr. 9, Pr. 51)

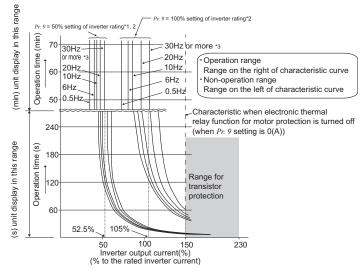
Set the current of the electronic thermal relay function to protect the motor from overheat. This feature provides the optimum protective characteristics, including reduced motor cooling capability, at low speed.

Parameter Number	Name	Initial Value	Setting Range	Description
9	Electronic thermal O/L relay	Inverter rated current *1	0 to 500A	Set the rated motor current.
51 *2	Second electronic thermal O/L relay *3	9999	0 to 500A 9999	Valid when the RT signal is ON. Set the rated motor current. Second electronic thermal O/L relay invalid

- *1 The initial value of the 0.75K or lower is set to 85% of the rated inverter current.
- *2 The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)
- *3 When parameter is read using the FR-PU04, a parameter name different from an actual parameter is displayed.

(1) Electronic thermal O/L relay (Pr. 9)

Electronic thermal O/L relay operation characteristic



This function detects the overload (overheat) of the motor and trips. (The operation characteristic is shown on the left)

- Set the rated current (A) of the motor in Pr. 9.
 (If the motor has both 50Hz and 60Hz rating and the Pr. 3 Base frequency is set to 60Hz, set the 1.1 times of the 60Hz rated motor current.)
- Set "0" in *Pr. 9* when you do not want to operate the electronic thermal O/L relay, e.g. when using an external thermal relay with the motor. (Note that the output transistor protection of the inverter functions (E.THT).)
- · When using a Mitsubishi constant-torque motor
 - 1) Set "1" or "13 to 16", "50", "53", "54" in any of *Pr.* 71. (This provides a 100% continuous torque characteristic in the low-speed range.
 - 2) Set the rated current of the motor in Pr. 9.
- *1 When 50% of the inverter rated output current (current value) is set to Pr. 9
- *2 The % value denotes the percentage to the inverter rated output current. It is not the percentage to the motor rated current.
- *3 When you set the electronic thermal O/L relay dedicated to the Mitsubishi constant-torque motor, this characteristic curve applies to operation at 6Hz or higher.



NOTE

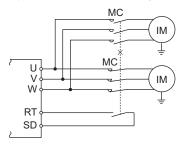
- Fault by electronic thermal relay function is reset by inverter power reset and reset signal input. Avoid unnecessary reset and power-OFF.
- When multiple motors are operated by a single inverter, protection cannot be provided by the electronic thermal function. Install an external thermal relay to each motor.
- When the difference between the inverter and motor capacities is large and the setting is small, the protective characteristics of the electronic thermal relay function will be deteriorated. In this case, use an external thermal relay.
- A special motor cannot be protected by the electronic thermal relay function.
- The operation time of the transistor protection thermal shortens when the Pr. 72 PWM frequency selection setting increases.



(2) Set two different electronic thermal O/L relays (Pr. 51)

Use this function when running two motors of different rated currents individually by a single inverter. (When running two motors together, use external thermal relays.)

- •Set the rated current of the second motor to Pr. 51.
- •When the RT signal is ON, thermal protection is provided based on the Pr. 51 setting.
- •To input the RT signal to a virtual terminal of CC-Link communication, set "3" in one of *Pr. 180 to Pr. 184 (input terminal function selection)* to assign the function to the terminal.



Pr. 450	Pr. 9	Pr.51	RT =	OFF	RT :	= ON
Second applied motor	Electronic thermal O/L relay	Second electronic thermal O/L relay	First motor	Second motor	First motor	Second motor
		9999	×	×	×	×
9999	0	0	×	×	×	×
		0.01 to 500	×	Δ	×	0
		9999	0	×	0	×
9999	Other than 0	0	0	×	Δ	×
		0.01 to 500	0	Δ	Δ	0
		9999	×	×	×	×
Other than 9999	0	0	×	×	×	×
		0.01 to 500	×	Δ	×	0
		9999	0	Δ	Δ	0
Other than 9999	Other than 0	0	0	×	Δ	×
		0.01 to 500	0	Δ	Δ	0

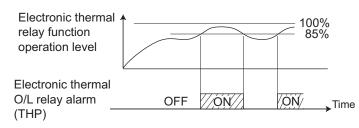
- O... Output current value is used to perform integration processing.
- Δ... Output current is assumed as 0A to perform integration processing. (cooling processing)
- x... Electronic thermal relay function is not activated.

• REMARKS

• The RT signal acts as the second function selection signal and makes the other second functions valid. (Refer to page 165)

(3) Electronic thermal relay function prealarm (TH) and alarm signal (THP signal)

100%: Electronic thermal O/L relay alarm operation value



- The alarm signal (THP) is output and electronic thermal relay function prealarm (TH) is displayed when the electronic thermal O/L relay cumulative value reaches 85% of the level set in Pr. 9 or Pr. 51. If it reaches 100% of the Pr. 9 Electronic thermal O/L relay setting, a motor overload trip (E.THM/E.THT) occurs.
- The inverter does not trip even when the alarm signal (THP) is output.
- To assign the THP signal to the terminal Y0 or a virtual terminal of CC-Link communication, set "8 (positive logic) or 108 (negative logic)" in one of *Pr.190 to Pr.192* and *Pr.313 to Pr.315 (output terminal function selection)*.



NOTE

Changing the assignment of the terminal Y0 or a virtual terminal of CC-Link communication with one of *Pr. 190 to Pr. 192*, and *Pr. 313 to Pr. 315 (output terminal function selection)* may affect other functions. Set parameters after confirming the function of the terminal Y0 and virtual terminals.



Parameters referred to

Pr. 71 Applied motor Refer to page 144

Pr. 72 PWM frequency selection 🎏 Refer to page 192

Pr. 180 to Pr. 184 (input terminal function selection) Refer to page 163

Pr. 190 to Pr. 192, Pr. 313 to Pr. 315 (output terminal function selection) Refer to page 167

5.11.2 Applied motor (Pr. 71, Pr. 450)

Setting of the used motor selects the thermal characteristic appropriate for the motor.

Setting is required to use a constant-torque motor. Thermal characteristic of the electronic thermal relay function suitable for the motor is set.

When General-purpose magnetic flux vector or Advanced magnetic flux vector control is selected, the motor constants (SF-JR, SF-HR, SF-JRCA, SF-HRCA, etc.) necessary for control are selected as well.

Parameter Number	Name	Initial Value	Setting Range	Description
71	Applied motor	0	0, 1, 3 to 6, 13 to 16, 23, 24, 40, 43, 44, 50, 53, 54	Selecting the standard motor or constant-torque motor sets the corresponding motor thermal characteristic.
450	Second applied motor	9999	0, 1 9999	Set when using the second motor. Second motor is invalid (thermal characteristic of the first motor (<i>Pr. 71</i>))

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)

(1) Set the motor to be used

Refer to the following list and set this parameter according to the motor used.

Pr. 71 (Pr. 450)					Motor (O	. Hood motor)
Se	tting	Thermal Characteristic of the Electron	ic Thermal Relay Function		Motor (O: Used motor)	
Pr. 71	Pr. 450	Thermal Gharasteristic of the Lieution	Standard (SF-JR, etc.)	Constant-torque (SF-JRCA, etc.)		
(<i>Pr. 71</i> ir	0 nitial value)	Thermal characteristics of a standard motor			0	
	1	Thermal characteristics of the Mitsubishi con	stant-torque m	otor		0
40	_	Thermal characteristic of Mitsubishi high effic	ciency motor (SF-HR)	O *1	
50	_	Thermal characteristic of Mitsubishi constant	-torque motor	(SF-HRCA)		O *2
3	_	Standard motor			0	
13	_	Constant-torque motor	Select "Offline auto tuning setting"			0
23	_	Mitsubishi standard motor (SF-JR 4P 1.5kW or less)			0	
43	_	Mitsubishi high efficiency motor (SF-HR)			O *1	
53	_	Mitsubishi constant-torque motor (SF-HRCA)				O *2
4	_	Standard motor			0	
14	_	Constant-torque motor				0
24	_	Mitsubishi standard motor (SF-JR 4P 1.5kW or less)		data can be read, ed, and set.	0	
44	_	Mitsubishi high efficiency motor (SF-HR)			O *1	
54	_	Mitsubishi constant-torque motor (SF-HRCA)				O *2
5	_	Standard motor	Star	Direct input of	0	
15	_	Constant-torque motor	connection	motor constants		0
6		Standard motor	Delta		0	
16	_	Constant-torque motor	connection	is enabled		0
_	9999 (initial value)	Without second applied motor				

^{*1} Motor constants of Mitsubishi high efficiency motor SF-HR.

> REMARKS

- When performing offline auto tuning, set any of "3, 13, 23, 43, 53" in *Pr. 71*. (*Refer to page 146* for offline auto tuning.)
- For the 5.5K and 7.5K, the *Pr. 0 Torque boost* and *Pr. 12 DC injection brake operation voltage* settings are automatically changed according to the *Pr. 71* setting as follows.

Automatic Change Parameter	Standard Motor Setting *1	Constant-torque Motor Setting *2
Pr. 0	3%	2%
Pr. 12	4%	2%

^{*1} Pr. 71 setting: 0, 3 to 6, 23, 24,40, 43, 44

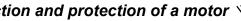
^{*2} Pr. 71 setting: 1, 13 to 16, 50, 53, 54



NOTE

Set the electronic thermal relay function to the thermal characteristic for the constant-torque motor when using a
geared motor (GM-S, GM-D, GM-SY, GM-HY2 series) to perform Advanced magnetic flux vector control or Generalpurpose magnetic-flux vector control.

^{*2} Motor constants of Mitsubishi constant-torque motor SF-HRCA.



(2) Use two motors (Pr. 450)

- Set Pr. 450 Second applied motor to use two different motors with one inverter.
- When "9999" (initial value) is set, no function is selected.
- When a value other than 9999 is set in Pr. 450, the second motor is valid when the RT signal turns ON.
- For the RT signal, set "3" in any of Pr. 180 to Pr. 184 (input terminal function selection) to assign the function.



• REMARKS

• The RT signal acts as the second function selection signal and makes the other second functions valid. (Refer to page 165)



• Changing the assignment of a virtual terminal of CC-Link communication with Pr. 180 to Pr. 184 (input terminal function selection) may affect other functions. Set parameters after confirming the function of each virtual terminal.



Net this parameter correctly according to the motor used.

Incorrect setting may cause the motor to overheat and burn.



Parameters referred to

Pr. 0 Torque boost Refer to page 113

Pr. 12 DC injection brake operation voltage Refer to page 154

Pr. 80 Motor capacity, Pr. 81 Number of motor poles Refer to page 146

Pr. 82 to Pr. 84, Pr. 90 to Pr. 94 (motor constants), Pr. 96 Auto tuning setting/status Refer to page 146

Pr. 800 Control method selection Refer to page 112

5.11.3 Exhibiting the best performance for the motor (offline auto tuning) (Pr. 71, Pr. 80 to Pr. 84, Pr. 90 to Pr. 94, Pr. 96, Pr. 859)

The motor performance can be maximized with offline auto tuning.

•What is offline auto tuning?

When performing Advanced magnetic flux vector control or General-purpose magnetic flux vector control, the motor can be run with the optimum operating characteristics by automatically measuring the motor constants (offline auto tuning) even when each motor constants differs, other manufacturer's motor is used, or the wiring length is long (30m or more as a reference).

Parameter Number	Name	Initial Va	lue	Setting Range	Description	
71	Applied motor	0		0, 1, 3 to 6, 13 to 16, 23, 24, 40, 43, 44, 50, 53, 54	By selecting a standard motor or constant- torque motor, thermal characteristic and motor constants of each motor are set.	
80	Motor capacity	9999		0.1 to 15kW	Applied motor capacity.	
	oto: oupdoing	0000		9999	V/F control	
81	Number of motor poles	9999		2, 4, 6, 8, 10	Number of motor poles.	
	•			9999	V/F control	
82	Motor excitation current	9999		0 to 500A	Tuning data (The value measured by offline auto tuning is automatically set.)	
				9999	Uses the Mitsubishi motor (SF-JR, SF-HR, SF-JRCA, SF-HRCA) constants.	
83	Rated motor voltage	200V class	200V	0 to 1000V	Rated motor voltage (V).	
03	Rateu motor voitage	400V class	400V	0 10 1000 0	Rated filotor voltage (v).	
84	Rated motor frequency	60Hz		10 to 120Hz	Rated motor frequency (Hz).	
90	Motor constant (R1)	9999 9999		0 to 50Ω, 9999	Tuning data	
91	Motor constant (R2)			0 to 50Ω, 9999	(The value measured by offline auto tuning is	
92	Motor constant (L1)	9999		0 to 1000mH, 9999	automatically set.)	
93	Motor constant (L2)	9999		0 to 1000mH, 9999	9999: Uses the Mitsubishi motor (SF-JR, SF-	
94	Motor constant (X)	9999		0 to 100%, 9999	HR, SF-JRCA, SF-HRCA) constants.	
				0	Offline auto tuning is not performed	
				1	For Advanced magnetic flux vector control Offline auto tuning is performed without motor running (all motor constants).	
96	Auto tuning setting/ status	0		11	For General-purpose magnetic flux vector control Offline auto tuning is performed without motor running. (motor constant (R1) only)	
				21	Offline auto tuning for V/F control (automatic restart after instantaneous power failure (with frequency search)) (Refer to page 182)	
859	Torque current	Forque current 9999		0 to 500A	Tuning data (The value measured by offline auto tuning is automatically set.)	
				9999	Uses the Mitsubishi motor (SF-JR, SF-HR, SF-JRCA, SF-HRCA) constants.	

The above parameters can be set when Pr. 160 User group read selection = "0".(Refer to page 197)



• The setting range and increments of *Pr. 82, Pr. 90* to *Pr. 94* and *Pr. 859* changes according to the setting value of *Pr. 71* and *Pr. 96*.

A	pplied Motor	Internal Stored Value *1		otor Internal Stored Value *1 Direct Input Value *2		Value *2	e *2 Auto Tuning Measured Valu	
Parameter	Function Name	Setting Range	Setting	Setting Range	Setting	Setting Range	Setting	
Number	T direction (value	Octung Range	Increments	Octung Range	Increments	Octung range	Increments	
82	Motor excitation current	0 to 500A, 9999	0.01A	0 to 500A, 9999	0.01A	0 to ****, 9999	1	
90	Motor constant (R1)	0 to 50Ω, 9999	0.001Ω	0 to 50Ω, 9999	0.001Ω	0 to ****, 9999	1	
91	Motor constant (R2)	0 to 50Ω, 9999	0.001Ω	0 to 50Ω, 9999	0.001Ω	0 to ****, 9999	1	
92	Motor constant (L1)	0 to 1000mH, 9999	0.1mH	0 to 50Ω, 9999	0.001Ω	0 to ****, 9999	1	
93	Motor constant (L2)	0 to 1000mH, 9999	0.1mH	0 to 50Ω, 9999	0.001Ω	0 to ****, 9999	1	
94	Motor constant (X)	0 to 100%, 9999	0.1%	0 to 500Ω, 9999	0.01Ω	0 to ****, 9999	1	
859	Torque current	0 to 500A, 9999	0.01A	0 to 500A, 9999	0.01A	0 to ****, 9999	1	

- *1 When Pr. 71 = "0, 1, 40 or 50", or setting value of Pr. 96 read after performing offline auto tuning is not "3, 13, 23".
- *2 When Pr. 71 = "5, 6, 15, or 16"
- *3 When Pr. 7I = "3, 13, 23, 43 or 53" and setting value of Pr. 96 read after performing offline auto tuning is "3, 13, 23". Or when Pr. 7I = "4, 14, 24, 44 or 54".



POINT

- This function is valid only when a value other than "9999" is set in *Pr. 80 and Pr. 81* and Advanced magnetic flux vector control or General-purpose magnetic flux vector control is selected.
- Even when motors (other manufacturer's motor, SF-JRC, etc.) other than Mitsubishi standard motor (SF-JR 0.2kW or more), high efficiency motor (SF-HR 0.2kW or more), and Mitsubishi constant-torque motor (SF-JRCA four-pole, SF-HRCA 0.2kW to 15kW) are used or the wiring length is long (30m or more as a reference), using the offline auto tuning function runs the motor with the optimum operating characteristics.
- Tuning is enabled even when a load is connected to the motor.
 As the motor may run slightly, fix the motor securely with a mechanical brake or make sure that there will be no problem in safety if the motor runs (caution is required especially in elevator). Note that tuning performance is unaffected even if the motor runs slightly.
- Reading/writing/copy of motor constants tuned by offline auto tuning are enabled.
- The offline auto tuning status can be monitored with the operation panel and PU (FR-PU04/FR-PU07).
- Do not connect a surge voltage suppression filter (FR-ASF-H/FR-BMF-H) between the inverter and motor.

(1) Before performing offline auto tuning

Check the following before performing offline auto tuning.

- Make sure Advanced magnetic flux vector control or General-purpose magnetic flux vector control (*Pr.* 80, *Pr.* 81) is selected. (Tuning can be performed even under V/F control selected by turning ON X18.)
- · A motor should be connected. Note that the motor should be at a stop at a tuning start.
- The motor capacity should be equal to or one rank lower than the inverter capacity. (note that the capacity should be 0.1kW or more)
- A high-slip motor, high-speed motor and special motor cannot be tuned. (The maximum frequency is 120Hz.)
- As the motor may run slightly, fix the motor securely with a mechanical brake or make sure that there will be no problem
 in safety if the motor runs (caution is required especially in elevator). Note that tuning performance is unaffected even if
 the motor runs slightly.
- Offline auto tuning will not be performed properly if it is performed with a surge voltage suppression filter (FR-ASF-H/FR-BMF-H) connected between the inverter and motor. Remove it before starting tuning.

(2) Setting

- 1) Select Advanced magnetic flux vector control (*Refer to page 114*) or General-purpose magnetic flux vector control (*Refer to page 117*).
- 2) Set "1" or "11" in Pr. 96 Auto tuning setting/status.
 - When the setting is "1" Tune all motor constants without running the motor.

When performing Advanced magnetic flux vector control, set "1" to perform tuning.

It takes approximately 25 to 75s* until tuning is completed.

(Excitation noise is produced during tuning.)

*Tuning time differs according to the inverter capacity and motor type.

• When the setting is "11"...... Tune motor constants (R1) only without running the motor.

When performing General-purpose magnetic flux vector control, set "11" to perform tuning.

It takes approximately 9s until tuning is completed.

- 3) Set the rated motor current (initial value is rated inverter current) in Pr. 9 Electronic thermal O/L relay. (Refer to page 142)
- 4) Set the rated voltage of motor (initial value is 200V/400V) in *Pr. 83 Rated motor voltage* and rated motor frequency (initial value is 60Hz) in *Pr. 84 Rated motor frequency*.

(For a Japanese standard motor, etc. which has both 50Hz and 60Hz rated values, use it with an initial value (200V/60Hz or 400V/60Hz).

5) Set Pr. 71 Applied motor according to the motor used.

Motor	Pr. 71 Setting *1	
	SF-JR	3
Mitsubishi standard motor	SF-JR 4P 1.5kW or less	23
Mitsubishi high efficiency motor	SF-HR	43
	Others	3
	SF-JRCA 4P	13
Mitsubishi constant-torque motor	SF-HRCA	53
	Others (SF-JRC, etc.)	13
Other manufacturer's standard motor		3
Other manufacturer's constant-torque motor	_	13

^{*1} Refer to page 144, for other settings of Pr. 71.

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(3) Execution of tuning



POINT

Before performing tuning, check the monitor display of the operation panel if the inverter is in the status for tuning. (Refer to 2) below.) When the start command is turned ON under V/F control, the motor starts.

1) In the PU operation mode, press (RUN) on the operation panel. In the Network operation mode, turn ON the start command via CC-Link communication. Tuning will start.



NOTE

- To end the tuning forcibly, input the MRS signal, command the inverter reset via CC-Link communication, or press
 - (STOP) on the operation panel. (Turning the start signal (STF signal or STR signal) OFF also ends tuning.)
- During offline auto tuning, only the following I/O signals are valid: (initial value)
- Input signal MRS, STF, STR
- Output signal RUN, ALM
- Since the RUN signal turns ON when tuning is started, caution is required especially when a sequence which releases a mechanical brake by the RUN signal has been designed.
- When executing offline auto tuning, input the run command after switching on the main circuit power (R/L1, S/L2, T/L3) of the inverter.
- Do not perform ON/OFF switching of the second function selection signal (RT) during execution of offline auto tuning. Auto tuning is not executed properly.
- 2) Monitor is displayed on the operation panel during tuning as below.

	Operation Panel Indication				
Pr. 96 setting	1	11			
(1) Setting	PU MON	PU MON			
(2)Tuning in progress	2 RUN MON PL	12 RUN MON			
(3)Normal end	Flickering	Flickering			
(4)Error end (when inverter protective function operation is activated)	3	RUN MON			

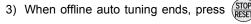


> REMARKS

Reference: Offline auto tuning time (when the initial value is set)

Offline Auto Tuning Setting	Time
Tune all motor constants (Pr. 96 = "1")	Approximately 25 to 75s
	(Tuning time differs according to the inverter capacity and motor type.)
Tune motor constants (R1) only (Pr. 96 = "11")	Approximately 9s

The set frequency monitor displayed during the offline auto tuning is 0Hz.



3) When offline auto tuning ends, press (STOP) on the operation panel during PU operation. In the Network operation mode, turn OFF the start command via CC-Link communication.

This operation resets the offline auto tuning and returns the operation panel monitor display to the normal display. (Without this operation, next operation cannot be started.)



REMARKS

- Do not change the Pr. 96 setting after completion of tuning (3 or 13). If the Pr. 96 setting is changed, tuning data is invalid.
 - If the Pr. 96 setting is changed, tuning must be performed again.

Perform an inverter reset and restart tuning.

4) If offline auto tuning ended in error (see the table below), motor constants are not set.

Error	Error Cause	Remedy
Display	Error Gause	Remedy
8	Forced end	Set "1" or "11" in Pr. 96 and perform tuning again.
9	Inverter protective function operation	Make setting again.
91	Current limit (stall prevention) function was activated.	Set "1" in Pr. 156.
92	Converter output voltage reached 75% of rated value.	Check for fluctuation of power supply voltage.
93	Calculation error	Check the motor wiring and make setting again.
93	A motor is not connected.	Set the rated current of the motor in Pr. 9.

- 5) 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 restart tuning.
- 6) After the tuning completes, set Pr. 9 Electronic thermal O/L relay again for the motor with the rated power supply of 200/ 220V(400/440V) 60Hz. Set the rated motor current multiplied by 1.1 in Pr. 9.



- The motor constants measured once in the offline auto tuning are stored as parameters and their data are held until the offline auto tuning is performed again.
- An instantaneous power failure occurring during tuning will result in a tuning error. After power is restored, the inverter goes into the normal operation mode. Therefore, when STF (STR) signal is ON, the motor runs in the forward (reverse) rotation.
- Any alarm occurring during tuning is handled as in the ordinary mode. Note that if a fault retry has been set, retry is

CAUTION

As the motor may run slightly during offline auto tuning, fix the motor securely with a mechanical brake or make sure that there will be no problem in safety if the motor runs. Note that if the motor runs slightly, tuning performance is unaffected.



(4) Utilizing or changing offline auto tuning data for use

The data measured in the offline auto tuning can be read and utilized or changed.

<Operating procedure>

1) Set Pr. 71 according to the motor used.

Motor	Motor			
	SF-JR	4		
Mitsubishi standard motor	SF-JR 4P 1.5kW or less	24		
Mitsubishi high efficiency motor	SF-HR	44		
	Others	4		
	SF-JRCA 4P	14		
Mitsubishi constant-torque motor	SF-HRCA	54		
	Others (SF-JRC, etc.)	14		
Other manufacturer's		4		
standard motor	-	4		
Other manufacturer's		14		
constant-torque motor	-	14		

^{*1} For other settings of Pr.71, refer to page 144.

2) In the parameter setting mode, read the following parameters and set desired values.

Parameter Number	Name	Setting Range	Setting Increments	Initial Value
82	Motor excitation current	0 to ****, 9999	1	9999
90	Motor constant (R1)	0 to ****, 9999	1	9999
91	Motor constant (R2)	0 to ****, 9999	1	9999
92	Motor constant (L1)	0 to ****, 9999	1	9999
93	Motor constant (L2)	0 to ****, 9999	1	9999
94	Motor constant (X)	0 to ****, 9999	1	9999
859	Torque current	0 to ****, 9999	1	9999



(I) REMARKS

- When "9999" is set in Pr. 82, Pr. 90 to Pr. 94, Pr. 859, Mitsubishi motor (SF-JR, SF-HR, SF-JRCA, SF-HRCA) constants are used.
- · 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 Pr. 90 value (5%)

When Pr. 90 is displayed as "2516",

set 2642, i.e. 2516 x 1.05=2641.8, in Pr. 90.

(The value displayed has been converted into a value for internal use. Hence, simple addition of a given value to the displayed value has no significance.)

$\overline{\gamma}$

(5) Method to set the motor constants without using the offline auto tuning data

The Pr. 90 to Pr. 94 motor constants may either be entered in $[\Omega]$ or in [mH]. Before starting operation, confirm which motor constant unit is used.

ullet To enter the Pr.~90 to Pr.~94 motor constants in $[\Omega]$

<Operating procedure>

1)Set Pr. 71 according to the motor used.

		Star Connection Motor	Delta Connection Motor
Setting	Standard motor	5	6
Octung	Constant-torque motor	15	16

2)In the parameter setting mode, read the following parameters and set desired values.

Ig =torque current, I100 =rated current, I0 =no load current

$$Iq = \sqrt{1100^2 - 10^2}$$

Parameter Number	Name	Setting Range	Setting Increments	Initial Value
82	Motor excitation current (no load current)	0 to 500A, 9999	0.01A	9999
90	Motor constant (r1)	0 to 50Ω, 9999	0.001Ω	9999
91	Motor constant (r2)	0 to 50Ω, 9999	0.001Ω	9999
92	Motor constant (x1)	0 to 50Ω, 9999	0.001Ω	9999
93	Motor constant (x2)	0 to 50Ω, 9999	0.001Ω	9999
94	Motor constant (xm)	0 to 500Ω, 9999	0.01Ω	9999
859	Torque current	0 to 500A, 9999	0.01A	9999

3)Refer to the following table and set Pr. 83 and Pr. 84.

Parameter Number	Name	Setting Range	Setting Increments	Initial	Value
83	Rated motor voltage	0 to 1000V	0.1V	200V class	200V
03	Nated motor voltage	0 10 1000 0	0.10	400V class	400V
84	Rated motor frequency	10 to 120Hz	0.01Hz	60	Hz



> REMARKS

• When "9999" is set in Pr. 82, Pr. 90 to Pr. 94, Pr. 859, Mitsubishi motor (SF-JR, SF-HR, SF-JRCA, SF-HRCA) constants are used.



NOTE

• If "star connection" is mistaken for "delta connection" or vice versa during setting of *Pr. 71*, Advanced magnetic flux vector control and General-purpose magnetic flux vector control cannot be exercised properly.



●To enter the Pr. 90 to Pr. 94 motor constants in [mH]

<Operating procedure>

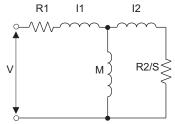
1) Set Pr. 71 according to the motor used.

Motor	Pr.71 Setting *1	
Mitsubishi standard motor	SF-JR	0
Mitsubishi high efficiency motor	SF-HR	40
Mitsubishi constant-torque motor	SF-JRCA 4P	1
Witsubishi constant-torque motor	SF-HRCA	50

^{*1} For other settings of Pr. 71, refer to page 144.

2) In the parameter setting mode, read the following parameters and set desired values. Calculate the *Pr. 94* value from the following formula.

$$Pr. 94 \text{ setting} = (1 - \frac{M^2}{L1 \times L2}) \times 100 \text{ (\%)}$$



R1: Primary resistance

R2: Secondary resistance

I1: Primary leakage inductance

I2: Secondary leakage inductanceM: Excitation inductance

S: Slip

L1 = I1 + M: Primary inductance L2 = I2 + M: Secondary inductance

Motor equivalent circuit diagram

Parameter Number	Name	Setting Range	Setting Increments	Initial Value
82	Motor excitation current (no load current)	0 to 500A, 9999	0.01A	9999
90	Motor constant (R1)	0 to 50Ω, 9999	0.001Ω	9999
91	Motor constant (R2)	0 to 50Ω, 9999	0.001Ω	9999
92	Motor constant (L1)	0 to 1000mH, 9999	0.1mH	9999
93	Motor constant (L2)	0 to 1000mH, 9999	0.1mH	9999
94	Motor constant (X)	0 to 100%, 9999	0.1%	9999
859	Torque current	0 to 500A, 9999	0.01A	9999

3) Refer to the following table and set Pr. 83 and Pr. 84.

	Parameter Number	Name	Setting Range	Setting Increments	Initial	Value
Ī	83	Rated motor voltage 0 to 1000V	0 to 1000V	0.1V	200V class	200V
	00		0 10 1000 V	0.17	400V class	400V
ı	84	Rated Motor Frequency	10 to 120Hz 0.01Hz		60	Hz

> REMARKS

• When "9999" is set in Pr. 82, Pr. 90 to Pr. 94, Pr. 859, Mitsubishi motor (SF-JR, SF-HR, SF-JRCA, SF-HRCA) constants are used.

Parameters referred to

Pr. 7 Acceleration time, Pr. 8 Deceleration time Refer to page 135

Pr. 9 Electronic thermal O/L relay Refer to page 142

Pr. 71 Applied motor Refer to page 144

Pr. 80 Motor capacity, Pr. 81 Number of motor poles Refer to page 112

Pr. 156 Stall prevention operation selection Refer to page 120

Pr. 180 to Pr. 184 (input terminal function selection) Refer to page 163

Pr. 190 to Pr. 192, Pr. 313 to Pr. 315 (output terminal function selection) Refer to page 167

Pr. 800 Control method selection Refer to page 112

5.12 Motor brake and stop operation

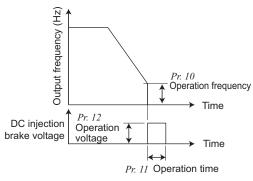
Purpose	Parameter that should be Set		
Motor braking torque adjustment	DC Injection brake	Pr. 10 to Pr. 12	154
Improve the motor braking torque with an option	Selection of a regenerative brake	Pr. 30, Pr. 70	155
Coast the motor to a stop	Selection of motor stopping method	Pr. 250	157
Used to stop the motor with a mechanical brake	Stop-on-contact control	Pr. 6, Pr. 48, Pr. 270,	158
(vibration restraint at stop-on-contact)	Stop-on-contact control	Pr. 275, Pr. 276	130
Used to stop the motor with a mechanical brake	Brake sequence function	Pr. 278 to Pr. 283,	160
(operation timing of a mechanical brake)	Brake sequence function	Pr. 292	100

5.12.1 DC injection brake (Pr. 10 to Pr. 12)

The DC injection brake can be operated at a motor stop to adjust the stop timing and braking torque. In DC injection brake operation, DC voltage is directly applied to the motor to prevent the motor shaft from rotating. The motor will not return to the original position if the motor shaft rotates due to external force.

Parameter Number	Name	Initial Value		Setting Range	Description
10	DC injection brake operation frequency	3Hz		0 to 120Hz	Operation frequency of the DC injection brake.
11	DC injection brake operation time	0.5s		0 0.1 to 10s	DC injection brake disabled Operation time of the DC injection brake.
12	DC injection brake operation voltage	0.1K, 0.2K 0.4K to 7.5K 11K, 15K	6% 4% 2%	0 to 30%	DC injection brake voltage (torque). When "0" is set, DC injection brake is disabled.

The above parameters can be set when Pr. 160 User group read selection ="0". (Refer to page 197)



(1) Operation frequency setting (Pr. 10)

•When the frequency at which the DC injection brake will be operated is set to *Pr. 10*, the DC voltage is applied to the motor upon reaching to the set frequency during deceleration.

(2) Operation time setting (Pr. 11)

- •In Pr. 11, set the time of the DC injection brake.
- •When the motor does not stop due to large load moment (J), increasing the setting produces an effect.
- •When *Pr. 11* = "0s", the DC injection brake is disabled. (At a stop, the motor coasts.)

(3) Operation voltage (torque) setting (Pr. 12)

- Use Pr. 12 to set the percentage to the power supply voltage.
- When Pr. 12 = "0%", the DC injection brake is disabled. (At a stop, the motor coasts.)
- When using the constant-torque motor (SF-JRCA) and energy saving motor (SF-HR, SF-HRCA), change the *Pr. 12* setting as follows:

Motor	Pr.12 DC injection brake operation voltage Setting			
SF-JRCA	3.7K or lower	4%		
SI -SINOA	5.5K or higher	2%		
	3.7K or lower	4%		
SF-HR, SF-HRCA	5.5K, 7.5K	3%		
	11K, 15K	2%		

> REMARKS

- For the 5.5K, 7.5K, when the *Pr. 12* setting is the following, changing the *Pr. 71 Applied motor* setting automatically changes the *Pr. 12* setting. Therefore, it is not necessary to change the *Pr. 12* setting.
 - (a) When 4% (initial value) is set in Pr. 12

The *Pr. 12* setting is automatically changed to 2% if the *Pr. 71* value is changed from the value selecting the standard motor (0, 3 to 6, 23, 24, 40, 43, 44) to the value selecting the constant-torque motor (1, 13 to 16, 50, 53, 54).

(b) When 2% is set in Pr. 12

The *Pr. 12* setting is automatically changed to 4% (initial value) if the *Pr. 71* value is changed from the value selecting the constant-torque motor (1, 13 to 16, 50, 53, 54) to the value selecting the standard motor (0, 3 to 6, 23, 24, 40, 43, 44).

• Even if the *Pr. 12* setting is increased, braking torque is limited so that the output current is within the rated inverter current.





As stop holding torque is not produced, install a mechanical brake.



Parameters referred to

Pr. 13 Starting frequency Refer to page 138 Pr. 71 Applied motor Refer to page 144

5.12.2 Selection of a regenerative brake (Pr. 30, Pr. 70)

 When making frequent starts/stops, use the optional brake resistor (MRS type, MYS type), high-duty brake resistor (FR-ABR) and brake unit (FR-BU2) to increase the regenerative brake duty.

Parameter	Name	Initial	Setting	Description	
Number	Name	Value	Range	Description	
				Inverter without regenerative function	
	Regenerative function selection	0	0	Brake resistor (MRS type, MYS type)	
30				Brake unit (FR-BU2)	
30			1	Brake resistor (MYS type) used at 100% torque / 6%ED	
				High-duty brake resistor (FR-ABR)	
			2	For manufacturer setting. Do not set.	
	Special regenerative			Brake duty (6%) when using the brake resistor (MYS type),	
70	•	0%	0 to 30%	Brake duty when using the high-duty brake resistor	
	brake duty			(FR-ABR)(10%)	

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)

(1) When using the brake resistor (MRS type, MYS type), brake unit (FR-BU2).

•Set Pr. 30 to "0" (initial value). The Pr. 70 setting is made invalid.

At this time, the regenerative brake duty is as follows.

Model	Regenerative Brake Duty
FR-E720-0.4KNC to 3.7KNC	3%
FR-E720S-0.4KNC or higher	376
FR-E720-5.5KNC or higher	2%
FR-E740-0.4KNC or higher	270

(2) When using the brake resistor (MYS type) at 100% torque / 6%ED (FR-E720-3.7KNC only)

- •Set "1" in Pr. 30.
- •Set "6%" in Pr. 70.

(3) When using the high-duty brake resistor (FR-ABR) (0.4K or higher)

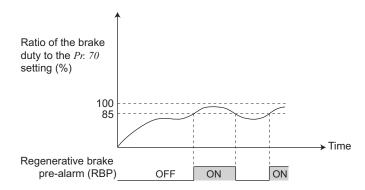
- •Set "1" in Pr. 30.
- •Set Pr. 70 as follows.

7.5K or lower.....10% 11K, 15K.....6%

7/

(4) Regenerative brake duty alarm output and alarm signal (RBP signal)

100%: regenerative overvoltage protection operation value



- •[RB] appears on the operation panel and an alarm signal (RBP) is output when 85% of the regenerative brake duty set in *Pr.* 70 is reached. If the regenerative brake duty reaches 100% of the *Pr.* 70 setting, a regenerative overvoltage (E.OV1 to E.OV3) occurs. Note that [RB] is not displayed when *Pr.* 30 = "0".
- •The inverter does not trip even when the alarm (RBP) signal is output.
- •To assign the RBP signal to the terminal Y0 or a virtual terminal of CC-Link communication, set "7 (positive logic) or 107 (negative logic)" in one of *Pr. 190 to Pr. 192* and *Pr. 313 to Pr. 315 (output terminal function selection)*.



▶ REMARKS

 Refer to page 26 to 29 for connecting the brake resistor (MRS type, MYS type), high-duty brake resistor (FR-ABR), brake unit (FR-BU2).



NOTE

Changing the assignment of the terminal Y0 or a virtual terminal of CC-Link communication with one of *Pr. 190 to Pr. 192*, and *Pr. 313 to Pr. 315 (output terminal function selection)* may affect other functions. Set parameters after confirming the function of the terminal Y0 and virtual terminals.



The value set in *Pr. 70* must not exceed the setting of the brake resistor used. Otherwise, the resistor can overheat.



Parameters referred to

Pr. 57 Restart coasting time 👺 Refer to page 180 Pr. 190 to Pr. 192, Pr. 313 to Pr. 315 (output terminal function selection) 🕦 Refer to page 167

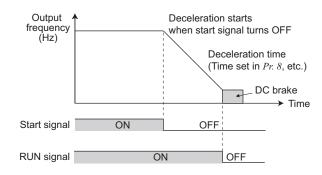


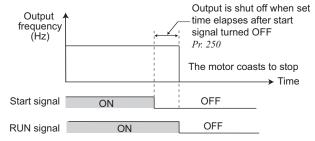
5.12.3 Stop selection (Pr. 250)

Used to select the stopping method (deceleration to a stop or coasting) when the start signal turns OFF. Used to stop the motor with a mechanical brake, etc. together with switching OFF of the start signal.

Parameter	Name	Initial	Sotting Dange	Description	
Number	Name	Value	Setting Range	Stop operation	
			0 to 100s	The motor is coasted to a stop when the preset time elapses	
		9999	0 10 1005	after the start signal is turned OFF.	
250	Stop selection		9999	When the start signal is turned OFF, the motor decelerates	
			9999	to stop.	
			1000s to 1100s, 8888	For manufacturer setting. Do not set.	

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)





(1) Decelerate the motor to a stop

- •Set Pr. 250 to "9999" (initial value) or "8888".
- •The motor decelerates to a stop when the start signal (STF/STR) turns OFF.

(2) Coast the motor to a stop

- •Use *Pr. 250* to set the time from when the start signal turns OFF until the output is shut off. When any of "1000 to 1100" is set, the output is shut off in (*Pr. 250* 1000)s.
- •The output is shut off when the time set in *Pr. 250* has elapsed after the start signal had turned OFF. The motor coasts to a stop.
- •The RUN signal turns OFF when the output stops.

REMARKS

- · Stop selection is invalid when the following functions are activated.
 - Power failure stop function (Pr. 261)
 - PU stop (Pr. 75)
 - Deceleration stop because of communication error (Pr. 502)
- When setting of *Pr. 250* is not 9999, acceleration/deceleration is performed according to the frequency command, until start signal is OFF and output is shutoff.



NOTE

•When the start signal is turned ON again during motor coasting, the motor starts at Pr. 13 Starting frequency.



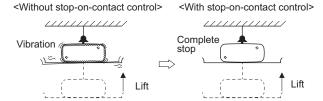
Parameters referred to

Pr. 7 Acceleration time, Pr. 8 Deceleration time Refer to page 135 Pr. 13 Starting frequency Refer to page 138

5.12.4 Stop-on contact control function (Pr. 6, Pr. 48, Pr. 270, Pr. 275, Pr. 276)

AD MFVC GP MFVC

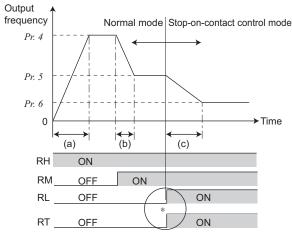
To ensure accurate positioning at the upper limit etc. of a lift, stop-on-contact control causes a mechanical brake to be closed while the motor is developing a holding torque to keep the load in contact with a mechanical stopper etc. This function suppresses vibration which is liable to occur when the load is stopped upon contact in vertical motion applications, ensuring steady precise positioning.



Parameter	er Name		Setting	Description
Number	Name	Value	Range	Description
6	Multi-speed setting (low speed)	10Hz	0 to 400Hz	Sets the output frequency for stop-on-contact control.
48 *1	Second stall prevention operation current	9999	0 to 200%	Sets the stall prevention operation level for stall prevention operation level.
	Operation current		9999	Pr. 22 setting
270 *1	Stop-on contact control		0	Normal operation
210 *1	selection	0	1	Stop-on-contact control
275 *1, *2	Stop-on contact excitation current low-speed multiplying		0 to 300%	Set the force (holding torque) for stop-on-contact control. Normally set 130% to 180%.
	factor		9999	Without compensation
276 *1	PWM carrier frequency at stop-	9999	0 to 9	Sets a PWM carrier frequency for stop-on-contact control.
210 *1	on contact		9999	As set in Pr. 72 PWM frequency selection.

- *1 This parameter can be set when Pr. 160 User group read selection = "0". (Refer to page 197)
- *2 This parameter allows its setting to be changed during operation even if "0" (initial value) is set in Pr. 77 Parameter write selection.

(1) Operation example



- * Goes into stop-on-contact control when both RL and RT switch ON. RL and RT may be switched on in any order with any time difference.
 - (a) Acceleration time (Pr. 7) (b) Deceleration time (Pr. 8)
 - (c) Second deceleration time (Pr. 44/Pr. 45)

(2) Set stop-on-contact control

- Make sure that the inverter is in Network operation mode. (Refer to page 103)
- Select Advanced magnetic flux vector control or General-purpose magnetic flux vector control.
- Set "1" in Pr. 270 Stop-on contact control selection.
- Set output frequency during stop-on-contact control in *Pr.* 6 *Multi-speed setting (low speed)*. The frequency should be as low as possible (about 2Hz). If it is set to more than 30Hz, the operating frequency will be 30Hz.
- When both the RT and RL signals are switched ON, the inverter starts the stop-on-contact control, in which operation is performed at the frequency set in *Pr.* 6 independently of the preceding speed.
- To input the RT signal to a virtual terminal of CC-Link communication, set "3" in one of *Pr. 180 to Pr. 184 (input terminal function selection)*. To input the RL signal to a virtual terminal of CC-Link communication, set "0" in one of *Pr. 180 to Pr. 184 (input terminal function selection)*.



NOTE

- By increasing the Pr. 275 setting, the low-speed (stop-on-contact) torque increases, but overcurrent fault (E.OCT) may
 occur or the machine may oscillate in a stop-on-contact state.
- The stop-on-contact function is different from servo-lock function, and if used to stop or hold a load for an extended period, this function can cause the motor to overheat.
 After a stop, immediately change to a mechanical brake to hold the load.
- Under the following operating conditions, the stop-on-contact function is invalid:
 PU operation (Pr. 79), Jog operation, PID control function operation (Pr. 128), remote setting function operation (Pr. 59), automatic acceleration/deceleration operation (Pr. 292)



(3) Function switching of stop-on-contact control selection

Main Functions	Normal Operation	With stop-on-contact Control
Maili Fullctions	(either RL or RT is OFF or both are OFF)	(both RL and RT are ON)
Output frequency	Multi-speed operation setting, set frequency, etc. (Refer to page 60.)	Pr. 6 setting
Stall prevention operation	Pr. 22 setting	Pr. 48 setting
level	rr. 22 Setting	(Pr. 22 when Pr. 48 = "9999")
Excitation current low		Only Pr. 275 (0 to 300%) is compensated
speed scaling factor	_	from normal operation
Carrier frequency	Pr. 72 setting	Pr. 276 setting when output frequency is 3Hz or less (Pr. 72 when Pr. 276 = "9999")
Fast-response current	Valid	Invalid
limit	vand	iiivalid

(4) Set frequency when stop-on-contact control (Pr. 270 = 1) is selected

- The following table lists the frequencies set when the input terminals (RH, RM, RL, RT) are selected together. Bold frame indicates stop-on-contact control is valid.
- Stop-on-contact control is invalid when remote setting function is selected (Pr. 59 = 1 to 3).

Input Signal (○ = ON)		ON)	Cot Fraguency		
RH	RM	RL	RT	Set Frequency	
0				Pr. 4 Multi-speed setting (high speed)	
	0			Pr. 5 Multi-speed setting (middle speed)	
		0		Pr. 6 Multi-speed setting (low speed)	
			0	Set frequency. (Refer to page 60.)	
0	0			Pr. 26 Multi-speed setting (speed 6)	
0		0		Pr. 25Multi-speed setting (speed 5)	
0			0	Pr. 4 Multi-speed setting (high speed)	
	0	0		Pr. 24 Multi-speed setting (speed 4)	
	0		0	Pr. 5 Multi-speed setting (middle speed)	
		0	0	Pr. 6 Multi-speed setting (low speed)	
	0	0	0	Pr. 6 Multi-speed setting (low speed)	
0		0	0	Pr. 6 Multi-speed setting (low speed)	
0	0		0	Pr. 26 Multi-speed setting (speed 6)	
0	0	0		Pr. 27 Multi-speed setting (speed 7)	
0	0	0	0	Pr. 6 Multi-speed setting (low speed)	
				Set frequency. (Refer to page 60.)	



NOTE

• Changing the assignment of a virtual terminal of CC-Link communication with *Pr. 180 to Pr. 184 (input terminal function selection)* may affect other functions. Set parameters after confirming the function of each virtual terminal.



Parameters referred to

Pr. 4 to Pr. 6, Pr. 24 to Pr. 27 (multi-speed setting) Refer to page 130

Pr. 15 Jog frequency Refer to page 201

Pr. 48 Second stall prevention operation current TF Refer to page 120

Pr. 59 Remote function selection Refer to page 132

Pr. 72PWM frequency selection Refer to page 192

Pr. 79 Operation mode selection Refer to page 103

Pr. 128 PID action selection Refer to page 203

Pr. 180 to Pr. 184 (input terminal function selection) Refer to page 163

Pr. 292 Automatic acceleration/deceleration Refer to page 140

5.12.5 Brake sequence function (Pr. 278 to Pr. 283, Pr. 292) AD MEVC GP MEVC

This function is used to output from the inverter the mechanical brake operation timing signal in vertical lift and other applications.

This function prevents the load from dropping with gravity at a start due to the operation timing error of the mechanical brake or an overcurrent alarm from occurring at a stop, ensuring secure operation.

Parameter Number	Name	Initial Value	Setting	Description
Number	Duratus aurantus u	value	Range	
278	Brake opening	3Hz	0 to 30Hz	Set to the rated slip frequency of the motor + about 1.0Hz.
	frequency		- 10 0011	This parameter may be set only if $Pr. 278 \le Pr. 282$.
				Generally, set this parameter to about 50 to 90%. If the setting
279	Brake opening current	130%	0 to 200%	is too low, the load is liable to drop due to gravity at start.
				Suppose that the rated inverter current is 100%.
000	Brake opening current			
280	detection time	0.3s	0 to 2s	Generally, set this parameter to about 0.1 to 0.3s.
				When $Pr. 292$ = "7", set the mechanical delay time until the
	Brake operation time at		0 to 5s	brake is loosened.
281	start	0.3s		Set the mechanical delay time until the brake is loosened +
				about 0.1 to 0.2s when Pr. 292 = "8".
				Set the frequency to activate the mechanical brake by turning
	Brake operation	6Hz	0 to 30Hz	OFF the brake opening request signal (BOF). Generally, set
282	frequency			this parameter to the <i>Pr. 278</i> setting + 3 to 4Hz.
				This parameter may be set only if $Pr. 278 \le Pr. 282$.
				Set the mechanical delay time until the brake is closed + 0.1s
	Brake operation time at		a	when Pr. 292 = 7.
283	stop	0.3s	0 to 5s	Sets the mechanical delay time until the brake is closed + 0.2
				to 0.3s when <i>Pr. 292</i> = 8.
			0	Normal operation mode
	Automatic acceleration/ deceleration	0	1, 11	Shortest acceleration/deceleration mode (Refer to page 140)
292			7	Brake sequence mode 1
			8	Brake sequence mode 2

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)

(1) Set the brake sequence mode

- Select Advanced magnetic flux vector control or General-purpose magnetic flux vector control. The brake sequence function is valid only when the Network operation mode is selected.
- Set "7 or 8" (brake sequence mode) in Pr. 292.
 - To ensure more complete sequence control, it is recommended to set "7" (brake opening completion signal input) in Pr. 292.
- Set "15" in any of *Pr. 180 to Pr. 184 (input terminal function selection)* and assign the brake opening completion signal (BRI) to a virtual terminal of CC-Link communication.
- To assign the brake opening request (BOF signal) to the terminal Y0 or a virtual terminal of CC-Link communication, set "20 (positive logic) or 120 (negative logic)" in one of *Pr. 190 to Pr. 192* and *Pr. 313 to Pr. 315 (output terminal function selection)*.



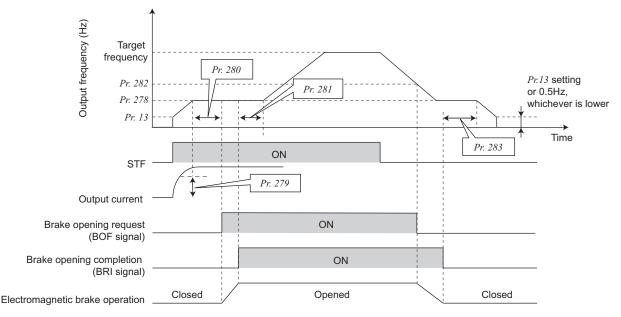
NOTE

- When brake sequence function is selected, automatic restart after instantaneous power failure is invalid.
- When using this function, set the acceleration time to 1s or longer.
- Changing the assignment of the terminal Y0 or a virtual terminal of CC-Link communication with one of *Pr. 180 to Pr. 184*, *Pr. 190 to Pr. 192*, and *Pr. 313 to Pr. 315* may affect other functions. Set parameters after confirming the function of the terminal Y0 and virtual terminals.



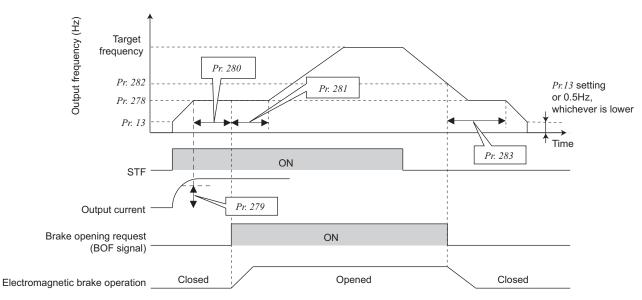
(2) With brake opening completion signal input (Pr. 292 = "7")

- When the start signal is input to the inverter, the inverter starts running. When the internal speed command reaches the value set in *Pr. 278* and the output current is not less than the value set in *Pr. 279*, the inverter outputs the brake opening request signal (BOF) after the time set in *Pr. 280* has elapsed.
 - When the time set in *Pr. 281* elapses after the brake opening completion signal (BRI) was activated, the inverter increases the output frequency to the set speed.
- When the inverter decelerates to the frequency set in *Pr.282* during deceleration, the inverter turns OFF the BOF signal and decelerates further to the frequency set in *Pr.278*. After electromagnetic brake operation completes and inverter recognizes the turn OFF of BRI signal, the inverter holds the frequency set in *Pr.278* for the time set in *Pr.283*. And after the time set in *Pr.283* passes, the inverter decelerates again. The inverter finally stops when its frequency reaches to *Pr.13 Starting frequency* setting or 0.5Hz, whichever is lower.



(3) Without brake opening completion signal input (Pr.292 = "8")

- When the start signal is input to the inverter, the inverter starts running. When the internal speed command reaches the value set in *Pr. 278* and the output current is not less than the value set in *Pr. 279*, the inverter outputs the brake opening request signal (BOF) after the time set in *Pr. 280* has elapsed.
 - When the time set in Pr. 281 elapses after the BOF signal is output, the inverter increases the output frequency to the set speed.
- When the inverter decelerates to the frequency set in *Pr.282* during deceleration, the inverter turns OFF the BOF signal and decelerates further to the frequency set in *Pr.278*. After the turn OFF of BOF signal, the inverter holds the frequency set in *Pr.278* for the time set in *Pr.283*. And after the time set in *Pr.283* passes, the inverter decelerates again. The inverter finally stops when its frequency reaches to *Pr.13 Starting frequency* setting or 0.5Hz, whichever is lower.







> REMARKS

• If brake sequence function has been selected, inputting the RT signal (second function selection) during an inverter stop will make brake sequence function invalid and give priority to the second function selection. Note that RT signal input is invalid even if RT signal is input during operation with brake sequence function.

(4) Protective functions

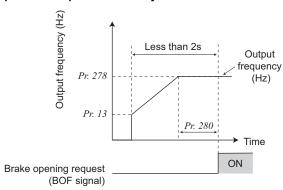
If any of the following occurs during the brake sequence operation, the inverter results in a fault, trips, and turns OFF the brake opening request signal (BOF).

Fault Display	Description
E.MB4	Although more than 2s have elapsed after the start command (forward or reverse rotation) is input, the brake opening request signal (BOF) does not turn ON.
E.MB5	Although more than 2s have elapsed after the brake opening request signal (BOF) turned on, the brake opening completion signal (BRI) does not turn ON.
E.MB6	Although the inverter had turned ON the brake opening request signal (BOF), the brake opening completion signal (BRI) turned OFF midway.
E.MB7	Although more than 2s have elapsed after the brake opening request signal (BOF) turned OFF at a stop, the brake opening completion signal (BRI) does not turn OFF.



NOTE

- During deceleration, inverter output is shut OFF when the frequency reaches *Pr.13 Starting frequency* or 0.5Hz, whichever is lower. For *Pr.278 Brake opening frequency*, set *Pr.13* or a frequency equal to or higher than 0.5Hz.
- Setting Pr. 278 Brake opening frequency too high activates stall prevention operation and may cause E.MB4.
- If the sum of the time between *Pr. 13 Starting frequency* and *Pr. 278 Brake opening frequency* + *Pr. 280 Brake opening current detection time* is more than 2s, E.MB4 occurs.





Parameters referred to

Pr. 13 Starting frequency Refer to page 138

Pr. 80 Motor capacity, Pr. 81 Number of motor poles Refer to page 112

Pr. 180 to Pr. 184 (input terminal function selection) Refer to page 163

Pr. 190 to Pr. 192, Pr. 313 to Pr. 315 (output terminal function selection) Refer to page 167

Pr. 800 Control method selection TF Refer to page 112



5.13 Function assignment of external terminals and CC-Link communication virtual terminals

Purpose	Parameter that sh	ould be Set	Refer to Page
To assign functions to the input virtual terminals of CC-Link communication	Input terminal function selection	Pr. 180 to Pr. 184	163
To set MRS signal (output shutoff) in NC contact specification	MRS input selection	Pr. 17	166
To assign functions to the terminal Y0 or output virtual terminals of CC-Link communication	Output terminal function assignment	Pr. 190 to Pr. 192, Pr. 313 to Pr. 315	167
To detect output frequency	Up-to-frequency sensitivity Output frequency detection	Pr. 41 to Pr. 43	171
To detect output current	Output current detection Zero current detection	Pr. 150 to Pr. 153	172
To use the remote output function	Remote output	Pr. 495, Pr. 496	174

5.13.1 Input terminal function selection (Pr. 180 to Pr. 184)

Use the parameters to select and change the functions assigned to input virtual terminals of CC-Link communication.

Parameter Number	Name	Initial Value	Initial Signal	Setting Range
180	RY4 function selection	0	RL (low-speed operation command)	
181	RY3 function selection	1	RM (middle speed operation command)	0.1. 5 7 0 40 40 444 40 40
182	182 RY2 function selection		RH (high-speed operation command)	0 to 5, 7, 8, 10, 12, 14 to 16, 18, 24, 25, 62, 65 to 67, 9999*
183	RY9 function selection	24	MRS (output stop)	
184	RYB function selection	62	Function invalid	

The above parameters can be set when *Pr. 160 User group read selection* = "0". (*Refer to page 197*)

^{*} The setting values "4, 5, 7, 10, 12, 16, 25, 62, and 65 to 67" are for manufacturer setting. Do not set.

(1) Input terminal function assignment

- •Using Pr. 180 to Pr. 184, set the functions of the input virtual terminals.
- •Refer to the following table and set the parameters:

Setting	Signal		Function	Related Parameters	Refer to Page		
0	DI	Pr. 59 = 0 (initial value)	Low-speed operation command	Pr. 4 to Pr. 6, Pr. 24 to Pr. 27 Pr.232 to Pr.239	130		
0	RL	Pr. 59 = 1, 2 *1	Remote setting (setting clear)	Pr. 59	132		
		Pr. 270 = 1 *2	Stop-on contact selection 0	Pr. 270, Pr. 275, Pr. 276	158		
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	130		
		Pr. 59 = 1, 2 *1	Remote setting (deceleration)	Pr. 59	132		
2	RH	<i>Pr.</i> 59 = 0 (initial value)	High-speed operation command	Pr. 4 to Pr. 6, Pr. 24 to Pr. 27, Pr. 232 to Pr. 239	130		
		Pr. 59 = 1, 2 *1	Remote setting (acceleration)	Pr. 59	132		
3	RT	Second function selection	n	Pr. 44 to Pr. 51	165		
3	KI	<i>Pr. 270</i> = 1 *2	Stop-on contact selection 1	Pr. 270, Pr. 275, Pr. 276	158		
4, 5, 7	For manuf	acturer setting. Do not set					
8	REX	15-speed selection (com	bination with three speeds RL, RM,	Pr. 4 to Pr. 6, Pr. 24 to Pr. 27, Pr. 232 to Pr. 239	130		
10, 12	For manuf	acturer setting. Do not set			1		
14	X14	PID control valid termina	ıl	Pr. 127 to Pr. 132, Pr. 134	203		
15	BRI	Brake opening completion	on signal	Pr. 278 to Pr. 283	160		
16	For manufacturer setting. Do not set.						
18	X18	V/F switchover (V/F conf	trol is performed when X18 is ON)	Pr. 80, Pr. 81, Pr. 800	112, 114, 117, 146		
24	MRS	Output stop		Pr. 17	166		
25, 62, 65 to 67	L For manufacturer setting. Do not set						
9999	_	No function	_	_	_		

^{*}I When Pr. 59 Remote function selection = "1" or "2", the functions of the RL, RM and RH signals are changed as given in the table.

^{*2} When Pr. 270 Stop-on contact control selection = "1", functions of RL and RT signals are changed as in the table.



NOTE

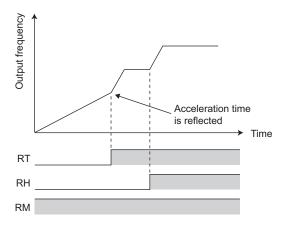
- Changing the assignment of a virtual terminal of CC-Link communication with *Pr. 180 to Pr. 184 (input terminal function selection)* may affect other functions. Set parameters after confirming the function of each virtual terminal.
- Same function can be assigned to two or more virtual terminals. In this case, the logic of virtual terminals input is OR.
- The priorities of the speed commands are in order of multi-speed setting (RH, RM, RL, REX) > PID (X14).
- Same virtual terminals are used to assign multi-speed (7 speeds) and remote setting. They cannot be set individually.
 (Same signal is used since multi-speed (7 speeds) setting and remote setting are not used to set speed at the same time.)
- Switch the control method using external terminal (X18 signal) during an inverter stop. If control method between V/F
 control and Advanced (General-purpose magnetic) flux vector control is switched during the operation, the actual
 switchover does not take place until the inverter stops. In addition, if control method is switched to V/F control during
 the operation, only second function becomes valid as V/F control and second function are selected simultaneously in
 V/F control.



(2) Second function selection signal (RT)

- · When the RT signal turns ON, the second function becomes valid.
- For the RT signal, set "3" in any of Pr. 180 to Pr. 184 (input terminal function selection) to assign the function.
- The second function has the following applications.
- (a) Switching between normal use and emergency use
- (b) Switching between heavy load and light load
- (c) Changing of acceleration/deceleration time by broken line acceleration/deceleration
- (d) Switching of characteristic between the main motor and sub motor

Second acceleration/deceleration time

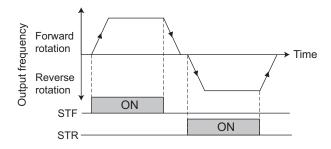


When the RT signal is ON, the following second functions are selected at the same time.

Function	First Function	Second Function	Refer to
Function	Parameter Number	Parameter Number	Page
Torque boost	Pr. 0	Pr. 46	113
Base frequency	equency Pr. 3		126
Acceleration time	Pr. 7 Pr. 44		135
Deceleration time	Pr. 8 Pr. 44, Pr. 45		135
Electronic thermal O/L relay	Pr. 9	Pr. 51	142
Stall prevention	on Pr. 22 Pr. 48		120
Applied motor	Pr. 71	Pr. 450	144

(3) Operation using start signals (STF and STR signals)

- The forward/reverse rotation signals (STF/STR) are used as start and stop signals. Turn ON either of the forward and reverse rotation signals to start the motor in the corresponding direction. Switch both OFF (or both ON) of the start signals during operation to decelerate the inverter to a stop.
- The frequency can be set with Pr. 4 to Pr. 6 Multi-speed setting (high, middle, low speeds), etc.



> REMARKS

• When Pr. 250 is set to any of "0 to 100", turning OFF the start command coasts the inverter to a stop. (Refer to page 157)



Parameters referred to

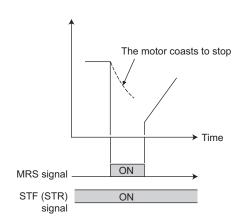
Pr.4 to Pr.6 Multi-speed setting Refer to page 130 Pr.250 Stop selection Refer to page 157

5.13.2 Inverter output shutoff signal (MRS signal, Pr. 17)

The inverter output can be shut off by the MRS signal. Also, logic for the MRS signal can be selected.

Parameter Number	Name	Initial Value	Setting Range	Description
			0, 4	Normally open input
17	MRS input selection	0	2	Normally closed input
			2	(NC contact input specifications)

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)



(1) Output shutoff signal (MRS signal)

- •Turning ON the output shutoff signal (MRS) during inverter running shuts off the output immediately.
- •MRS signal may be used as described below.
- (a) When mechanical brake (e.g. electromagnetic brake) is used to stop motor

The inverter output is shut off when the mechanical brake operates.

- (b) To provide interlock to disable operation by the inverter With the MRS signal ON, the inverter cannot be operated if the start signal is entered into the inverter.
- (c) Coast the motor to a stop.When the start signal is turned OFF,

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.

(2) MRS signal logic inversion (Pr. 17)

 When Pr. 17 is set to "2", the MRS signal (output stop) can be changed to the normally closed (NC contact) input specification. When the MRS signal turns ON (opens), the inverter shuts off the output.



> REMARKS

• The MRS signal is initially assigned to a virtual terminal of CC-Link communication. Set "24" in one of *Pr. 180 to Pr. 184 (input terminal function selection)* to assign the MRS signal to another virtual terminal.



NOTE

• Changing the assignment of a virtual terminal of CC-Link communication with *Pr. 180 to Pr. 184 (input terminal function selection)* may affect other functions. Set parameters after confirming the function of each virtual terminal



Parameters referred to

Pr. 180 to Pr. 184 (input terminal function selection) Refer to page 163



5.13.3 Output terminal function selection (Pr. 190 to Pr. 192, Pr. 313 to Pr. 315)

The function assigned to the terminal Y0 or an output virtual terminal of CC-Link communication can be changed.

Parameter Number	Name		Initial Value	Initial Signal	Setting Range
190 *1	RX2 (terminal Y0) Open collector output terminal		0	RUN (inverter running)	0, 1, 3, 4, 7, 8, 11 to 16, 20, 25,
191 *1	RX6 function selection		4	FU (output frequency detection)	26, 46, 47, 64, 68, 80, 81, 90, 91, 93*2, 95, 96*3, 98, 99, 100, 101, 103, 104, 107, 108, 111 to 116,
192 *1	RX7 function select	tion	99	ALM (fault output)	120, 125, 126, 146, 147, 164,
313	RX9 function selection		9999	No function	168, 180, 181, 190, 191, 193*2, 195, 196*3, 198, 199, 9999
314	RXA function selection		9999	No function	193, 190*3, 190, 199, 9999
315	RXB function selec	tion	9999	No function	

^{*1} The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)

(1) Output signal list

- •A function can be assigned to the terminal Y0 or an output virtual terminal of CC-Link communication.
- •Refer to the following table and set the parameters: (0 to 99: positive logic, 100 to 199: negative logic)

Setting					Deleted	Refer
Positive logic	Negative logic	Signal	Function	Operation	Related Parameter	to Page
0	100	RUN	Inverter running	Output during operation when the inverter output frequency rises to or above <i>Pr. 13 Starting frequency</i> .	_	169
1	101	SU	Up to frequency *	Output when the output frequency is reached to the set frequency.	Pr. 41	171
3	103	OL	Overload alarm	Output while stall prevention function is activated.	Pr. 22, Pr. 23, Pr. 66	120
4	104	FU	Output frequency detection	Output when the output frequency reaches the frequency set in <i>Pr. 42</i> (<i>Pr. 43</i> for reverse rotation).	Pr. 42, Pr. 43	171
7	107	RBP	Regenerative brake pre-alarm	Output when 85% of the regenerative brake duty set in Pr . 70 is reached.	Pr. 70	155
8	108	THP	Electronic thermal O/L relay pre-alarm	Output when the electronic thermal value reaches 85% of the trip level. (Electronic thermal relay function protection (E.THT/E.THM) activates, when the value reached 100%.)	Pr. 9, Pr. 51	142
11	111	RY	Inverter operation ready	Output when reset process is completed (when the inverter can be started by switching the start signal ON or while it is running) after powering on inverter.	_	169
12	112	Y12	Output current detection	Output when the output current is higher than the $Pr. 150$ setting for longer than the time set in $Pr. 151$.	Pr. 150, Pr. 151	172
13	113	Y13	Zero current detection	Output when the output power is lower than the $Pr. 152$ setting for longer than the time set in $Pr. 153$.	Pr. 152, Pr. 153	172
14	114	FDN	PID lower limit	Output when the feedback value falls below the lower limit of PID control.		
15	115	FUP	PID upper limit	Output when the feedback value rises above the upper limit of PID control	Pr. 127 to Pr. 134	203
16	116	RL	PID forward/reverse rotation output	Output when forward rotation is performed in PID control.		
20	120	BOF	Brake opening request	Output to open the brake when the brake sequence function is selected.	Pr. 278 to Pr. 283, Pr. 292	160
25	125	FAN	Fan fault output	Output at the time of a fan fault.	Pr. 244	213
26	126	FIN	Heatsink overheat pre-alarm	Output when the heatsink temperature reaches about 85% of the heatsink overheat protection providing temperature.	_	239
46	146	Y46	During deceleration at occurrence of power failure	Output when the power failure-time deceleration function is executed. (retained until release)	Pr. 261	186
47	147	PID	During PID control activated	Output during PID control.	Pr. 127 to Pr. 134	203

^{*2} The setting values "93" and "193" are not available for Pr. 192.

^{*3} The setting values "96" and "196" are only available for Pr. 190. When these values are set in Pr. 191, Pr. 192, and Pr. 313 to Pr. 315, their functions are invalid.

Function assignment of external terminals and CC-Link communication virtual terminals

Setting					Related	Refer
Positive logic	Negative logic	Signal	Function	Function Operation		to Page
64	164	Y64	During retry	Output during retry processing.	Pr. 65 to Pr. 69	188
68	168	EV	24V external power supply operation	The signal is output while the main circuit power supply is off and the 24V power is supplied externally.	_	_
80	180	SAFE	Safety monitor output	Output while safety stop function is activated.	_	24
81	181	SAFE2	Safety monitor output 2	The signal is output when no internal safety circuit failure (E.SAF, E.6, E.7, E.CPU) exists.	_	24
90	190	Y90	Life alarm	Output when any of the control circuit capacitor, main circuit capacitor and inrush current limit circuit or the cooling fan approaches the end of its service life.	Pr. 255 to Pr. 259	214
91	191	Y91	Fault output 3 (power-off signal)	Output when a fault occurs due to the internal circuit failure of the inverter wiring mistake.	_	170
93	193	Y93	Current average value monitor signal	Average current value and maintenance timer value are output as pulses. The signal can not be set in <i>Pr. 192 RX7 function selection</i> .	Pr. 555 to Pr. 557	218
95	195	Y95	Maintenance timer signal	Output when Pr. 503 rises to or above the Pr. 504 setting.	Pr. 503, Pr. 504	217
96	196	REM	Remote output	Output to the terminal when a value is set to the parameter.	Pr. 495, Pr. 496	174
98	198	LF	Alarm output	Output when an alarm (fan failure or communication error warning) occurs.	Pr. 244, Pr. 500	107, 213
99	199	ALM	Fault output	Output when the fault occurs. The signal output is stopped when the fault is reset.	_	170
99	999	_	No function	_	_	_

* Note that when the frequency setting is varied using an analog signal or of the operation panel, the output of the SU (up to frequency) signal may alternate ON and OFF depending on that varying speed and the timing of the varying speed due to acceleration/deceleration time setting. (The output will not alternate ON and OFF when the acceleration/deceleration time setting is "0s".)



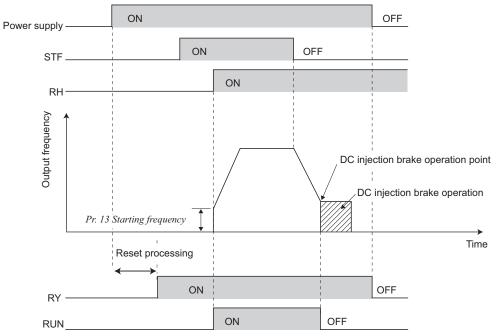
• REMARKS

- The same function may be set to more than one terminal.When the function is executed, the terminal conducts at the setting of any of "0 to 99", and does not conduct at the setting of



• Changing the assignment of the terminal Y0 or a virtual terminal of CC-Link communication with one of *Pr. 190 to Pr. 192*, and *Pr. 313 to Pr. 315 (output terminal function selection)* may affect other functions. Set parameters after confirming the function of the terminal Y0 and virtual terminals.





- When the inverter is ready to operate, the output of the operation ready signal (RY) is ON. (It is also ON during inverter running.)
- When the output frequency of the inverter rises to or above Pr. 13 Starting frequency, the output of the inverter running signal (RUN) is turned ON. During an inverter stop or DC injection brake operation, the output is OFF.
- When using the RY and RUN signals, assign functions to Pr. 190 to Pr. 192, Pr. 313 to Pr. 315 (output terminal selection function) referring to the table below.

Output	Pr. 190 to Pr. 192, Pr. 313 to Pr. 315 Setting				
Signal	Positive logic	Negative logic			
RY	11	111			
RUN	0	100			

Inverter Status		24V external power supplied (EV displayed	Start Signal	Start Start Signal ON Signal ON (during (during stop) operation)		Signal ON					Under				Automatic Restart afte Instantaneous Power Failure		
Output signal	Resetting	on the operation panel)	OFF (during stop)		` •	Injection	shutoff *2	Start signal ON	Start	Restarting							
RY	OFF	OFF	ON	ON	ON	ON	OFF	ON	*1	ON							
RUN	OFF	OFF	OFF	OFF	ON	OFF	OFF	OI	F	ON							

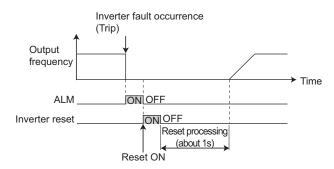
This signal turns OFF during power failure or undervoltage.

> REMARKS

• The RUN signal (positive logic) is assigned to the terminal Y0 in the initial setting.

Output is shutoff under conditions such as a fault occurrence, MRS signal ON, and the safety stop operation.

(3) Fault output signal (ALM signal)



• If the inverter comes to trip, the ALM signal is output.

(I) REMARKS

- The ALM signal is initially assigned to a virtual terminal of CC-Link communication. To assign the ALM signal to the terminal Y0 or another virtual terminal of CC-Link communication, set "99 (positive logic)" or "199 (negative logic)" in one of *Pr. 190 to Pr. 192* and *Pr. 313 to Pr. 315 (output terminal function selection)*.
- Refer to page 234 for the inverter fault description.

(4) Fault output 3 (power-off signal) (Y91 signal)

- The Y91 signal is output at occurrence of a fault attributable to the failure of the inverter circuit or a fault caused by a wiring
 mistake.
- For the Y91 signal, assign the function to the terminal Y0 or a virtual terminal of CC-Link communication by setting "91 (positive logic) or 191 (negative logic)" in one of *Pr. 190 to Pr. 192* and *Pr. 313 to Pr. 315 (output terminal function selection).*
- The following table indicates the faults that will output the Y91 signal. (Refer to page 233 for the fault description.)

Operation Indicat		Name		
Е. ЬЕ	E. BE	Brake transistor alarm detection		
E. GF	E.GF	Output side earth (ground) fault overcurrent		
E. LF	E.LF	Output phase loss		
E. PE	E.PE	Parameter storage device fault		
6.283	E.PE2	Internal board fault		
E. 5' E. 6' E. 7,	E. 5/ E. 6/ E. 7/ E.CPU	CPU fault		
EJ 0H	E.IOH	Inrush current limit circuit fault		

• REMARKS

 At occurrence of output side earth (ground) fault overcurrent (E.GF), overcurrent trip during acceleration (E.OC1) may be displayed. At this time, the Y91 signal is output.



Parameters referred to

Pr. 13 Starting frequency Refer to page 138

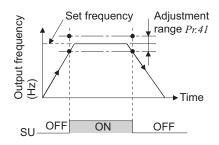


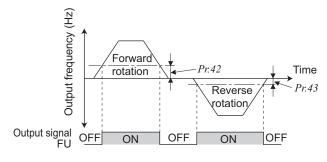
5.13.4 Detection of output frequency (SU, FU signal, Pr. 41 to Pr. 43)

The inverter output frequency is detected and output at the output signals.

Parameter Number	Name	Initial Value	Setting Range	Description
41	Up-to-frequency sensitivity	10%	0 to 100%	Level where the SU signal turns ON.
42	Output frequency detection	6Hz	0 to 400Hz	Frequency where the FU signal turns ON.
43	Output frequency 43 detection for reverse		0 to 400Hz	Frequency where the FU signal turns ON in reverse rotation.
	rotation		9999	Same as Pr. 42 setting

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)





(1) Up-to-frequency sensitivity (SU signal, Pr. 41)

- When the output frequency reaches the set frequency, the up-to-frequency signal (SU) is output.
- The Pr.~41 value can be adjusted within the range 0% to $\pm 100\%$ on the assumption that the set frequency is 100%.
- •This parameter can be used to ensure that the running frequency has been reached to provide the operation start signal etc. for related equipment.
- •To assign the SU signal to the terminal Y0 or a virtual terminal of CC-Link communication, set "1 (positive logic) or 101 (negative logic)" in one of *Pr. 190 to Pr. 192* and *Pr. 313 to Pr. 315 (output terminal function selection)*.

(2) Output frequency detection (FU signal, *Pr. 42*, *Pr. 43*)

- The output frequency detection signal (FU) is output when the output frequency reaches or exceeds the *Pr. 42* setting.
- •This function can be used for electromagnetic brake operation, open signal, etc.
- Frequency detection that is dedicated to reverse operation can be set by setting detection frequency to *Pr. 43*. This function is effective for switching the timing of electromagnetic brake operation between forward rotation (rise) and reverse rotation (fall) during vertical lift operation, etc.
- •When $Pr. 43 \neq$ "9999", the Pr. 42 setting is used for forward rotation and the Pr. 43 setting is used for reverse rotation.

• REMARKS

- The FU signal is initially assigned to a virtual terminal of CC-Link communication. To assign the signal to the terminal Y0 or another virtual terminal of CC-Link communication, set "4 (positive logic) or 104 (negative logic)" in one of *Pr. 190 to Pr. 192* and *Pr. 313 to Pr. 315 (output terminal function selection)*.
- · All signals are OFF during DC injection brake.
- The output frequency to be compared with the set frequency is the output frequency before slip compensation is performed.



NOTE

• Changing the assignment of the terminal Y0 or a virtual terminal of CC-Link communication with one of *Pr. 190 to Pr. 192*, and *Pr. 313 to Pr. 315 (output terminal function selection)* may affect other functions. Set parameters after confirming the function of the terminal Y0 and virtual terminals.



Parameters referred to

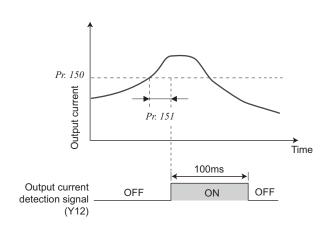
Pr. 190 to Pr. 192, Pr. 313 to Pr. 315 (output terminal function selection) (Refer to page 167)

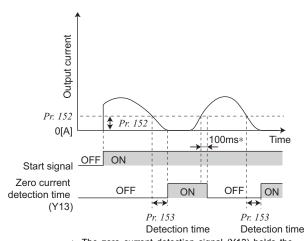
5.13.5 Output current detection function (Y12 signal, Y13 signal, Pr. 150 to Pr. 153)

The output current during inverter operation can be detected and output to terminal Y0 or a virtual terminal of CC-Link communication.

Parameter Number	Name	Initial Value	Setting Range	Description
150	Output current detection level	150%	0 to 200%	100% is the rated inverter current.
151	Output current detection signal delay time	0s	0 to 10s	Output current detection period. The time from when the output current has risen above the setting until the output current detection signal (Y12) is output.
152	Zero current detection level	5%	0 to 200%	The rated inverter current is assumed to be 100%.
153	Zero current detection time	0.5s	0 to 1s	Period from when the output current drops below the <i>Pr. 152</i> value until the zero current detection signal (Y13) is output.

The above parameters can be set when *Pr. 160 User group read selection* = "0". (*Refer to page 197*)





 The zero current detection signal (Y13) holds the signal for approximately 100ms once turned ON.

(1) Output current detection (Y12 signal, *Pr. 150, Pr. 151*)

- •The output current detection function can be used for excessive torque detection, etc.
- •If the output current remains higher than the *Pr.* 150 setting during inverter operation for the time set in *Pr.* 151 or longer, the output current detection signal (Y12) is output from the terminal Y0 or a virtual terminal of CC-Link communication.
- When the Y12 signal turns ON, the ON state is held for approximately 100ms.
- •To assign the Y12 signal to the terminal Y0 or a virtual terminal of CC-Link communication, set "12 (positive logic) or 112 (negative logic)" in one of *Pr. 190 to Pr. 192* and *Pr. 313 to Pr. 315 (output terminal function selection)*.

(2) Zero current detection (Y13 signal, Pr. 152, Pr. 153)

- •If the output current remains lower than the Pr.~152 setting during inverter operation for longer than the time set in Pr.~153, the zero current detection (Y13) signal is output from the inverter's open collector or relay output terminal.
- •When the inverter's output current falls to "0", torque will not be generated. This may cause a drop due to gravity when the inverter is used in vertical lift application.
- To prevent this, the Y13 signal, which closes the mechanical brake at "0" output current, can be output from the terminal Y0 or a virtual terminal of CC-Link communication.
- •To assign the Y13 signal to the terminal Y0 or a virtual terminal of CC-Link communication, set "13 (positive logic) or 113 (negative logic)" in one of *Pr.190 to Pr.192* and *Pr.313 to Pr.315 (output terminal function selection)*.

REMARKS

- This function is also valid during execution of the offline auto tuning.
- The response time of Y12 and Y13 signals is approximately 0.1s. Note that the response time changes according to the load condition.

When Pr. 152 = "0", detection is disabled.



NOTE

Changing the assignment of the terminal Y0 or a virtual terminal of CC-Link communication with one of *Pr. 190 to Pr. 192*, and *Pr. 313 to Pr. 315 (output terminal function selection)* may affect other functions. Set parameters after confirming the function of the terminal Y0 and virtual terminals.

! CAUTION

The zero current detection level setting should not be too low, and the zero current detection time setting not too long. Otherwise, the detection signal may not be output when torque is not generated at a low output current.

To prevent the machine and equipment from resulting in hazardous conditions detection signal, install a safety backup such as an emergency brake even the zero current detection function is set valid.



Parameters referred to

Offline auto tuning F Refer to page 146
Pr. 190 to Pr. 192, Pr. 313 to Pr. 315 (output terminal function selection) F Refer to page 167

5.13.6 Remote output selection (REM signal, Pr. 495, Pr. 496)

You can utilize the ON/OFF of the inverter's output signals instead of the remote output terminal of the programmable logic controller.

Parameter	Name	Initial	Setting	Description		
Number	Name	Value	Range	Description		
			0	Remote output data clear at powering OFF	Remote output data is	
		0	1	Remote output data retention at powering	cleared during an	
495	Remote output selection			OFF	inverter reset	
495			10	Remote output data clear at powering OFF	Remote output data is	
			11	Remote output data retention at powering	retained during an	
			''	OFF	inverter reset	
496*	Remote output data 1	0	0 to 4095	Refer to the following diagram.		

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)

* This parameter allows its setting to be changed during operation in any operation mode even if "0" (initial value) is set in Pr. 77 Parameter write selection.

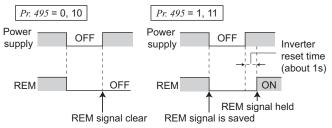
<Remote output data>

* Any

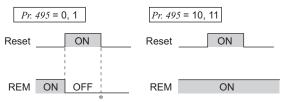
- The output terminal (Y0) can be turned ON/OFF depending on the Pr. 496 setting. The remote output selection can be controlled ON/OFF by CC-Link communication.
- To assign the remote output (REM) signal to the terminal Y0, set "96 (positive logic) or 196 (negative logic)" in *Pr.190 RX2 (terminal Y0) function selection*.
- When you refer to the diagram on the left and set 1 to the terminal bit (terminal Y0 where the REM signal has been assigned) of *Pr. 496*, the terminal Y0 turns ON (OFF for negative logic). By setting 0, the terminal Y0 turns OFF (ON for negative logic).

Example: When "96 (positive logic)" is set in *Pr. 190 RX2 (terminal Y0) function selection* and "1" (H01) is set in *Pr. 496*, the terminal Y0 turns ON.

ON/OFF example for positive logic



Signal condition during a reset



* When Pr. 495 = "1," the signal condition saved in EEPROM (condition of the last power OFF) is applied.

- When Pr. 495 = "0 (initial value), 10", performing a power ON reset (including a power failure) clears the REM signal output. (The ON/OFF status of the terminal Y0 is as set in Pr. 190.) The Pr. 496 setting is also "0".
 - When Pr. 495 = "1, 11", the remote output data before power OFF is stored into the EEPROM, so the signal output at power recovery is the same as before power OFF. (See the chart on the left) However, it is not stored when the inverter is reset (reset request via CC-Link communication).
- When Pr. 495 = "10 or 11," the signal before the reset is held even during an inverter reset.

> REMARKS

• The output terminal where the REM signal is not assigned using any of *Pr. 190* does not turn ON/OFF if 0/1 is set to the terminal bit of *Pr. 496*. (It turns ON/OFF with the assigned function.)

11

Parameters referred to

Pr. 190 RX2 (terminal Y0) function selection TF Refer to page 167



5.14 Monitor display and monitor output signal

Purpose	Parameter that shou	ıld be Set	Refer to Page
Display motor speed Set speed	Speed display and speed setting	Pr. 37	175
Change operation panel monitor	Operation panel main display data selection	Pr. 52, Pr. 170, Pr. 171, Pr. 268,	176
display data	Cumulative monitor clear	Pr. 563, Pr. 564	176

5.14.1 Speed display and speed setting (Pr. 37)

The monitor display and frequency setting of the operation panel can be changed to the machine speed.

Parameter Number	Name	Initial Value	Setting Range	Description
37	37 Speed display		0	Frequency display, setting
31	Speed display	U	0.01 to 9998*	Machine speed at 60Hz.

The above parameters can be set when Pr. 160User group read selection = "0". (Refer to page 197)

* The maximum value of the setting range differs according to the Pr. 1 Maximum frequency (Pr.18 High speed maximum frequency) and it can be calculated from the following formula.

Maximum setting value of
$$Pr. 37 < \frac{16777.215 \times 60 \text{ (Hz)}}{\text{Setting value of } Pr. 1 (Pr.18) \text{ (Hz)}}$$

Note that the maximum setting value of Pr. 37 is 9998 if the result of the above formula exceeds 9998.

• To display the machine speed, set in Pr. 37 the machine speed for 60Hz operation.

For example, when Pr. 37 = "1000", "1000" is displayed on the output frequency and set frequency monitor when the running frequency is 60Hz. When running frequency is 30Hz, "500" is displayed.

Pr. 37 Setting		Set Frequency Monitor	Frequency Setting	Parameter Setting
0 (initial value)	Hz	Hz	Hz	Hz
0.01 to 9998	Machine speed *1	Machine speed *1	Machine speed *1	112

- *1 Machine speed conversion formulaPr. 37 × frequency/60Hz
- Hz is displayed in 0.01Hz increments and machine speed is in 0.001.



NOTE

- Under V/F control, the output frequency of the inverter is displayed in terms of synchronous speed, and therefore, displayed value = actual speed + motor slip. The display changes to the actual speed (estimated value calculated based on the motor slip) when Advanced magnetic flux vector control was selected or slip compensation was valid.
- Since the panel display of the operation panel is 4 digits in length, the monitor value of more than "9999" is displayed "----".
- While the machine speed is displayed on the monitor, values of other parameters related to speed (*Pr. 1*, etc.) are in frequency increments. Set other parameters (*Pr. 1*, etc.) related to speed in increments of frequency.
- Due to the limitations on the resolution of the set frequency, the indication in the second decimal place may differ from the setting.



Make sure that the running speed setting is correct.

Otherwise, the motor might run at extremely high speed, damaging the machine.



Parameters referred to

Pr. 1 Maximum frequency, Pr.18 High speed maximum frequency & Refer to page 124
Pr. 52 DU/PU main display data selection & Refer to page 176
Pr. 800 Control method selection & Refer to page 112

5.14.2 Monitor display selection of operation panel (Pr. 52, Pr. 170, Pr. 171, Pr. 268, Pr. 563, Pr. 564)

The monitor to be displayed on the main screen of the operation panel can be selected.

Number	Description
DU/PU main display data 0 0, 5, 7 to 12, 14, Select the monitor to	o be displayed on the
52 *1 selection (output 20, 23 to 25, 52 to operation panel.	
frequency) 55, 61, 62, 100 *2 Refer to the following	g table for monitor description.
0 Set "0" to clear the v	watt-hour meter monitor.
Sets the maximum v	value for the monitoring from
170 Watt-hour meter clear 9999 communication to 9	999kWh.
9999 Sets the maximum v	value for the monitoring from
communication to 6	5535kWh.
Set "0" in the param	eter to clear the operation time
171 Operation hour meter clear 9999 0, 9999 monitor.	
Setting 9999 does n	not clear.
Monitor decimal digits 0 Displayed as integra	al value
268 ∗ 1 Displayed in 0.1 inc	rements.
selection 9999 No function	
Energization time carrying- 0 to 65535 The numbers of cum	ulative energization time
I 563 I I I I I I I I I I I I I I I I I I I	5535h is displayed. (Reading
over times (reading only) only)	
Operating time carrying- 0 to 65535 The numbers of operating time carrying-	eration time monitor exceeded
over times 0 (reading only) 65535h is displayed	I. (Reading only)

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)

(1) Monitor description list (Pr. 52)

- •Set the monitor to be displayed on the operation panel in Pr. 52 DU/PU main display data selection.
- •Refer to the following table and set the monitor to be displayed.

Types of Monitor	Increment	Pr. 52 Setting	Description
Output frequency	0.01Hz	0/100	Displays the inverter output frequency.
Output current	0.01A	0/100	Displays the inverter output current effective value.
Output voltage	0.1V	0/100	Displays the inverter output voltage.
Fault display	-	0/100	Displays 8 past faults individually.
Frequency setting value	0.01Hz	5	Displays the set frequency.
Motor torque	0.1%	7	Displays the motor torque in % on the assumption that the rated motor torque is 100%. (Displays 0% during V/F control)
Converter output voltage	0.1V	8	Displays the DC bus voltage value.
Regenerative brake duty	0.1%	9	Brake duty set in Pr. 30, Pr. 70
Electronic thermal relay function load factor	0.1%	10	Displays the thermal cumulative value on the assumption that the thermal operation level is 100% (Larger thermal between the motor thermal and transistor thermal). *4
Output current peak value	0.01A	11	Holds and displays the peak value of the output power monitor. (Cleared at every start)
Converter output voltage peak value	0.1V	12	Holds and displays the peak value of the DC bus voltage value. (Cleared at every start)
Output power	0.01kW	14	Displays the power on the inverter output side
Cumulative energization time *1	1h	20	Adds up and displays the energization time after inverter shipment. You can check the numbers of the monitor value exceeded 65535h with <i>Pr.</i> 563.
Actual operation time *1, *2	1h	23	Adds up and displays the inverter operation time. You can check the numbers of the monitor value exceeded 65535h with <i>Pr. 564</i> . Can be cleared by <i>Pr. 171</i> . (<i>Refer to page 179</i>)
Motor load factor	0.1%	24	Displays the output current value on the assumption that the inverter rated current value is 100%. Monitor value = output power monitor value/rated inverter current 100 [%]

^{*1} This parameter allows its setting to be changed during operation in any operation mode even if "0" (initial value) is set in Pr. 77 Parameter write selection.

^{*2} The setting values "56 and 57" are for manufacturer setting. Do not set.



Types of Monitor	Increment	Pr. 52 Setting	Description
Cumulative power *3	0.01kWh *5	25	Adds up and displays the power amount based on the output power monitor. Can be cleared by <i>Pr. 170. (Refer to page 178)</i>
PID set point	0.1%	52	52 Displays the set point, measured value and deviation during PID control (<i>Refer to page 207</i> for details)
PID measured value	0.1%	53	
PID deviation	0.1%	54	
Inverter output terminal monitor	_	55	Displays the ON/OFF status of inverter's output terminals and virtual terminals of CC-Link communication (RX2, RX6, RX7).
Motor thermal load factor	0.1%	61	Displays the motor thermal heat cumulative value. (Motor overload trip (E.THM) at 100%)
Inverter thermal load factor	0.1%	62	Displays the transistor thermal heat cumulative value. (Inverter overload trip (E.THT) at 100%)
Cumulative power 2	0.01kWh	_	Adds up and displays the power amount based on the output power monitor (The monitor dedicated to CC-Link communication) This can be cleared by <i>Pr. 170. (Refer to page 178)</i>

- *1 The cumulative energization time and actual operation time are accumulated from 0 to 65535 hours, then cleared, and accumulated again from 0.

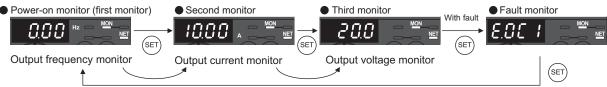
 When the operation panel is used, the time is displayed up to 65.53 (65530h) in the indication of 1h = 0.001, and thereafter, it is added up from 0.
- *2 Actual operation time is not accumulated when the cumulative operation time is less than 1h until turning OFF of the power supply.
- *3 Since the panel display of the operation panel is 4 digits in length, the monitor value of more than "9999" is displayed "----".
- *4 Larger thermal value between the motor thermal and transistor thermal is displayed.
 - A value other than 0% is displayed if the surrounding air temperature (heatsink temperature) is high even when the inverter is at a stop.
- *5 The increment is 1kWh during monitoring via CC-Link communication.

> REMARKS

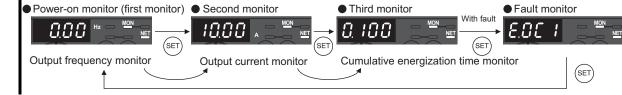
- By setting "0" in Pr. 52, the monitoring of output speed to fault display can be selected in sequence by (SET)
- When the operation panel is used, the displayed units are Hz and A only and the others are not displayed.
- The monitor set in *Pr. 52* is displayed in the third monitor position. However, change the output current monitor for the motor load factor.

Initial Value

* The monitor displayed at power ON is the first monitor. Display the monitor you want to display on the first monitor and hold down (SET) for 1s. (To return to the output frequency monitor, hold down (SET) for 1s after displaying the output frequency monitor.)



Example)When Pr. 52 is set to "20" (cumulative energization time), the monitor is displayed on the operation panel as described below.



Display set frequency during stop (Pr. 52)

• When "100" is set in Pr. 52, the set frequency and output frequency are displayed during stop and operation respectively. (LED of Hz flickers during stop and is lit during operation.)

	Pr. 52				
	0	10	100		
	During	uring During stop			
	running/stop	During stop	running		
Output frequency	Output	Set	Output		
Output frequency	frequency	frequency*	frequency		
Output current	Output current				
Output voltage	Output voltage				
Fault display	Fault display				

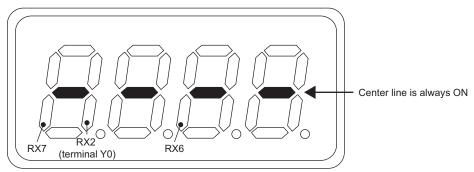
The set frequency displayed indicates the frequency to be output when the start command is ON. Different from the frequency setting displayed when Pr. 52 = "5", the value based on maximum/minimum frequency and frequency jump is displayed.

> REMARKS

- During an error, the output frequency at error occurrence appears.
 During MRS signal is ON, the values displayed are the same as during a stop.
 During offline auto tuning, the tuning status monitor has priority.

(3) Operation panel I/O terminal monitor (Pr. 52)

- •Set Pr. 52 = "55" to monitor the statuses of the output terminals and virtual terminals of CC-Link communication (RX2, RX6, RX7) on operation panel.
- •The I/O terminal monitor is displayed on the third monitor.
- •The LEDs are ON when the RX2 (terminal Y0), RX6 and RX7 are ON, and the LEDs are OFF when the terminals are OFF. The center line of LED is always ON.



Cumulative power/Cumulative power 2 monitor and clear (Pr. 170)

- Monitored output power is accumulated and updated in 1h increments for the cumulative power monitor (Pr. 52 = "25") and the cumulative power monitor 2 (dedicated to CC-Link communication).
- The operation panel, CC-Link communication display increments and display ranges are as indicated below.

Operation Panel *			CC-Link Communication		
Pango	Cumulative power	Range Pr. 170 = 10		Cumulative power	Cumulative power 2
Range	monitor increment			monitor increment	monitor increment
0 to 99.99kWh	0.01kWh		0 to 65535kWh		
100.0 to 999.9kWh	0.1kWh	0 to 9999kWh	(initial value)	1kWh	0.01kWh
1000 to 9999kWh	1kWh		(Illitial value)		

^{*} Power is measured in the range 0 to 9999.99kWh, and displayed in 4 digits.

When the monitor value exceeds "99.99", a carry occurs, e.g. "100.0", so the value is displayed in 0.1kWh increments.

•Writing "0" in Pr. 170 clears the cumulative power monitor/Cumulative power 2 monitor .

REMARKS

• If "0" is written to Pr. 170 and Pr. 170 is read again, "9999" or "10" is displayed.



(5) Cumulative energization time and actual operation time monitor (Pr. 171, Pr. 563, Pr. 564)

- •Cumulative energization time monitor (Pr. 52 = "20") accumulates energization time from shipment of the inverter every one hour.
- •On the actual operation time monitor (Pr. 52 = "23"), the inverter running time is added up every hour. (Time is not added up during a stop.)
- •If the monitored value exceeds 65535, it is added up from 0. You can check the numbers of cumulative energization time monitor exceeded 65535h with Pr. 563 and the numbers of actual operation time monitor exceeded 65535h with Pr. 564.
- •Writing "0" to Pr. 171 clears the cumulative power monitor. (The cumulative time monitor can not be cleared.)



(I) REMARKS

- The cumulative energization time does not increase if the power is ON for less than an hour.
- The actual operation time does not increase if the cumulative running time during power-ON status is less than an hour.
- If "0" is written to $Pr.\ 171$ and $Pr.\ 171$ is read again, "9999" is always displayed. Setting "9999" does not clear the actual operation time meter.

(6) You can select the decimal digits of the monitor (Pr. 268)

•As the operation panel display is 4 digits long, the decimal places may vary at analog input, etc. The decimal places can be hidden by selecting the decimal digits.

In such a case, the decimal digits can be selected by Pr. 268.

Pr. 268 Setting	Description
9999 (initial value)	No function
	For the first or second decimal places (0.1 increments or 0.01 increments) of the monitor, numbers in the first
0	decimal place and smaller are rounded to display an integral value (1 increments). The monitor value smaller than
	0.99 is displayed as 0.
1	When 2 decimal places (0.01 increments) are monitored, the 0.01 decimal place is dropped and the monitor
'	displays the first decimal place (0.1 increments). The monitored digits in 1 increments are displayed as they are.



• REMARKS

• The number of display digits on the cumulative energization time (Pr. 52 = "20"), actual operation time (Pr. 52 = "23"), and cumulative power (Pr. 52 = "25") does not change.



Parameters referred to

Pr. 30 Regenerative function selection, Pr. 70 Special regenerative brake duty Refer to page 155 Pr. 37 Speed display 🖫 Refer to page 175

5.15 Operation selection at power failure and instantaneous power failure

Purpose	Parameter ti	Refer to Page	
At instantaneous power failure	Automatic restart operation	Pr. 57, Pr. 58, Pr. 96,	
occurrence, restart inverter without	after instantaneous power	Pr. 162, Pr. 165, Pr. 298, Pr. 299,	180
stopping motor	failure/flying start	Pr. 611	
When undervoltage or a power	Power failure-time		
failure occurs, the inverter can be	deceleration-to-stop	Pr. 261	186
decelerated to a stop.	function		

5.15.1 Automatic restart after instantaneous power failure/flying start (Pr. 57, Pr. 58, Pr. 96, Pr. 162, Pr. 165, Pr. 298, Pr. 299, Pr. 611)

You can restart the inverter without stopping the motor in the following cases:

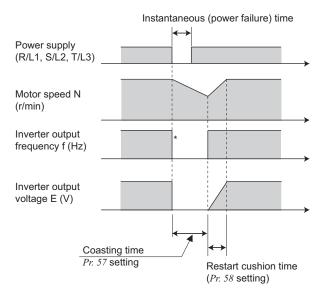
- When power comes back on after an instantaneous power failure
- When motor is coasting at start

Parameter			Setting	.
Number	Name	Initial Value	Range	Description
			0	1.5K or lower 1s
				2.2K to 7.5K 2s
57	Restart coasting time	9999		11K or higher 3s
57	Restart coasting time	9999		The above times are coasting time. Waiting time for inverter-triggered restart after an instantaneous
			0.1 to 5s	power failure.
			9999	No restart
58	Restart cushion time	1s	0 to 60s	Voltage starting time at restart.
	Trootare outliness time		0	Offline auto tuning is not performed
				Advanced magnetic flux vector control
			1 1	Offline auto tuning is performed without motor running (all motor
				constants) (Refer to page 114)
				For General-purpose magnetic flux vector control
96	Auto tuning setting/status	0	11	Offline auto tuning is performed without motor running (motor
				constants (R1) only) (Refer to page 117)
				Offline auto tuning (tuning performed without motor running) for
			21	V/F control and automatic restart after instantaneous power
				failure (with frequency search)
	Automatic restart after		0	With frequency search
162	instantaneous power	1	1	Without frequency search (reduced voltage system)
102	-	'	10	Frequency search at every start
	failure selection		11	Reduced voltage at every start
165	Stall prevention	150%	0 to 200%	Considers the rated inverter current as 100% and sets the stall
100	operation level for restart	130 /6		prevention operation level during restart operation.
				When offline auto tuning is performed under V/F control,
			0 to 32767	frequency search gain necessary for frequency search for
298	Frequency search gain	9999	0 10 32707	automatic restart after instantaneous power failure is set as well
230	l requeitey scareit gain	0000		as the motor constants (R1).
			9999	Uses the Mitsubishi motor (SF-JR, SF-HR, SF-JRCA, SF-HRCA)
				constants
			0	Without rotation direction detection
	Rotation direction		1	With rotation direction detection
299	detection selection at	0		When <i>Pr.</i> 78 = 0, With rotation direction detection
	restarting		9999	When Pr : 78 = 1. 2
				Without rotation direction detection
				Acceleration time to reach <i>Pr. 20 Acceleration/deceleration reference</i>
044	Acceleration time at a restart		0 to 3600s	frequency at a restart.
611		9999	9999	Acceleration time for restart is the normal acceleration time (e.g.
				Pr. 7)
		l .	l .	-

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)

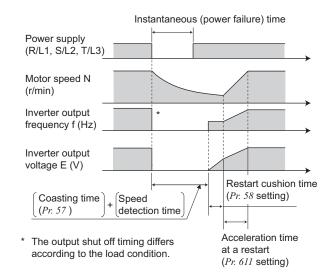
1

When Pr. 162 = 1, 11 (without frequency search)



^{*} The output shut off timing differs according to the load condition.

When Pr. 162 = 0, 10 (with frequency search)



(1) Automatic restart operation selection

(Pr. 162, Pr. 299)

Without frequency search

When Pr. 162 = "1 (initial value)" or "11", automatic restart operation is performed in a reduced voltage system, where the voltage is gradually risen with the output frequency unchanged from prior to an instantaneous power failure independently of the coasting speed of the motor.

> REMARKS

This system stores the output frequency and rotation direction prior to an instantaneous power failure and restart using the stored value. Therefore, if the instantaneous power failure time exceeds 0.2s and the stored value cannot be retained, the inverter starts at *Pr. 13 Starting frequency* (initial value = 0.5Hz) in the starting direction upon power restoration.

With frequency search

When "0 or 10" is set in *Pr. 162*, the inverter smoothly starts after detecting the motor speed upon power restoration. (The motor capacity should be equal to or one rank lower than the inverter capacity)

When using the frequency search, perform offline auto tuning.

(*Refer to page 146* for Advanced magnetic flux vector control, General-purpose magnetic flux vector control and page 182 for V/F control.)

- •During reverse rotation, the inverter can be restarted smoothly as the direction of rotation is detected.
- •You can select whether to make rotation direction detection or not with *Pr. 299 Rotation direction detection selection at restarting.*

When capacities of the motor and inverter differ, set "0" (without rotation direction detection) in Pr. 299.

Pr. 299 Setting	Pr. 78 Setting			
Fr. 299 Setting	0	1	2	
9999	0	×	×	
0 (initial value)	×	×	×	
1	0	0	0	

- O: the rotation direction is detected.
- x: the rotation direction is not detected.



▶ REMARKS

- Speed detection time (frequency search) changes according to the motor speed. (maximum 100ms)
- When the inverter capacity is two rank or more larger than the motor capacity, the inverter may not start due to overcurrent trip (E.OC□).
- If two or more motors are connected to one inverter, the function does not operate properly. (The inverter does not start smoothly.)
- When reverse rotation is detected when Pr. 78 = "1" (reverse rotation disabled), the rotation direction is changed to forward rotation after decelerates in reverse rotation when the start command is forward rotation. The inverter will not start when the start command is reverse rotation.



NOTE

- When automatic restart operation after instantaneous power failure is activated while the motor is running at a low speed (less than 10Hz), the motor restarts in the direction prior to instantaneous power failure without detecting the rotation direction (*Pr. 299 Rotation direction detection selection at restarting* = "1").
- If the frequency search result exceeds the set frequency, the output frequency is limited at the set frequency.
- When the wiring length exceeds 100m, select without frequency search (Pr. 162 = "1, 11").



Restart operation at every start

When Pr. 162 = "10 or 11", automatic restart operation is also performed every start, in addition to the automatic restart after instantaneous power failure. When Pr. 162 = "0", automatic restart operation is performed at the first start after power supply ON, but not performed at the second time or later.

(2) Restart coasting time (Pr. 57)

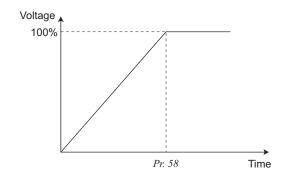
- •Coasting time is the time from when the motor speed is detected until automatic restart control is started.
- •Set Pr. 57 to "0" to perform automatic restart operation.

The coasting time is automatically set to the value below. Generally this setting will pose no problems.

- 1.5K or lower.... 1s
- 2.2K to 7.5K 2s
- 11K or higher ... 3s
- •Operation may not be performed well depending on the magnitude of the moment of inertia (J) of the load or running frequency. Adjust the coasting time between 0.1s and 5s according to the load specifications.

(3) Restart cushion time (Pr. 58)

- Cushion time is the length of time taken to raise the voltage appropriate to detected motor speed (output frequency prior to instantaneous power failure when Pr. 162 = "1, 11") from 0V.
- •Normally the initial value need not be changed for operation, but adjust it according to the magnitude of the moment of inertia (J) of the load or torque.



(4) Automatic restart operation adjustment (Pr. 165, Pr. 611)

- •Using Pr. 165, you can set the stall prevention operation level at a restart.
- •Using *Pr. 611*, you can set the acceleration time until *Pr.20 Acceleration/deceleration reference frequency* is reached when automatic restart operation is performed besides the normal acceleration time.



> REMARKS

• If the Pr. 21 Acceleration/deceleration time increments is changed, the setting increments of Pr. 611 remain unchanged.

(5) Frequency search gain (Pr. 298), offline auto tuning (Pr. 96)

- •When automatic restart after instantaneous power failure operation (with frequency search) is valid at V/F control, perform offline auto tuning.
- •Perform offline auto tuning during V/F control in the following order to set *Pr. 298 Frequency search gain* automatically. (*Refer to page 146* during Advanced magnetic flux vector control and General-purpose magnetic flux vector control.)



Before performing offline auto tuning

Check the following before performing offline auto tuning.

- •The inverter is under V/F control
- •A motor should be connected. Note that the motor should be at a stop at a tuning start.
- •The motor capacity should be equal to or one rank lower than the inverter capacity. (note that the capacity is 0.1kW or
- A high-slip motor, high-speed motor and special motor cannot be tuned. (The maximum frequency is 120Hz.)
- •Even if tuning is performed without motor running (Pr. 96 Auto tuning setting/status = "21"), the motor may run slightly. Therefore, fix the motor securely with a mechanical brake, or before tuning, make sure that there will be no problem in safety if the motor runs (caution is required especially in vertical lift applications). Note that tuning performance is unaffected even if the motor runs slightly.
- •Offline auto tuning will not be performed properly if it is performed with a surge voltage suppression filter (FR-ASF-H, FR-BMF-H) connected between the inverter and motor. Remove it before starting tuning.

Setting

1) Set "21" in Pr. 96 Auto tuning setting/status.

Tuning is performed without motor running.

It takes approximately 9s * until tuning is completed.

(Excitation noise is produced during tuning.)

- *Tuning time differs according to the inverter capacity and motor type.
- 2) Set the rated motor current (initial value is rated inverter current) in Pr. 9 Electronic thermal O/L relay. (Refer to page 142)
- 3) Set Pr. 71 Applied motor according to the motor used.

Motor	Pr. 71 Setting *1	
	SF-JR	3
Mitsubishi standard motor	SF-JR 4P 1.5kW or less	23
Mitsubishi high efficiency motor	SF-HR	43
	Others	3
Mitsubishi constant-torque motor	SF-JRCA 4P	13
	SF-HRCA	53
motor	Others (SF-JRC, etc.)	13
Other manufacturer's standard motor	_	3
Other manufacturer's constant torque motor	_	13

^{*1} Refer to page 144, for other settings of Pr. 71.

Execution of tuning



Before tuning, check the monitor display on the operation panel to confirm that the inverter is ready for tuning. (Refer

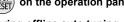
1) In the PU operation mode, press (RUN) on the operation panel.

In the Network operation mode, turn on the start command via CC-Link communication. And tuning will start.



NOTE

To end the tuning forcibly, input the MRS signal, command the inverter reset via CC-Link communication, or press



- on the operation panel. (Turning the start signal (STF signal or STR signal) OFF also ends tuning.)
- During offline auto tuning, only the following I/O signals are valid: (initial value)
 - Input signal MRS, STF, STR
 - Output signal RUN, ALM
- Since the RUN signal turns ON when tuning is started, caution is required especially when a sequence which releases a mechanical brake by the RUN signal has been designed.
- When executing offline auto tuning, input the run command after switching ON the main circuit power (R/L1, S/L2, T/ L3) of the inverter.
- Do not perform ON/OFF switching of the second function selection signal (RT) during execution of offline auto tuning. Auto tuning is not executed properly.

7

2) Monitor is displayed on the operation panel during tuning as below.

	Operation Panel Indication
Pr. 96 setting	21
(1) Setting	2 / PU MON -
(2) Tuning in progress	22 PU MON
(3) Normal end	Flickering
(4) Error end (when inverter protective function operation is activated)	3 <u>PU</u> MON

•Reference: Offline auto tuning time (when the initial value is set)

Offline Auto Tuning Setting	Time		
Tune motor constants (R1) only	Approx. 9s (Tuning time differs according to the inverter capacity		
(<i>Pr.</i> 96 = "21")	and motor type.)		

3) When offline auto tuning ends, press (STOP) of the operation panel during PU operation. In the Network operation mode, turn OFF the start command via CC-Link communication.

This operation resets the offline auto tuning and the operation panel monitor display returns to the normal indication. (Without this operation, next operation cannot be started.)



REMARKS

- Do not change the Pr.~96 setting after completion of tuning (23).
 - If the Pr. 96 setting is changed, tuning data is invalid.
 - If the Pr. 96 setting is changed, tuning must be performed again.
- 4) If offline auto tuning ended in error (see the table below), motor constants are not set. Perform an inverter reset and restart tuning.

Error	Error Cause	Remedy	
Display	Elloi Cause		
8	Forced end	Set "21" in Pr. 96 and perform tuning again.	
9	Inverter protective function operation	Make setting again.	
91	Current limit (stall prevention) function was	Set "1" in <i>Pr. 156</i> .	
91	activated.	Set F1. 130.	
92	Converter output voltage reached 75% of rated	Check for fluctuation of power supply voltage.	
92	value.	Check for nuctuation of power supply voltage.	
93	Calculation error	Check the motor wiring and make setting again.	
93	A motor is not connected.	Set the rated current of the motor in Pr. 9.	

- 5) 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 normally. (The motor constants have not been set.)

 Perform an inverter reset and restart tuning.
- 6) After the tuning completes, set *Pr. 9 Electronic thermal O/L relay* again for the motor with the rated power supply of 200/220V(400/440V) 60Hz. Set the rated motor current multiplied by 1.1 in *Pr. 9*.



NOTE

- The motor constants measured once in the offline auto tuning are stored as parameters and their data are held until the offline auto tuning is performed again.
- An instantaneous power failure occurring during tuning will result in a tuning error.
 After power is restored, the inverter goes into the normal operation mode. Therefore, when STF (STR) signal is ON, the motor runs in the forward (reverse) rotation.
- Any alarm occurring during tuning is handled as in the ordinary mode. Note that if a fault retry has been set, retry is ignored.
- · The set frequency monitor displayed during the offline auto tuning is 0Hz.
- · The SU and FU signals are not output during a restart. They are output after the restart cushion time has elapsed.
- · Automatic restart operation will also be performed after a reset or when a retry is made by the retry function.



Mhen automatic restart after instantaneous power failure has been selected, the motor and machine will start suddenly (after the reset time has elapsed) after occurrence of an instantaneous power failure.

Stay away from the motor and machine.

When you have selected automatic restart after instantaneous power failure function, apply in easily visible places the CAUTION stickers supplied to the instruction manual (basic).

When the start signal is turned OFF or (RESE) is pressed during the restart cushion time after instantaneous power failure, deceleration starts after *Pr. 58 Restart cushion time* has elapsed.



Parameters referred to

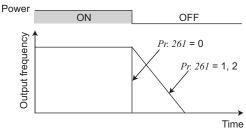
Pr. 7 Acceleration time, Pr. 21 Acceleration/deceleration time increments Refer to page 135
Pr. 13 Starting frequency Refer to page 138
Pr. 65, Pr. 67 to Pr. 69 Retry function Refer to page 188
Pr. 71 Applied motor Refer to page 144
Pr. 78 Reverse rotation prevention selection Refer to page 197
Pr. 180 to Pr. 184 (input terminal function selection) Refer to page 163
Pr. 190 to Pr. 192, Pr. 313 to Pr. 315 (output terminal function selection)

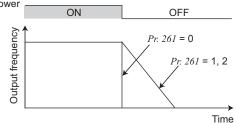
5.15.2 Power-failure deceleration stop function (Pr. 261)

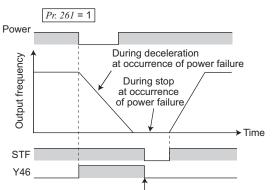
When a power failure or undervoltage occurs, the inverter can be decelerated to a stop or can be decelerated and reaccelerated to the set frequency.

Parameter	Name	Initial	Setting	Description
Number	Name	Value	Range	Description
261	Power failure stop selection	0	0 1 2	Coasts to stop. When undervoltage or power failure occurs, the inverter output is shut off. When undervoltage or a power failure occurs, the inverter can be decelerated to a stop. When undervoltage or a power failure occurs, the inverter can be decelerated to a stop. If power is restored during a power failure, the inverter accelerates again.

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)







Turn OFF STF once to make acceleration again

(1) Parameter setting

•When Pr. 261 is set to "1" or "2", the inverter decelerates to a stop if an undervoltage or power failure occurs.

Operation outline of deceleration to stop at power

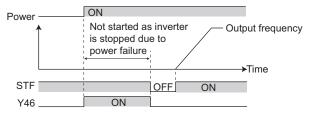
•When undervoltage or power failure has occurred, the output frequency is decreased and controlled so that the converter circuit (DC bus) voltage is constant and decreased to 0Hz to stop.

(3) Power failure stop function (Pr. 261 = "1")

•If power is restored during power failure deceleration, deceleration to a stop is continued and the inverter remains stopped. To restart, turn OFF the start signal once, then turn it ON again.

> REMARKS

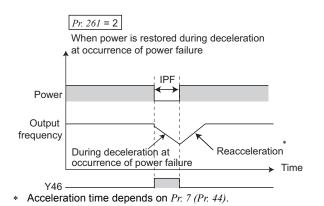
- When automatic restart after instantaneous power failure is selected (Pr. 57 ≠ "9999"), power failure stop function is invalid and automatic restart operation after instantaneous power failure is valid.
- Powering ON while a start signal (STF/STR) is being input via CC-Link communication does not start the motor if the powerfailure deceleration stop function has been set valid (Pr. 261 = "1"). After switching ON the power, turn OFF the start signal once and then ON again to make a start.

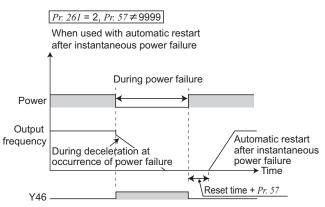




(4) Operation continuation at instantaneous power failure function (Pr. 261 = "2")

- •When power is restored during deceleration after a power failure, the inverter accelerates back up to the set frequency.
- •When this function is used in combination with the automatic restart after instantaneous power failure function(*Pr.57* ≠ "9999"), deceleration can be made at a power failure and acceleration can be made again after power restoration.







NOTE

When operation continuation at instantaneous power failure function is used, keep the starting signal (STF/STR) ON even during instantaneous power failure. If the starting signal turns OFF during instantaneous power failure, the inverter decelerates according to the deceleration time setting, causing the motor to coast if enough regenerative energy is not obtained.

(5) Power failure deceleration signal (Y46 signal)

- •The Y46 signal is ON during deceleration at an instantaneous power failure or during a stop after deceleration at an instantaneous power failure.
- •After a power failure stop, the inverter can not start even if power is restored the start command is given. In this case, check the power failure deceleration signal (Y46 signal). (at occurrence of input phase loss (E.ILF), etc.)
- •To assign the Y46 signal to the terminal Y0 or a virtual terminal of CC-Link communication, set "46 (positive logic)" or "146 (negative logic)" in one of *Pr.190 to Pr.192* and *Pr.313 to Pr.315 (output terminal function selection)*.



> REMARKS

During a stop or trip, the power failure stop selection is not performed.



NOTE

• Changing the assignment of the terminal Y0 or a virtual terminal of CC-Link communication with one of *Pr. 190 to Pr. 192*, and *Pr. 313 to Pr. 315 (output terminal function selection)* may affect other functions. Set parameters after confirming the function of the terminal Y0 and virtual terminals.



Even if the power failure stop function is valid, some loads may cause the inverter to trip and the motor to coast.

The motor will coast if enough regenerative energy is not given from the motor to the inverter.



Parameters referred to

Pr. 57 Restart coasting time Refer to page 180
Pr. 190 to Pr. 192, Pr. 313 to Pr. 315 (output terminal function selection) Refer to page 167

5.16 Operation setting at fault occurrence

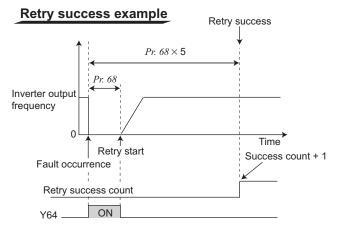
Purpose	Parameter th	nat should be Set	Refer to Page
Recover by retry operation at fault	Retry operation	Pr. 65, Pr. 67 to Pr. 69	188
occurrence	rion's operation	,	100
Do not output input/output phase	Input/output phase failure protection Pr. 251, Pr. 872		100
failure alarm			190
Detect an earth (ground) fault at	Earth (ground) fault detection at start Pr. 249		190
start			190

5.16.1 Retry function (Pr. 65, Pr. 67 to Pr. 69)

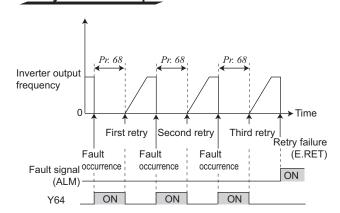
If a fault occurs, the inverter resets itself automatically to restart. You can also select the fault for a retry. When you have selected automatic restart after instantaneous power failure ($Pr. 57 Restart coasting time \neq 9999$), restart operation is performed at the retry operation time which is the same of that of a power failure. (Refer to page 180 for the restart function.)

Parameter	Name	Initial	Setting	Description
Number	Name	Value Range		Description
65	Retry selection	0	0 to 5	A fault for retry can be selected. (Refer to the next page)
			0	No retry function
			1 to 10	Set the number of retries at fault occurrence.
67	Number of retries at fault	0	1 10 10	A fault output is not provided during retry operation.
67	occurrence		101 to 110	Set the number of retries at fault occurrence. (The setting
				value of minus 100 is the number of retries.)
				A fault output is provided during retry operation.
68	Potry waiting time	v vveiting time		Set the waiting time from when an inverter fault occurs
30	Retry waiting time	1s	0.1 to 360s	until a retry is made.
69	Retry count display erase	0	0	Clear the number of restarts succeeded by retry.

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)



Retry failure example



- Retry operation automatically resets a fault and restarts the inverter at the starting frequency when the time set in Pr. 68 elapses after the inverter is tripped.
- Retry operation is performed by setting *Pr.* 67 to any value other than "0". Set the number of retries at fault occurrence in *Pr.* 67.
- When retries fail consecutively more than the number of times set in Pr. 67, a retry count excess fault (E.RET) occurs, resulting in inverter trip. (Refer to retry failure example)
- Use Pr. 68 to set the waiting time from when the inverter trips until a retry is made in the range 0.1 to 360s.
- Reading the *Pr.* 69 value provides the cumulative number of successful restart times made by retry.

The cumulative count in $Pr.\ 69$ is increased by 1 when a retry is regarded as successful after normal operation continues without faults occurring for more than four times longer than the time set in $Pr.\ 68$ after a retry start.

(When retry is successful, cumulative number of retry failure is cleared.)

- Writing "0" to Pr. 69 clears the cumulative count.
- During a retry, the Y64 signal is ON. To assign the Y64 signal to the terminal Y0 or a virtual terminal of CC-Link communication, set "64 (positive logic)" or "164 (negative logic)" in one of *Pr.190 to Pr.192* and *Pr.313 to Pr.315 (output terminal function selection)*.



- Using *Pr.* 65, you can select the fault that will cause a retry to be executed. No retry will be made for the fault not indicated. (*Refer to page 234* for the fault description.)
 - indicates the faults selected for retry.

Fault for	Pr. 65 Setting					
Retry	0	1	2	3	4	5
E.OC1	•	•		•	•	•
E.OC2	•	•		•	•	
E.OC3	•	•		•	•	•
E.OV1	•		•	•	•	
E.OV2	•		•	•	•	
E.OV3	•		•	•	•	
E.THM	•					
E.THT	•					
E. BE	•				•	
E. GF	•				•	

Fault for	Pr. 65 Setting					
Retry	0	1	2	3	4	5
E.USB	•				•	
E.OLT	•				•	
E.OPT	•				•	
E.OP1	•				•	
E. PE	•				•	
E.MB4	•				•	
E.MB5	•				•	
E.MB6	•				•	
E.MB7	•				•	
E.ILF	•				•	



NOTE

- Changing the assignment of the terminal Y0 or a virtual terminal of CC-Link communication with one of *Pr. 190 to Pr. 192, and Pr. 313 to Pr. 315 (output terminal function selection)* may affect other functions. Set the parameters after confirming the function of the terminal Y0 and virtual terminals.
- The data stored as the error reset for retry is only that of the fault which occurred the first time.
- When an inverter fault is reset by the retry function at the retry time, the accumulated data of the electronic thermal relay function, regeneration brake duty etc. are not cleared. (Different from the power-ON reset.)
- Retry is not performed if E.PE (Parameter storage device fault) occurred at power ON.
- If a fault that is not selected for a retry occurs during retry operation (retry waiting time), the retry operation stops while the fault indication is still displayed.



When you have selected the retry function, stay away from the motor and machine when the inverter is tripped. They will start suddenly (after the reset time has elapsed) after the inverter trip.

When you have selected the retry function, apply in easily visible places the CAUTION stickers supplied.



Parameters referred to

Pr. 57 Restart coasting time 👺 Refer to page 180

5.16.2 Input/output phase loss protection selection (Pr. 251, Pr. 872)

You can choose whether to make the input/output phase loss protection valid or invalid.

- Output phase loss protection is a function to stop the inverter output if one of the three phases (U, V, W) on the inverter's output side (load side) is lost.
- Input phase loss protection is a function to stop the inverter output if one of the three phases (R/L1, S/L2, T/L3) on the inverter's input side is lost.

Parameter Number	Name	Initial Value	Setting Range	Description
251	Output phase loss	4	0	Without output phase loss protection
251	protection selection	1	1	With output phase loss protection
070	Input phase loss protection	4	0	Without input phase loss protection
872 *	selection	1	1	With input phase loss protection

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)

(1) Output phase loss protection selection (Pr. 251)

- If phase loss occurs during inverter running (except for during DC brake operation, or output frequency is 1Hz or less), output phase loss protection (E.LF) activates, and inverter trips.
- When Pr. 251 is set to "0", output phase loss protection (E.LF) becomes invalid.

(2) Input phase loss protection selection (Pr. 872)

• When *Pr. 872* is set to "1", input phase loss protection (E.ILF) is provided if a phase loss of one phase among the three phases is detected for 1s continuously.



NOTE

- If an input phase loss continues for a long time, the converter section and capacitor lives of the inverter will be shorter.
- If the load is light or during a stop, lost phase cannot be detected because detection is performed based on the fluctuation of bus voltage. Large unbalanced phase-to-phase voltage of the three-phase power supply may also cause input phase loss protection (E.ILF).
- Phase loss can not be detected during regeneration load operation.

5.16.3 Earth (ground) fault detection at start (Pr. 249)

You can choose whether to make earth (ground) fault detection at start valid or invalid. Earth (Ground) fault detection is executed only right after the start signal is input to the inverter.

Protective function will not activate if an earth (ground) fault occurs during operation.

Parameter Number	Name	Initial Value	Setting Range	Description
240	Earth (ground) fault	0	0	Without earth (ground) fault detection
249	detection at start	U	1	With earth (ground) fault detection

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)



NOTE

- As detection is executed at start, output is delayed for approx. 20ms every start.
- If an earth (ground) fault is detected with "1" set in *Pr. 249*, output side earth (ground) fault overcurrent (E.GF) is detected and the inverter trips. (*Refer to page 240*)
- If the motor capacity is smaller than the inverter capacity of the 5.5K or higher, earth (ground) fault detection may not be provided.

^{*} Available only for the three-phase power input model.



5.17 Energy saving operation

Purpose	Parameter th	Refer to Page	
Energy saving operation	Optimum excitation control	Pr. 60	191

Optimum excitation control (Pr. 60)

Without a fine parameter setting, the inverter automatically performs energy saving operation. This operation is optimum for fan and pump applications

Parameter Number	Name	Initial Value	Setting Range	Description
60	Energy saving control	0	0	Normal operation mode
60	selection	0	9	Optimum excitation control mode

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)

- When "9" is set in *Pr.* 60, the inverter operates in the Optimum excitation control mode.
- The Optimum excitation control mode is a control system which controls excitation current to improve the motor efficiency to maximum and determines output voltage as an energy saving method.



• REMARKS

· When the motor capacity is too small as compared to the inverter capacity or two or more motors are connected to one inverter, the energy saving effect is not expected.



- When the Optimum excitation control mode is selected, deceleration time may be longer than the setting value. Since overvoltage alarm tends to occur as compared to the constant-torque load characteristics, set a longer deceleration
- Optimum excitation control functions only under V/F control. Optimum excitation control does not function under Advanced magnetic flux vector control and General-purpose magnetic flux vector control.
- Optimum excitation control will not be performed during an automatic restart after instantaneous power failure.
- · Since output voltage is controlled by Optimum excitation control, output current may slightly increase.



Parameters referred to

Advanced magnetic flux vector control Refer to page 114 General-purpose magnetic flux vector control **Refer to page 117 Pr. 57 Restart coasting time TF

5.18 Motor noise, EMI measures, mechanical resonance

Purpose of Use	Parameter that	should be Set	Refer to Page
Reduction of the motor noise Measures against EMI and leakage currents	Carrier frequency and Soft-PWM selection	Pr. 72, Pr. 240	192
Reduce mechanical resonance	Speed smoothing control	Pr. 653	193

5.18.1 PWM carrier frequency and soft-PWM control (Pr. 72, Pr. 240)

You can change the motor sound.

Parameter Number	Name	Initial Value	Setting Range	Description
72	PWM frequency selection	1	0 to 15	You can change the PWM carrier frequency. The setting is in [kHz]. Note that 0 indicates 0.7kHz and 15 indicates 14.5kHz.
240	Soft-PWM operation	1	0	Soft-PWM is invalid
240	selection		1	When $Pr. 72$ = "0 to 5", soft-PWM is valid.

The above parameters can be set when Pr.160 User group read selection = "0". (Refer to page 197)

(1) PWM carrier frequency changing (Pr. 72)

- •You can change the PWM carrier frequency of the inverter.
- •Changing the PWM carrier frequency produces an effect on avoiding the resonance frequency of a mechanical system or motor or on EMI measures or on leakage current reduction caused by the PWM switching.

(2) Soft-PWM control (Pr. 240)

•Soft-PWM control is a control method that changes the motor noise from a metallic tone into an unoffending complex tone.



NOTE

- Decreasing the PWM carrier frequency effect on EMI measures and on leakage current reduction, but increases motor noise.
- When PWM carrier frequency is set to 1kHz or less $(Pr.72 \le 1)$, fast response current limit may function prior to stall prevention operation due to increase in ripple currents, resulting in insufficient torque. In such case, set fast-response current limit operation invalid using Pr. 156 Stall prevention operation selection.
- When setting 2kHz or more in *Pr. 72* to perform operation in the place where the surrounding air temperature exceeding 40°C, caution should be taken as the rated inverter current should be reduced. (*Refer to page 266*)



Parameters referred to

Pr. 156 Stall prevention operation selection Refer to page 120

The above parameters allow their settings to be changed during operation even if "0" (initial value) is set in Pr. 77 Parameter write selection.



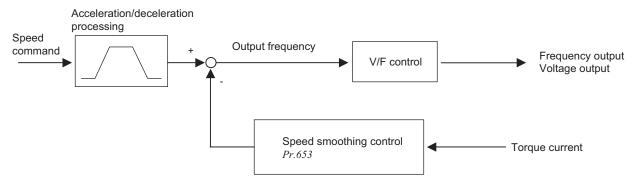
5.18.2 Speed smoothing control (Pr. 653)

Vibration due to mechanical resonance influences the inverter control, causing the output current (torque) unstable. In this case, the output current (torque) fluctuation can be reduced to ease vibration by changing the output frequency.

Parameter Number	Name	Initial Value	Setting Range	Description
653	Speed smoothing control	0	0 to 200%	Increase or decrease the value using 100% as reference to check an effect.

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)

(1) Control block diagram



(2) Setting method

If vibration due to mechanical resonance occurs, set 100% in *Pr. 653*, run the inverter at the frequency which generates maximum vibration and check if the vibration will be reduced or not after several seconds.

If effect is not produced, gradually increase the Pr. 653 setting and check the effect repeatedly until the most effective value is set in Pr. 653.

If vibration becomes large by increasing the Pr. 653 setting, gradually decrease the Pr. 653 setting than 100% to check the effect in a similar manner.



NOTE

Depending on the machine, vibration may not be reduced enough or an effect may not be produced.

5.19 Misoperation prevention and parameter setting restriction

Purpose	Parameter that should	l be Set	Refer to Page
Limits reset function	Reset selection/disconnected PU	Pr. 75	194
Stops from operation panel	detection/PU stop selection	selection Pr. 75	
Prevention of parameter rewrite	Parameter write disable selection	Pr. 77	196
Prevention of reverse rotation of the motor	Reverse rotation prevention selection	Pr. 78	197
Diaplaya nagagary parameters	Display of applied parameters and	Pr. 160,	197
Displays necessary parameters	user group function	Pr. 172 to Pr. 174	197
Parameter restriction using password	Password function	Pr. 296, Pr. 297	199
Control of parameter write by communication	EEPROM write selection	Pr. 342	110

5.19.1 Reset selection/PU stop selection (Pr. 75)

You can select the reset input acceptance and operation panel stop function.

Parameter Number	Name	Initial Value	Setting Range	Description
75	Reset selection/PU stop selection	14	0 to 3, 14 to 17	For the initial value, reset always enabled, and with operation panel stop function are set.

[•] The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)

[•] This parameter allows its setting to be changed during operation in any operation mode even if "0 (initial value) or 1" is set in *Pr. 77 Parameter write selection*. Also, if parameter (all) clear is executed, this setting will not return to the initial value.

Pr. 75	Reset Selection	PU Stop Selection	
Setting		·	
0, 2	Reset input is always enabled	Pressing (STOP) decelerates the motor to a stop only	
1, 3	Reset input is enabled only when the fault occurs.	in the PU operation mode.	
14(initial value), 16	Reset input is always enabled	Pressing (STOP) decelerates the motor to a stop in	
15, 17	Reset input is enabled only when the fault occurs.	either of the PU or Network operation mode.	

(1) Reset selection

- •You can select the enable condition of reset function (reset command through CC-Link communication) input.
- •When Pr. 75 is set to any of "1, 3, 15, 17", a reset can be input only when the inverter is tripped.



NOTE

- When the reset is input during operation, the motor coasts since the inverter being reset shuts off the output.
- When reset is performed, cumulative values of electronic thermal O/L relay, regenerative brake duty are cleared.
- $\frac{\overline{\text{STOP}}}{\overline{\text{RESEI}}}$ on the operation panel is only valid when the inverter is tripped, independently of the *Pr.75* setting.

(2) PU stop selection

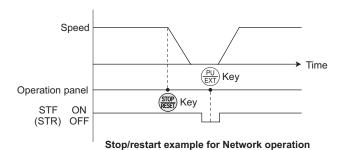
- •Set Pr. 75 = "14" to "17" to enable (RESET) on the operation panel to command emergency stop in PU and Network operation
- •When the inverter is stopped by the PU stop function, " 🗗 💆 " (PS) is displayed. A fault output is not provided.
- •After the motor is stopped from the PU, it is necessary to perform PU stop (PS) reset to restart. PS reset can be made from the operation panel.
- •PS reset can be also made by resetting the power or transmitting a reset command via CC-Link communication. The motor can restart after the PS reset.
- •When Pr. 75 is set to any of "0 to 3", PU stop (PS display) is invalid, deceleration to a stop by (RESET) is valid only in the PU operation mode.

• REMARK

During operation in the PU operation mode through USB communication, the motor decelerates to stop (PU stop) when entered from the operation panel (STOP) .

(3) How to restart the motor stopped by (RESET) input in the Network operation mode (PU stop (PS) reset method)





- 1)After completion of deceleration to a stop, switch OFF the STF or STR signal.
- 3)Press $\stackrel{\text{PU}}{\left(\text{EXT}\right)}$ to return to $\stackrel{\text{NET}}{=}$.
- 4)Switch ON the STF or STR signal.
- •The motor can be also restarted by resetting the power or transmitting a reset command via CC-Link communication.



(I) REMARKS

If Pr. 250 Stop selection is set to other than "9999" to select coasting to a stop, the motor will not be coasted to a stop but decelerated to a stop by the PU stop function during CC-Link communication operation.



not reset the inverter while the start signal is being input.

Otherwise, the motor will start instantly after resetting, leading to potentially hazardous conditions.



Parameters referred to

Pr. 250 Stop selection Refer to page 157

5.19.2 Parameter write disable selection (Pr. 77)

You can select whether write to various parameters can be performed or not. Use this function to prevent parameter values from being rewritten by misoperation.

Parameter Number	Name	Initial Value	Setting Range	Description
	Parameter write selection	0	0	Write is enabled only during a stop.
77			1	Parameter can not be written.
11			2	Parameter write is enabled in any operation
				mode regardless of operation status.

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)

Pr. 77 can be always set independently of the operation mode and operation status. It cannot be set via CC-Link communication.

(1) Write parameters only during stop (setting "0" initial value)

- •Parameters can be written only during a stop in the PU operation mode.
- •The shaded parameters in the parameter list (page 84) can always be written regardless of the operation mode and operating status. However, Pr. 72 PWM frequency selection, Pr. 240 Soft-PWM operation selection, and Pr. 275 Stop-on contact excitation current low-speed multiplying factor can be written when the inverter is running in the PU operation mode, but cannot be written in the Network operation mode.

(2) Inhibit parameter write (setting "1")

- Parameter write is not enabled.
 (Read is enabled.)
- Parameter clear and all parameter clear cannot be performed, either.
- •The parameters given on the right can be written if Pr: 77 = "1". (The setting values of Pr:77 and Pr:79, however, cannot be changed via CC-Link communication.)

Parameter Number	Name
22	Stall prevention operation level
75	Reset selection/PU stop selection
77	Parameter write selection
79	Operation mode selection
160	User group read selection
296	Password lock level
297	Password lock/unlock

(3) Write parameters during operation (setting "2")

- •Parameters can always be written.
- •The following parameters cannot be written when the inverter is running if Pr. 77 = "2". Stop the inverter when changing their parameter settings.

Parameter	Name
Number	Name
23	Stall prevention operation level compensation
25	factor at double speed
40	RUN key rotation direction selection
48	Second stall prevention operation current
60	Energy saving control selection
61	Reference current
66	Stall prevention operation reduction starting
00	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 constants)

Parameter	Name
Number	Name
96	Auto tuning setting/status
180 to 184	(input terminal function selection)
190 to 192	(output terminal function selection)
277	Stall prevention operation current switchover
292	Automatic acceleration/deceleration
293	Acceleration/deceleration separate selection
298	Frequency search gain
450	Second applied motor
541	Frequency command sign selection (CC-Link)
800	Control method selection
859	Torque current



Parameters referred to

Pr. 79 Operation mode selection 👺 Refer to page 103



5.19.3 Reverse rotation prevention selection (Pr. 78)

This function can prevent reverse rotation fault resulting from the incorrect input of the start signal.

Parameter Number	Name	Initial Value	Setting Range	Description
	Reverse rotation prevention selection	0	0	Both forward and reverse rotations allowed
78			1	Reverse rotation disabled
			2	Forward rotation disabled

The above parameters can be set when *Pr. 160 User group read selection* = "0". (*Refer to page 197*)

- Set this parameter when you want to limit the motor rotation to only one direction.
- This parameter accepts the command from (RUN) on the operation panel or the forward and reverse rotation commands transmitted through communication.

5.19.4 Extended parameter display and user group function (Pr. 160, Pr. 172 to Pr. 174)

Parameters that can be read from the operation panel can be restricted.



POINT

Any parameter can be read via CC-Link communication regardless of the Pr. 160 setting.

Parameter Number	Name	Initial Value	Setting Range	Description
	User group read selection	0	9999	Displays only the simple mode parameters
160 *3			0	Displays simple mode + extended parameters
100 49			1	Displays the parameters registered in the user group.
172 *1	User group registered display/batch clear	0	(0 to 16)	Displays the number of cases registered as a user group (reading only)
			9999	Batch clear the user group registration
173 *1, *2	User group registration	9999	0 to 999, 9999	Sets the parameter numbers to be registered to the user group
174 *1, *2	User group clear	9999	0 to 999, 9999	Sets the parameter numbers to be cleared from the user group

- *1 The above parameters can be set when Pr. 160 User group read selection = "0".
- *2 The values read from *Pr. 173 and Pr. 174* are always "9999".
- *3 This parameter allows its setting to be changed during operation in any operation mode even if "0 (initial value) or 1" is set in *Pr. 77 Parameter write selection*.

(1) Display of simple mode parameters and extended parameters (Pr. 160)

- •When Pr. 160 = "9999", only the simple mode parameters can be displayed on the operation panel. (Refer to the parameter list, page 84, for the simple mode parameters.)
- •In the initial setting (Pr. 160 = "0") status, simple mode parameters and extended parameters can be displayed.

(2) User group function (Pr. 160, Pr. 172 to Pr. 174)

- •The user group function is designed to display only the parameters necessary for setting.
- •From among all parameters, 16 parameters maximum can be registered in the user group. When *Pr. 160* is set to "1", only the parameters registered to the user group can be accessed. (The parameters not registered in the user group can not be read.)
- •To set a parameter in the user group, set its parameter number in Pr. 173.
- •To delete a parameter from the user group, set its parameter number to *Pr. 174*. Set "9999" in *Pr. 172* to batch delete parameters registered.

(3) Registration of parameter to user group (Pr. 173)

When registering Pr. 3 to user group

- Operation -

- Confirm the operation display and operation mode display.
 - The inverter should be at a stop.
 - Make sure that the inverter is in PU operation mode.
- 2. Press (MODE) to choose the parameter setting mode.
- 3. Turn to change the set value to
- 4. Press (SET) to display 9999.
- 5. Turn until Pr. 3 appears.
- 6. Press (SET) to set.
 "P. 173" and "3" are displayed a

"P. 173" and "3" are displayed alternately. To continue parameter registration, repeat steps 3 to 6.

- Display -





Parameter setting mode



Displays Pr. 173 User group registration



When *Pr. 173* is read, "9999" is displayed



Select the parameter number to be registered.





or Posistration of By 2 to 1

Flicker...Registration of *Pr. 3* to user group completed!!

(4) Deletion of parameter from user group (Pr. 174)

When deleting Pr. 3 from user group

Operation -

- Confirm the operation display and operation mode display.
 - The inverter should be at a stop.
 - The inverter should be in the PU operation mode.
- 2. Press (MODE) to choose the parameter setting mode.
- 3. Turn until 🖰 ! 🤼 appears.
- 4. Press (SET) to display " 9999"
- 5. Turn until Pr. 3 appears.
- 6. Press (SET) to set.

"P. 174" and "3" are displayed alternately. To continue parameter clear, repeat steps 3 to

---- Display -



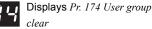




Parameter setting mode











When *Pr. 174* is read, "9999" is displayed





Select the parameter number to be registered.







Flicker...Clear of Pr. 3 to user group completed!!

• REMARKS

- Pr. 77 and Pr. 160 can always be read, independently of the user group setting.
- Pr. 77, Pr. 160 and Pr. 172 to Pr. 174 cannot be registered to the user group.
- When Pr. 174 is read, "9999" is always displayed. Although "9999" can be written, no function is available.
- When any value other than "9999" is set to Pr. 172, no function is available.



5.19.5 Password function (Pr. 296, Pr. 297)

Registering a 4-digit password can restrict parameter reading/writing.

Parameter Number	Name	Initial Value	Setting Range	Description
296 *1	Password lock level	9999	0 to 6, 99, 100 to 106, 199 *4	Select restriction level of parameter reading/ writing when a password is registered.
	T dooword look love.		9999	No password lock
	Password lock/unlock	9999	1000 to 9998	Register a 4-digit password
297 *2			(0 to 5) *3	Displays password unlock error count. (Reading only) (Valid when <i>Pr. 296</i> = "100" to "106")
			9999 *3	No password lock

The above parameters allow their settings to be changed during operation in any operation mode even if "0 (initial value) or 1" is set in *Pr. 77 Parameter write selection*.

- *1 This parameter can be set when Pr. 160 User group read selection = "0."
- *2 If Pr. 296 = "9999" (no password lock), Pr. 297 can be set while Pr. 160 = "0." When the password lock is valid, Pr. 297 can be set regardless of the Pr. 160 setting.
- *3 Pr. 297 can be written as "0 or 9999," but the Pr. 297 setting does not change.
- *4 Do not set Pr.296 to "0" or "100." Doing so will activate the option fault (E.OPT) and trip the inverter.

(1) Parameter reading/writing restriction level (Pr. 296)

•Level of reading/writing restriction by PU/NET mode operation command can be selected by Pr. 296.

Pr. 296 Setting	Command from the Operation Panel		Command through CC-Link Communication	
	Read *1	Write *2	Read	Write *2
9999	0	0	0	0
0, 100	Optio	on fault (E.OPT) occu	irs, and the inverter	trips.
1, 101	0	×	0	×
2, 102	0	×	0	0
3, 103	0	0	0	×
4, 104	×	×	0	×
5, 105	×	×	0	0
6, 106	0	0	0	×
99, 199	Only parameters registered in the user group can be read/written. *3 (For the parameters not registered in the user group, same restriction level as "4, 104" applies.)			

O: enabled, x: restricted

- *1 If the parameter reading is restricted by the Pr. 160 setting, those parameters are unavailable for reading even when "O" is indicated.
- *2 If the parameter writing is restricted by the Pr. 77 setting, those parameters are unavailable for writing even when "O" is indicated.
- *3 Read/write is enabled only in the simple mode parameters registered in the user group when Pr. 160 User group read selection = "9999". Pr. 296 and Pr. 297 are always read/write enabled whether registered to a user group or not.

(2) Password lock/unlock (Pr. 296, Pr. 297)

<Lock>

• Set parameter reading/writing restriction level. (Pr. 296 ≠ 9999)

Pr. 296 Setting Restriction of Password Unlock Error		Pr. 297 Display
0 to 6, 99	No restriction	Always 0
100 to 106, 199	Restricted at fifth error	Displays error count (0 to 5)

- * During [*Pr. 296* = any of "100 to 106, 199"], if password unlock error has occurred 5 times, correct password will not unlock the restriction. All parameter clear can unlock the restriction. (In this case, parameter settings are cleared.)
- Write a four-digit number (1000 to 9998) in *Pr. 297* as a password.
 (When *Pr. 296* = "9999", *Pr. 297* cannot be written.)

When password is registered, parameter reading/writing is restricted with the restriction level set in Pr. 296 until unlocking.





> REMARKS

- After registering a password, a read value of Pr. 297 is always one of "0" to "5".
- When a password restricted parameter is read/written, L [[] d is displayed.
- Even if a password is registered, parameters which the inverter itself writes, such as inverter parts life, are overwritten as needed.

<Unlock>

There are two ways of unlocking the password.

- Enter a password in Pr. 297.
 - Unlocked when a password is correct. If a password is incorrect, an error occurs and not unlocked.
 - During [Pr. 296 = any of "100 to 106, 199"], if password unlock error has occurred 5 times, correct password will not unlock the restriction. (During password lock)
- · Perform all parameter clear.



NOTE

- If the password has been forgotten, perform all parameter clear to unlock the parameter restriction. In that case, other parameters are also cleared.
- Parameter all clear can not be performed during the operation.
- Do not use the FR Configurator when parameter read is restricted (*Pr. 296* = any of "0, 4, 5, 99, 100, 104, 105, 199"). FR Configurator may not function properly.



> REMARKS

• The password unlock method is different for operation panel and CC-Link communication.

	Operation panel	CC-Link communication	
All parameter clear	0	0	
(communication instruction code H9966, H55AA)		\cup	
Parameter clear	V	0	
(communication instruction code H9696, H5A5A)	^	\cup	

O:Password can be unlocked. x:Password cannot be unlocked.

(3) Parameter operation during password lock/unlock

Parameter operation		Unlo	cked	Password registered	Locked
		Pr. 296 = 9999 Pr. 297 = 9999	<i>Pr.</i> 296 ≠ 9999 <i>Pr.</i> 297 = 9999	<i>Pr. 296 ≠</i> 9999 <i>Pr. 297</i> = 0 to 4 (Read value)	Pr. 296 = 100 to 106, 199 Pr. 297 = 5 (Read value)
Pr. 296	Read	O *1	0	0	0
11. 270	Write	O *1	O *1	×	×
Pr. 297	Read	O *1	0	0	0
Pr. 29/	Write	×	0	0	O *3
Performing parameter clear		0	0	× *4	× *4
Performing par	rameter all clear	0	0	O *2	O *2

O: enabled, x: restricted

- *1 Reading/writing is unavailable when there is restriction to reading by the Pr. 160 setting. (Reading is available in NET mode regardless of Pr. 160 setting.)
- *2 Unavailable during the operation.
- *3 Correct password will not unlock the restriction.
- *4 Parameter clear is available only from the CC-Link communication option.



Parameters referred to

Pr. 77 Parameter write selection 👺 Refer to page 196

Pr. 160 Extended function display selection 👺 Refer to page 197



5.20 Special operation and frequency control

Purpose	Parameter t	hat should be Set	Refer to Page
Perform jog operation	Jog operation	Pr. 15, Pr. 16	201
Perform process control such as pump and air volume.	PID control	Pr. 127 to Pr. 132, Pr. 134, Pr. 125, C2	203
Frequency control appropriate for load torque	Droop control	Pr. 286, Pr. 287	210
Avoid overvoltage alarm due to regeneration by automatic adjustment of output frequency	Regeneration avoidance function	Pr. 882, Pr. 883, Pr. 885, Pr. 886	211

5.20.1 JOG operation (Pr. 15, Pr. 16)

You can set the frequency and acceleration/deceleration time for JOG operation. JOG operation can be performed from the operation panel.

This operation can be used for conveyor positioning, test operation, etc.

Parameter Number	Name	Initial Value	Setting Range	Description
15	Jog frequency	5Hz	0 to 400Hz	Frequency for Jog operation.
16	Jog acceleration/ deceleration time	0.5s	0 to 3600/ 360s *	Acceleration/deceleration time for Jog operation. As the acceleration/deceleration time, set the time taken to reach the frequency (initial value is 60Hz) set in <i>Pr. 20 Acceleration/deceleration reference frequency</i> . Acceleration/deceleration time can not be set separately.

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)

^{*} When the *Pr. 21 Acceleration/deceleration time increments* setting is "0" (initial value), the setting range is "0 to 3600s" and setting increments is "0.1s". When the setting is "1", the setting range is "0 to 360s" and the setting increments is "0.01s".

(1) Jog operation from operation panel

•Selects Jog operation mode from the operation panel. Operation is performed only while the start button is pressed.

Operation -

- 1. Confirmation of the operating status indicator and operation mode indicator
 - The monitor mode should have been selected.
 - The inverter should be at a stop.
- 2. Press $\frac{PU}{EVT}$ to choose the PU Jog operation mode.
- 3. Press (RUN)
 - While (RUN) is pressed, the motor rotates.
 - The motor runs at 5Hz. (Pr. 15 initial value)
- 4. Release (RUN)











Display -

[When changing the frequency of PU Jog operation]

5. Press (MODE) to choose the parameter setting mode.



PRM indicator is lit



(The parameter number read previously appears.)

- **6.** Turn until *Pr. 15 Jog frequency* appears.
- 7. Press (SET) to show the currently set value. (5Hz)
- 8. Turn to set the value to " ![[[][]". (10Hz)
- 9. Press (SET) to set.











Flicker...Parameter setting complete!!

10. Perform the operations in steps 1 to 4. The motor rotates at 10Hz.



NOTE

- When Pr. 29 Acceleration/deceleration pattern selection = "1" (S-pattern acceleration/deceleration A), the acceleration/ deceleration time is the period of time required to reach Pr. 3 Base frequency.
- The Pr. 15 setting should be equal to or higher than the Pr. 13 Starting frequency.
- During Jog operation, the second acceleration/deceleration via the RT signal cannot be selected. (The other second functions are valid. (Refer to page 165))



Parameters referred to

- Pr. 13 Starting frequency Refer to page 138
- Pr. 20 Acceleration/deceleration reference frequency, Pr. 21 Acceleration/deceleration time increments Refer to page 135
 Pr. 29 Acceleration/deceleration pattern selection Refer to page 139



5.20.2 PID control (Pr. 125, Pr. 127 to Pr. 132, Pr. 134, C2)

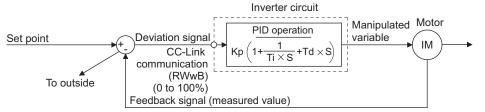
The inverter can be used to exercise process control, e.g. flow rate, air volume or pressure. Use the value set in the CC-Link communication register (RWw9) as the set point, and the value set in the CC-Link communication register (RWwA) as the feedback value. With these values, configure a feedback system and perform PID control.

Parameter	Name	Initial	Setting		Description	
Number	Name	Value	Range		Description	
127	PID control automatic	9999	0 to 400Hz	Frequency at which t	the control is automatically changed to PID control.	
121	switchover frequency	9999	9999	Without PID automatic switchover function		
			0	PID action is not per	formed	
			20, 21, 40 to 43	For manufacturer se	tting. Do not set.	
128	PID action selection	0	50	PID reverse action	Deviation value signal input (CC-Link	
			51	PID forward action	communication)	
			60	PID reverse action	Measured value, set point input (CC-Link	
			61	PID forward action	communication)	
				If the proportional ba	and is narrow (parameter setting is small), the	
			0.1 to	•	e varies greatly with a slight change of the	
129 *1	PID proportional band	100%	1000%		nce, as the proportional band narrows, the	
120	i i proportional band	10070	100070		(gain) improves but the stability deteriorates, e.g.	
					Kp= 1/proportional band	
			9999	No proportional cont		
					is input, time (Ti) is the time required for integral (I)	
400	n.n		0.1 to	action to provide the same manipulated variable as the proportional (P)		
130 *1	PID integral time	1s	3600s	action. As the integral time decreases, the set point is reached earlier		
			0000	but hunting occurs more easily.		
			9999	No integral control.		
		9999	0 to	Maximum value	average the potting the FUD signal is suffered. The	
131	PID upper limit		100%	If the feedback value exceeds the setting, the FUP signal is output. The		
			9999	No function	e measured value is equivalent to 100%.	
			שששש	Minimum frequency		
			0 to	. ,	falls below the setting range, the FDN signal is	
132	PID lower limit	9999	100%	output. The maximum input of the measured value is equivalent to		
		2200	10070	100%.		
			9999	No function		
					nput, time (Td) required for providing only the	
404	DID differential times	0000	0.01 to		e for the proportional (P) action. As the differential	
134 *1	PID differential time	9999	10.00s	-	ter response is made to a deviation change.	
			9999	No differential contro	-	
405	Frequency setting	0011	0 to	Outrot for	4000/ designificant and DID	
125	gain	60Hz	400Hz	Output frequency at	100% deviation input under PID control	
	Frequency setting		0 to			
C2	bias	0Hz	400Hz	Output frequency at	0% deviation input under PID control	
The above parameters can be set when Pr 160 User group read selection ="0" (Refer to page 197)						

The above parameters can be set when Pr. 160 User group read selection ="0". (Refer to page 197)

(1) PID control basic configuration

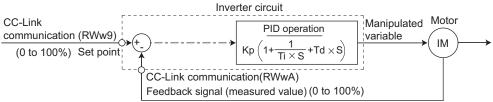
•*Pr. 128* = "50, 51" (measured value input)



Kp: Proportionality constant Ti: Integral time S: Operator Td: Differential time

^{*1} This parameter allows its setting to be changed during operation in any operation mode even if "0" (initial value) is set in *Pr. 77 Parameter write selection*.

•Pr. 128 = "60, 61" (measured value input)



Kp: Proportionality constant Ti: Integral time S: Operator Td: Differential time

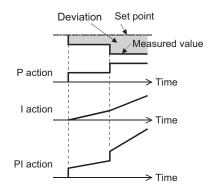
(2) PID action overview

1)PI action

A combination of proportional control action (P) and integral control action (I) for providing a manipulated variable in response to deviation and changes with time.

[Operation example for stepped changes of process value]

(Note) PI action is the sum of P and I actions.

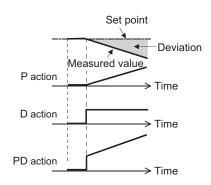


2)PD action

A combination of proportional control action (P) and differential control action (D) for providing a manipulated variable in response to deviation speed to improve the transient characteristic.

[Operation example for proportional changes of process value]

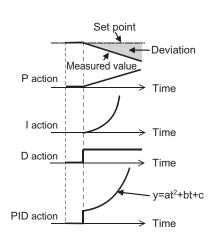
(Note) PD action is the sum of P and D actions.



3)PID action

The PI action and PD action are combined to utilize the advantages of both actions for control.

(Note) PID action is the sum of P, I and D actions.





4)Reverse operation

Increases the manipulated variable (output frequency) if deviation X = (set point - measured value) is positive, and decreases the manipulated variable if deviation is negative.



5)Forward operation

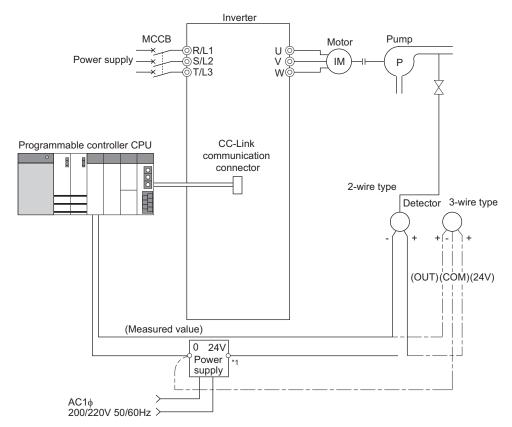
Increases the manipulated variable (output frequency) if deviation X = (set point - measured value) is negative, and decreases the manipulated variable if deviation is positive.



Relationships between deviation and manipulated variable (output frequency)

	Devi	ation
	Positive	Negative
Reverse action	71	K
Forward action	ĸ	71

(3) Connection diagram



*1 The power supply must be selected in accordance with the power specifications of the detector used.

(4) I/O signals and parameter setting

- •Set "50, 51, 60 or 61" in Pr. 128 to perform PID operation.
- Set "14" in any of Pr. 180 to Pr. 184 (input terminal function selection) to assign the PID control selection signal (X14) to turn the X14 signal ON.

When the X14 signal is not assigned, only the Pr. 128 setting makes PID control valid.

• Enter the set point and measured value via CC-Link communication.



REMARKS

- When Pr. 128 = "0" or X14 signal is OFF, normal inverter operation is performed without PID action.
- Turning ON/OFF of bit of the virtual terminal, to which X14 signal is assigned through CC-Link communication, enables PID

	Signal Terminal Used		Function	Description	Parameter Setting	
	X14	Depending on	PID control	Turn ON X14 signal to perform PID	Set 14 in any of <i>Pr. 180</i> to <i>Pr.</i>	
	Pr. 180 to Pr. 184		selection	control. *1	184.	
Input			Deviation value	Inputs the deviation value from CC-Link	<i>Pr. 128</i> = 50, 51	
프	CC-Link	_	input	communication.	17. 120 00, 01	
	Communication		Set point, measured	Inputs the set point and measured value	<i>Pr. 128</i> = 60, 61	
			value input	from CC-Link communication.	17. 120 – 60, 61	
				Output to indicate that the measured	<i>Pr. 128</i> = 60, 61	
	FUP		Upper limit output	value signal exceeded the maximum	<i>Pr. 131</i> ≠ 9999	
	FOF			value (Pr. 131).	Set 15 or 115 in any of <i>Pr. 190</i>	
				value (17. 131).	to Pr. 192, Pr. 313 to Pr. 315. *2	
		Depending on	Depending on			<i>Pr. 128</i> = 60, 61
	FDN			Lower limit output	Output when the measured value signal	<i>Pr. 132</i> ≠ 9999
Output	I DIN	Pr. 190 to Pr. 192,	Lower minic output	Lower mint output	falls below the minimum value (Pr. 132).	Set 14 or 114 in any of Pr. 190
Out		Pr. 313 to Pr. 315			to Pr. 192, Pr. 313 to Pr. 315. *2	
		17. 313 10 17. 313	Forward (reverse)	"Hi" is output to indicate that the output		
	RL		rotation direction	indication of the operation panel is	Set 16 or 116 in any of Pr. 190	
	KL		forward rotation or "Low" to indicate that	to Pr. 192, Pr. 313 to Pr. 315. *2		
			output	it is reverse rotation or stop.		
	PID		During PID control	Turns ON during PID control.	Set 47 or 147 in any of Pr. 190	
	טו ו		activated	Turns On during Fib Control.	to Pr. 192, Pr. 313 to Pr. 315. *2	

When the X14 signal is not assigned, only the Pr. 128 setting makes PID control valid.

When 100 or larger value is set in any of Pr. 190 to Pr. 192, Pr. 313 to Pr. 315 (output terminal function selection), the terminal output has negative logic. (For details, Refer to page 167)



NOTE

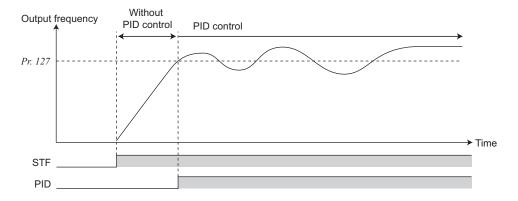
• Changing the assignment of the terminal Y0 or a virtual terminal of CC-Link communication with one of Pr. 180 to Pr. 184, Pr. 190 to Pr. 192, and Pr. 313 to Pr. 315 may affect other functions.

Set parameters after confirming the function of the terminal Y0 and virtual terminals.



(5) PID automatic switchover control (Pr. 127)

- •The system can be started up without PID control only at a start.
- •When the frequency is set to *Pr. 127 PID control automatic switchover frequency* within the range 0 to 400Hz, the inverter starts up without PID control from a start until output frequency is reached to the set frequency of *Pr. 127*, and then it shifts to PID control. Once the system has entered PID control operation, it continues PID control if the output frequency falls to or below *Pr.127*.

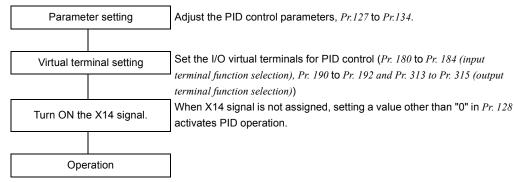


(6) PID monitor function

- •The PID control set point, measured value and deviation value can be displayed on the operation panel.
- •Integral value indicating a negative % can be displayed on the deviation monitor. 0% is displayed as 1000.
- •For each monitor, set the following value in Pr. 52 DU/PU main display data selection.

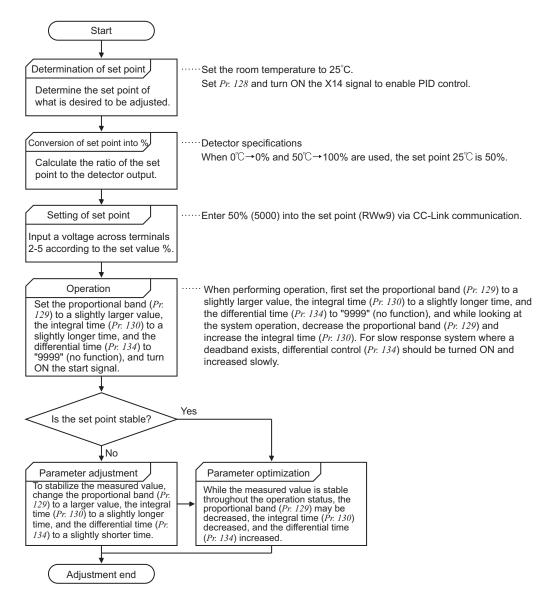
Setting	Monitor Description	Minimum Increments	Remarks
52	PID set point	0.1%	
53	PID measured value	0.1%	_
54	PID deviation	0.1%	Displays 1000 when the PID deviation is 0%.

(7) Adjustment procedure



(8) Calibration example

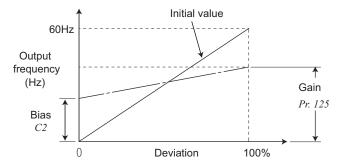
Set the room temperature to be 25°C with PID control, which has its set point commanded though the master module to the inverter.





(9) Changing the frequency at a deviation input (Pr.125, C2)

- •To change the output frequency at 0% deviation, set the new frequency in C2 Frequency setting bias (initially 0Hz).
- •To change the output frequency at 100% deviation, set the new frequency in Pr. 125 Frequency setting gain (initially 60Hz).



7

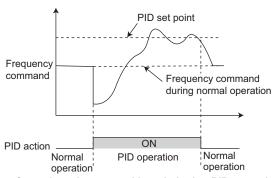
NOTE

- If the RH, RM, RL signal (multi-speed) or JOG operation is entered with the X14 signal ON, PID control is stopped and multi-speed or Jog operation started.
- With the following setting, PID control is invalid.

Pr. 79 Operation mode selection ="6" (switchover mode)

When the inverter is at a stop with Pr. 261 Power failure stop selection selected.

- Changing the assignment of the terminal Y0 or a virtual terminal of CC-Link communication with one of *Pr. 180 to Pr. 184*, *Pr. 190 to Pr. 192*, and *Pr. 315* may affect other functions. Set parameters after confirming the function of the terminal Y0 and virtual terminals.
- The remote operation function is invalid during PID operation.
- When the control is switched to PID control during normal operation, the frequency command value calculated by PID operation using 0Hz as standard is used without the frequency during the operation.



Operation when control is switched to PID control during normal operation



Parameters referred to

Pr. 59 Remote function selection Refer to page 132

Pr. 79 Operation mode selection Refer to page 103

Pr. 180 to Pr. 184 (input terminal function selection) The Refer to page 163

Pr. 190 to Pr. 192, Pr. 313 to Pr. 315 (output terminal function selection) TF Refer to page 167

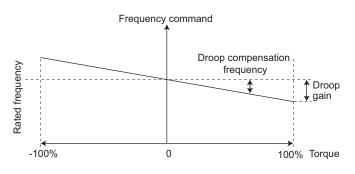
Pr. 261 Power failure stop selection Refer to page 186

5.20.3 Droop control (Pr. 286, Pr. 287) ADMEVC

This function is designed to balance the load in proportion to the load torque to provide the speed drooping characteristic under Advanced magnetic flux vector control.

This function is effective for balancing the load when using multiple inverters.

Parameter	Name	Initial	Setting	Description	
Number	Name	Value	Range	Description	
			0	Droop control is invalid (Normal operation)	
286	Droop gain	0%	0.1% to 100%	Droop control is valid Drooping amount at the rated torque as a percentage with respect to the rated motor frequency.	
287	Droop filter time constant	0.3s	0 to 1s	Time constant of the filter applied on the torque current.	



Droop compensation frequency = Torque current after filtering Rated value of torque current

(1) Droop control

- The output frequency is changed according to the magnitude of torque current under Advanced magnetic flux vector control.
 The drooping amount at the rated torque is set by the droop gain as a percentage using the rated frequency as a reference.
- The maximum droop compensation frequency is 120Hz.

REMARKS

• Set the droop gain to about the rated slip of the motor.

- Droop control is invalid during PID control operation.
- The maximum value of frequency after droop compensation is either 120Hz or Pr. 1 Maximum frequency, whichever is smaller.

Parameters referred to

Pr. 1 Maximum frequency Refer to page 124
PID control Refer to page 203



5.20.4 Regeneration avoidance function (Pr. 665, Pr. 882, Pr. 883, Pr. 885, Pr. 886)

This function detects a regeneration status and increases the frequency to avoid the regenerative status.

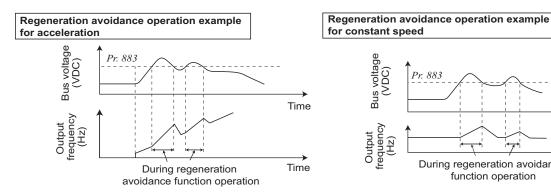
 Possible to avoid regeneration by automatically increasing the frequency and continue operation if the fan happens to rotate faster than the set speed due to the effect of another fan in the same duct.

Parameter Number	Name	Initial Value		Setting Range	Description	
	Regeneration			0	Regeneration avoidance function invalid	
882	G	0		1	Regeneration avoidance function is always valid	
302	selection			2	Regeneration avoidance function is valid only during a constant speed operation	
883	Regeneration avoidance operation	200V 400 class VDC	300 to 800V	Bus voltage level at which regeneration avoidance operates. When the bus voltage level is set to low, overvoltage error will be less apt		
level	_	400V class	780 VDC)	to occur. However, the actual deceleration time increases. The set value must be higher than the "power supply voltage \times $\sqrt{2}$ ".	
	Regeneration avoidance			0 to 10Hz	Limit value of frequency which rises at activation of regeneration avoidance function.	
885	compensation frequency limit value	6Hz		9999	Frequency limit invalid	
886	Regeneration avoidance voltage gain	100%		0 to 200%	Responsiveness at activation of regeneration avoidance. A larger setting will improve responsiveness to the bus voltage change. However, the output frequency could become unstable.	
665	Regeneration avoidance frequency gain			0 to 200%	When vibration is not suppressed by decreasing the $Pr.~886$ setting, set a smaller value in $Pr.~665$.	

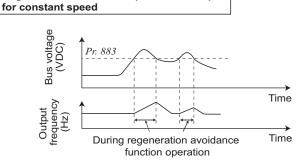
The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)

(1) What is regeneration avoidance function? (Pr. 882, Pr. 883)

- •When the regeneration load is large, the DC bus voltage rises and an overvoltage fault (E. OV□) may occur. When this bus voltage rise is detected and the bus voltage level reaches or exceeds Pr. 883, increasing the frequency avoids the regeneration status.
- •The regeneration avoidance function is always ON when "1" is set in Pr. 882 and activated only during a constant speed when "2" is set in Pr. 882.



Regeneration avoidance



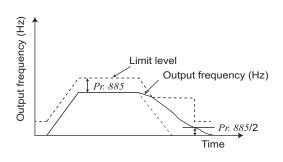
operation example for deceleration Bus voltage Pr. 883 (VDC) Time Output frequency (Hz) During regeneration Time avoidance function operation





REMARKS

- The acceleration/deceleration ramp while the regeneration avoidance function is operating changes depending on the regeneration load.
- The DC bus voltage of the inverter is about √2 times as input voltage.
 When the input voltage is 220VAC, bus voltage is approximately 311VDC.
 When the input voltage is 440VAC, bus voltage is approximately 622VDC.
 However, it varies with the input power supply waveform.
- The *Pr. 883* setting should be kept higher than the DC bus voltage level. Otherwise, the regeneration avoidance function is always on even in the non-regeneration status and the frequency increases.
- While overvoltage stall (() is activated only during deceleration and stops the output frequency, the regeneration avoidance function is always on (*Pr.* 882 = 1) or activated only during a constant speed (*Pr.* 882 = 2) and increases the frequency according to the regeneration amount.



(2) Limit regeneration avoidance operation frequency (Pr. 885)

You can limit the output frequency compensated for (increased) by the regeneration avoidance function.

- •The frequency is limited to the output frequency (frequency prior to regeneration avoidance operation) + *Pr. 885 Regeneration avoidance compensation frequency limit value* during acceleration or constant speed. If the frequency increased by regeneration avoidance function exceeds the limit value during deceleration, the limit value is held until the output frequency falls to 1/2 of *Pr. 885*.
- •When the frequency increased by regeneration avoidance function has reached *Pr. 1 Maximum frequency*, it is limited to the maximum frequency.
- •When *Pr.* 885 is set to "9999", regeneration avoidance function operation frequency setting is invalid.

(3) Regeneration avoidance function adjustment (Pr. 665, Pr. 886)

•If the frequency becomes instable during regeneration avoidance operation, decrease the setting of *Pr. 886 Regeneration avoidance voltage gain.* Reversely, if sudden regeneration causes an overvoltage alarm, increase the setting.

When vibration is not suppressed by decreasing the *Pr. 886* setting, set a smaller value in *Pr. 665 Regeneration avoidance frequency gain*.



NOTE

- When regeneration avoidance operation is performed, $\Box \dot{L}$ (overvoltage stall) is displayed and the OL signal is output. Set the operation pattern at an OL signal output using Pr.156 Stall prevention operation selection. Set the output timing of the OL signal using Pr.157 OL signal output timer.
- · When regeneration avoidance operation is performed, stall prevention is also activated.
- The regeneration avoidance function cannot shorten the actual deceleration time taken to stop the motor. The actual
 deceleration time depends on the regeneration energy consumption capability. When shortening the deceleration
 time, consider using the regeneration unit (FR-BU2) and brake resistor (MRS type, MYS type and FR-ABR etc.,) to
 consume regeneration energy at constant speed.
- When using the regeneration unit (FR-BU2) and brake resistor (MRS type, MYS type, FR-ABR etc.,), set *Pr. 882* to "0 (initial value)" (regeneration avoidance function invalid). When using the regeneration unit, etc. to consume regeneration energy at deceleration, set *Pr. 882* to "2" (regeneration avoidance function valid only at a constant speed).



Parameters referred to

Pr. 1 Maximum frequency Refer to page 124 Pr. 8 Deceleration time Refer to page 135

Pr. 22 Stall prevention operation level Refer to page 120



5.21 Useful functions

Purpose	Parameter ti	hat should be Set	Refer to Page
Increase cooling fan life	Cooling fan operation selection	Pr. 244	213
	Inverter part life display	Pr. 255 to Pr. 259	214
To determine the maintenance time of parts.	Maintenance output function Pr. 503, Pr. 504		217
	Current average value monitor signal	Pr. 555 to Pr. 557	218
Communication using USB (FR Configurator)	USB communication	Pr. 547, Pr. 548, Pr. 551	220
Freely available parameter	Free parameter	Pr. 888, Pr. 889	222

5.21.1 Cooling fan operation selection (Pr. 244)

You can control the operation of the cooling fan built in the inverter (FR-E720-1.5KNC or higher, FR-E740-1.5KNC or higher, FR-E720S-0.75KNC or higher).

Parameter Number	Name	Initial Value	Setting Range	Description
			0	Operates in power-ON status. Cooling fan ON/OFF control invalid (the cooling fan is always ON at power ON)
244	Cooling fan operation selection	1	1	Cooling fan ON/OFF control valid 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 above parameters can be set when Pr.160 User group read selection = "0". (Refer to page 197)

- In either of the following cases, fan operation is regarded as faulty, [FN] is shown on the operation panel, and the fan fault (FAN) and alarm (LF) signals are output.
 - Pr. 244 = "0"

When the fan comes to a stop with power ON.

•Pr. 244 = "1"

When the inverter is running and the fan stops during fan ON command.

 To assign the FAN signal to the terminal Y0 or a virtual terminal of CC-Link communication, set "25 (positive logic) or 125 (negative logic)" in one of Pr. 190 to Pr. 192 and Pr. 313 to Pr. 315 (output terminal function selection). To assign the LF signal, set "98 (positive logic) or 198 (negative logic)."



• Changing the assignment of the terminal Y0 or a virtual terminal of CC-Link communication with one of Pr. 190 to Pr. 192, and Pr. 313 to Pr. 315 (output terminal function selection) may affect other functions. Set parameters after confirming the function of the terminal Y0 and virtual terminals.



Parameters referred to

Pr. 190 to Pr. 192, Pr. 313 to Pr. 315 (output terminal function selection) 👺 Refer to page 167



5.21.2 Display of the life of the inverter parts (Pr. 255 to Pr. 259)

Degrees of deterioration of main circuit capacitor, control circuit capacitor, cooling fan and inrush current limit circuit can be diagnosed by monitor.

When any part has approached the end of its life, an alarm can be output by self diagnosis to prevent a fault.

(Use the life check of this function as a guideline since the life except the main circuit capacitor is calculated theoretically.)

For the life check of the main circuit capacitor, the alarm signal (Y90) will not be output if a measuring method of (4) is not performed.

Parameter	Name	Initial Value	Setting	Description
Number			Range	
				Displays whether the control circuit capacitor,
255	Life alarm status display	0	(0 to 15)	main circuit capacitor, cooling fan, and each parts
	zno diami otatao diopiay		(0 10 10)	of the inrush current limit circuit has reached the
				life alarm output level or not. (Reading only)
	Inrush current limit circuit			Displays the deterioration degree of the inrush
256	life display	100%	(0 to 100%)	current limit circuit.
				(Reading only)
	Control circuit capacitor life display	100%	(0 to 100%)	Displays the deterioration degree of the control
257				circuit capacitor.
				(Reading only)
				Displays the deterioration degree of the main
258	Main circuit capacitor life	100%	(0 to 100%)	circuit capacitor.
230	display	100 /6		(Reading only)
	. ,			The value measured by Pr. 259 is displayed.
				Setting "1" and turning the power supply off starts
	Main circuit canacitor life		0.1	the measurement of the main circuit capacitor life.
259	Main circuit capacitor life measuring	0	0, 1	When the Pr. 259 value is "3" after powering on
			(2, 3, 8, 9)	again, the measuring is completed.
				Writes deterioration degree in Pr. 258.

The above parameters can be set when $Pr.\ 160\ User\ group\ read\ selection$ = "0". (Refer to page 197)



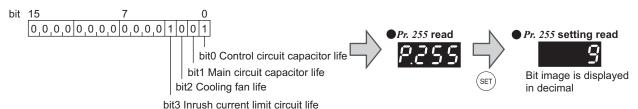
> REMARKS

• 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.



(1) Life alarm display and signal output (Y90 signal, Pr. 255)

•Whether any of the control circuit capacitor, main circuit capacitor, cooling fan and inrush current limit circuit has reached the life alarm output level or not can be checked by *Pr. 255 Life alarm status display* and life alarm signal (Y90).



Pr. 255 (decimal)	Bit (binary)	Inrush Current Suppression Circuit Life	Cooling Fan Life	Main Circuit Capacitor Life	Control Circuit Capacitor Life
15	1111	0	0	0	0
14	1110	0	0	0	×
13	1101	0	0	×	0
12	1100	0	0	×	×
11	1011	0	×	0	0
10	1010	0	×	0	×
9	1001	0	×	×	0
8	1000	0	×	×	×
7	0111	×	0	0	0
6	0110	×	0	0	×
5	0101	×	0	×	0
4	0100	×	0	×	×
3	0011	×	×	0	0
2	0010	×	×	0	×
1	0001	×	×	×	0
0	0000	×	×	×	×

O: With warnings, \times : Without warnings

- •The life alarm signal (Y90) turns ON when any of the control circuit capacitor, main circuit capacitor, cooling fan and inrush current limit circuit reaches the life alarm output level.
- •To assign the Y90 signal to the terminal Y0 or a virtual terminal of CC-Link communication, set "90 (positive logic) or 190 (negative logic)" in one of *Pr. 190* to *Pr. 192* and *Pr. 313* to *Pr. 315 (output terminal function selection)*.



NOTE

• Changing the assignment of the terminal Y0 or a virtual terminal of CC-Link communication with one of *Pr. 190* to *Pr. 192*, and *Pr. 313* to *Pr. 315* (output terminal function selection) may affect other functions. Set parameters after confirming the function of the terminal Y0 and virtual terminals.

(2) Inrush current limit circuit life display (Pr. 256)

- •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 times) every 1%/10,000 times.

As soon as 10% (900,000 times) is reached, Pr. 255 bit 3 is turned ON and also an alarm is output to the Y90 signal.

(3) Control circuit capacitor life display (Pr. 257)

- •The deterioration degree of the control circuit capacitor is displayed in Pr. 257 as a life.
- •In the operating status, the control circuit capacitor life is calculated from the energization time and temperature, and is counted down from 100%.

As soon as the control circuit capacitor life falls below 10%, *Pr. 255* bit 0 is turned ON and also an alarm is output to the Y90 signal.

(4) Main circuit capacitor life display (Pr. 258, Pr. 259)

- •The deterioration degree of the control circuit capacitor is displayed in Pr. 258 as a life.
- On the assumption that the main circuit capacitor capacitance at factory shipment is 100%, the capacitor life is displayed in *Pr. 258* every time measurement is made.

When the measured value falls to or below 85%, Pr. 255 bit 1 is turned ON and also an alarm is output to the Y90 signal.

- Measure the capacitor capacity according to the following procedure and check the deterioration level of the capacitor capacity.
 - 1) Check that the motor is connected and at a stop.
 - 2) Set "1" (measuring start) in Pr. 259.
 - 3) Switch 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 LED of the operation panel is OFF, power ON again. (When using the 24V external power supply, turn ON the power again after "EV" appears.)
 - 5) Check that "3" (measuring completion) is set in *Pr. 259*, read *Pr. 258*, and check the deterioration degree of the main circuit capacitor.

Pr. 259	Description	Remarks
0	No measurement	Initial value
1	Measurement start	Measurement starts when the power supply
l	i Weasurement start	is switched OFF.
2	During measurement	
3	Measurement complete	Only displayed and cannot be set
8	Forced end	Only displayed and carmot be set
9	Measurement error	

> REMARKS

- When the main circuit capacitor life is measured under the following conditions, "forced end" (*Pr. 259* = "8") or "measuring error" (*Pr. 259* = "9") occurs or it remains in "measuring start" (*Pr. 259* = "1"). Therefore, do not measure in such case.
- In addition, even when "measurement completion" (Pr. 259 = "3") is confirmed under the following conditions, normal measurement can not be done.
- (a) DC power supply is connected to the terminal P/+ and N/-.
- (b) The power supply switched ON during measurement.
- (c) The motor is not connected to the inverter.
- (d) The motor is running (coasting)
- (e) The motor capacity is two rank smaller as compared to the inverter capacity.
- (f) The inverter is tripped or a fault occurred when power is OFF.
- (g) The inverter output is shut off with the MRS signal.
- (h) The start command is given while measuring.
- (i) An input/output signal to/from the control terminal block or a signal of CC-Link communication is ON (conducting).
- (j) "EV" is displayed on the operation panel. (The main circuit power supply is OFF and the 24V external power supply is ON.)
- Turning the power ON during measuring before LED of the operation panel turns OFF, it may remain in "measuring" (*Pr. 259* = "2") status. In such case, carry out operation from step 2.



POINT

For accurate life measurement of the main circuit capacitor, wait 3 hours or longer after powering OFF. The temperature left in the main circuit capacitor affects measurement.



Mhen measuring the main circuit capacitor capacity (*Pr. 259 Main circuit capacitor life measuring* = "1"), the DC voltage is applied to the motor for 1s at powering OFF. Never touch the motor terminal, etc. right after powering OFF to prevent an electric shock.



(5) Cooling fan life display

•The cooling fan speed of 50% or less is detected and "FN" is displayed on the operation panel. As an alarm display, *Pr. 255* bit 2 is turned ON and also an alarm is output to the Y90 signal.



> REMARKS

• When the inverter is mounted with two or more cooling fans, "FN" is displayed with one or more fans with speed of 50% or less.



NOTE

• For replacement of each part, contact the nearest Mitsubishi FA center.

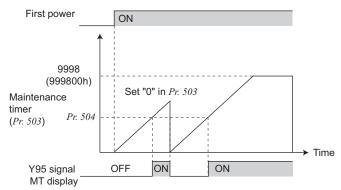
5.21.3 Maintenance timer alarm (Pr. 503, Pr. 504)

When the cumulative energization time of the inverter reaches the parameter set time, the maintenance timer output signal (Y95) is output. Π (MT) is displayed on the operation panel.

This can be used as a guideline for the maintenance time of peripheral devices.

Parameter Number	Name	Initial Value	Setting Range	Description
503	Maintenance timer	0	0 (1 to 9998)	Displays the cumulative energization time of the inverter in 100h increments. (Reading only) Writing the setting of "0" clears the cumulative energization time while <i>Pr. 503</i> = "1 to 9998".
504	Maintenance timer alarm	9999	0 to 9998	Time taken until when the maintenance timer alarm output signal (Y95) is output.
	output set time		9999	No function

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)



- The cumulative energization time of the inverter is stored into the EEPROM every hour and is displayed in *Pr. 503 Maintenance timer* in 100h increments. *Pr. 503* is clamped at 9998 (999800h).
- When the *Pr. 503* value reaches the time set to *Pr. 504 Maintenance timer alarm output set time* (100h increments), the maintenance timer alarm output signal (Y95) is output.
- To assign the Y95 signal to the terminal Y0 or a virtual terminal of CC-Link communication, set "95 (positive logic) or 195 (negative logic)" in one of *Pr.190* to *Pr.192* and *Pr.313* to *Pr.315* (output terminal function selection).



NOTE

- · The cumulative energization time is counted every hour. The energization time of less than 1h is not counted.
- Changing the assignment of the terminal Y0 or a virtual terminal of CC-Link communication with one of *Pr. 190* to *Pr. 192*, and *Pr. 313* to *Pr. 315* (output terminal function selection) may affect other functions. Set parameters after confirming the function of the terminal Y0 and virtual terminals.



Parameters referred to

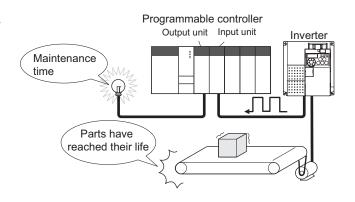
Pr. 190 to Pr. 192, Pr.313 to Pr.315 (output terminal function selection) 👺 Refer to page 167

5.21.4 Average current monitor signal (Pr. 555 to Pr. 557)

The average value of the output current during constant speed operation and the maintenance timer value are output as a pulse to the current average value monitor signal (Y93).

The pulse width output to the I/O module of the programmable controller or the like can be used as a guideline due to abrasion of machines and elongation of the belt and for aged deterioration of devices to know the maintenance time.

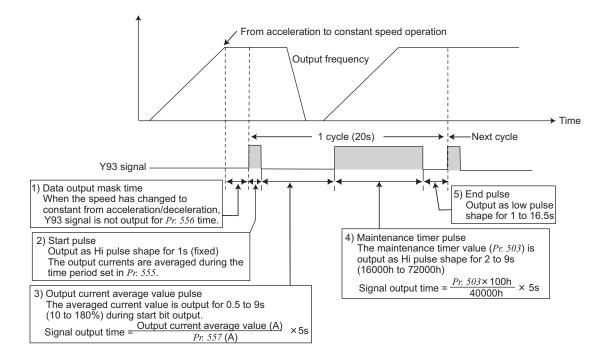
The current average value monitor signal (Y93) is output as pulse for 20s as 1 cycle and repeatedly output during constant speed operation.



Parameter Number	Name	Initial Value	Setting Range	Description
555	Current average time	1s	0.1 to 1.0s	Time taken to average the current during start pulse output (1s).
556	Data output mask time	0s	0.0 to 20.0s	Time for not obtaining (mask) transient state data.
557	Current average value monitor signal output reference current	Rated inverter current	0 to 500A	Reference (100%) for outputting the signal of the current average value.

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)

The above parameters allow its setting to be changed during operation in any operation mode even if "0" (initial value) is set in Pr. 77 Parameter write selection.



- The pulse output of the current average value monitor signal (Y93) is shown above.
- To assign the Y93 signal to the terminal Y0 or a virtual terminal of CC-Link communication, set "93 (positive logic) or 193 (negative logic)" in one of *Pr. 190, Pr. 191 and Pr. 313 to Pr. 315 (output terminal function selection).* (The signal cannot be assigned with *Pr. 192 RX7 function selection.*)
- 1) Setting of Pr. 556 Data output mask time

The output current is unstable (transient state) right after the operation is changed from the acceleration/deceleration state to the constant speed operation. Set the time for not obtaining (mask) transient state data in *Pr.* 556.

2) Setting of *Pr. 555 Current average time*

The average output current is calculated during Hi output of start pulse (1s). Set the time taken to average the current during start bit output in Pr. 555.



3) Setting of Pr. 557 Current average value monitor signal output reference current

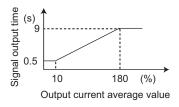
Set the reference (100%) for outputting the signal of the current average value. Obtain the time to output the signal from the following calculation.

$\frac{\text{Output current average value}}{\textit{Pr. }557\,\text{setting}} \times \text{5s (Output current average value }100\%/5\text{s)}$

Note that the output time range is 0.5 to 9s and the output time is either of the following values when the output current average value is the corresponding percentage of the Pr. 557 setting.

Less than 10% ... 0.5s, more than 180% ... 9s

Example) when Pr. 557 = 10A and the average value of output current is 15A As 15A/10A x 5s=7.5, the current average value monitor signal is output as low pulse shape for 7.5s.

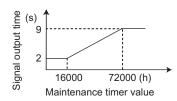


4) Setting of Pr. 503 Maintenance timer

After the output current average value is output as low pulse shape, the maintenance timer value is output as high pulse shape. The output time of the maintenance timer value is obtained from the following calculation.

$$\frac{Pr. 503 \times 100}{40000h} \times 5s \quad \text{(Maintenance timer value 100\%/5s)}$$

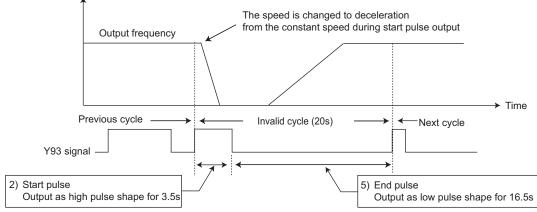
Note that the output time range is 2 to 9s, and it is 2s when the Pr. 503 setting is less than 16000h and 9s when exceeds 72000h.



(1) F

> REMARKS

- Mask of data output and sampling of output current are not performed during acceleration/deceleration.
- When the speed is changed to acceleration/deceleration from constant speed during start pulse output, the data is judged as
 invalid, the start pulse is output as high pulse shape for 3.5s, and the end signal is output as low pulse shape for 16.5s.
 The signal is output for at least 1 cycle even when acceleration/deceleration state continues after the start pulse output is
 completed.



- When the output current value (inverter output current monitor) is 0A on completion of the 1 cycle signal output, the signal is not
 output until the speed becomes constant next time
- The current average value monitor signal (Y93) is output as low pulse shape for 20s (without data output) under the following condition.
 - (a) When the motor is in the acceleration/deceleration state on completion of the 1 cycle signal output
 - (b) When 1-cycle signal output was ended during restart operation with the setting of automatic restart after instantaneous power failure (Pr. 57 ≠ "9999")
 - (c) When restart operation was being performed at the point of data output mask end with the setting of automatic restart after instantaneous power failure (*Pr.* 57 ≠ "9999")



NOTE

• Changing the assignment of the terminal Y0 or a virtual terminal of CC-Link communication with one of *Pr.190 to Pr.192*, and *Pr.313 to Pr.315 (output terminal function selection)* may affect other functions. Set parameters after confirming the function of the terminal Y0 and virtual terminals.



Parameters referred to

Pr. 57 Restart coasting time Refer to page 180
Pr. 190 to Pr. 192, Pr.313 to Pr.315 (output terminal function selection) Refer to page 167
Pr. 503 Maintenance timer Refer to page 217

5.21.5 USB communication (Pr. 547, Pr. 548, Pr. 551)

Inverter setup can be easily performed using the FR Configurator by connecting the inverter and personal computer with a USB cable.

A personal computer and inverter can be easily connected with one USB cable.

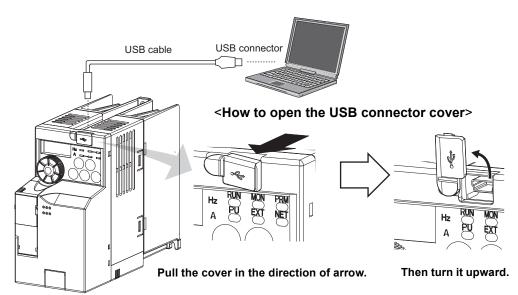
Parameter Number	Name	Initial Value	Setting Range	Description
547 *1	USB communication station number	0	0 to 31	Inverter station number specification
			0	USB communication is possible Trips in the PU operation mode (E.USB)
548 *1	USB communication check time interval	9999	0.1 to 999.8s	Sets the interval of communication check time. If a no-communication state persists for longer than the permissible time, the inverter trips (E.USB).
			9999	No communication check
			2	For manufacturer setting. Do not set.
			3	USB connector is the command source when PU operation mode.
551 *2	PU mode operation command source selection	9999	4	Operation panel is the command source when PU operation mode.
:			9999	USB automatic recognition Normally, operation panel is the command source. When USB is connected, USB connector is the command source.

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)

- *1 Changed setting value is valid when powering on or resetting the inverter.
- *2 This parameter can be changed during a stop in any operation mode.

(1) USB communication specifications

Interface	Conforms to USB1.1
Transmission	12Mbps
Speed:	12Mbps
Wiring Length	Maximum 5m
Connector	USB mini B connector (receptacle mini B type)
Power supply	Self-power supply



• You can perform parameter setting and monitoring with the FR Configurator. Refer to the instruction manual of the FR Configurator for details.



• REMARKS

• USB cable available on the market

Name	Model	Application/Specifications		
USB cable	MR-J3USBCBL3M Cable length 3m	Connector for amplifier mini-B connector (5 pin)	Connector for personal computer A connector	

(2) Select the command source of the PU operation mode (Pr. 551)

- •Either the operation panel, or USB connector can be specified as the command source in the PU operation mode.
- •You can write parameters and monitor different items with FR Configurator through the USB connector. To do that, set Pr.551 = "9999 (initial value) or 3" in PU operation mode.



- Changed setting value is valid when powering ON or resetting the inverter.
 All of the operation mode indicator (PU_EXT_NET) of the operation panel turns OFF when command source is not

PU...PU operation mode, NET...network operation mode, —....without command source

Pr. 551	Command Source					
Setting	Operation panel USB connector CC-Link communic					
3	_	PU	NET			
4	PU	_	NET			
9999	PU *	PU *	NET			
(initial value)	10*	10*	INCI			

* When Pr. 551 = "9999", the priorities of the PU command source is USB connector > operation panel.



5.21.6 Free parameter (Pr. 888, Pr. 889)

You can input any number within the setting range 0 to 9999.

For example, the number 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.

Parameter Number	Name	Initial Value	Setting Range	Description	
888	Free parameter 1	9999	0 to 9999	Any values can be set. Data is held even	
889	Free parameter 2	9999	0 to 9999	if the inverter power is turned OFF.	

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)

The above parameters allow thier settings to be changed during operation in any operation mode even if "0" (initial value) is set in *Pr.77 Parameter write selection*.



> REMARKS

Pr. 888 and Pr. 889 do not influence the inverter operation.



5.22 Setting from the operation panel

Purpose	Parameter	that should be Set	Refer to Page
Selection of rotation direction by (RUN) of the operation panel	RUN key rotation direction selection	Pr. 40	223
Use the setting dial of the operation panel like a potentiometer for frequency setting. Key lock of operation panel	Operation panel operation selection	Pr. 161	224
Change the magnitude of change of frequency setting by the setting dial of the operation panel	Magnitude of frequency change setting	Pr. 295	226

5.22.1 RUN key rotation direction selection (Pr. 40)

Used to choose the direction of rotation by operating $(\overline{\text{\scriptsize RUN}})$ of the operation panel.

Parameter Number	Name	Initial Value	Setting Range	Description
40	RUN key rotation direction	0	0	Forward rotation
40	selection		1	Reverse rotation

The above parameters can be set when *Pr. 160 User group read selection* = "0". (*Refer to page 197*)

5.22.2 Operation panel frequency setting/key lock operation selection (Pr. 161)

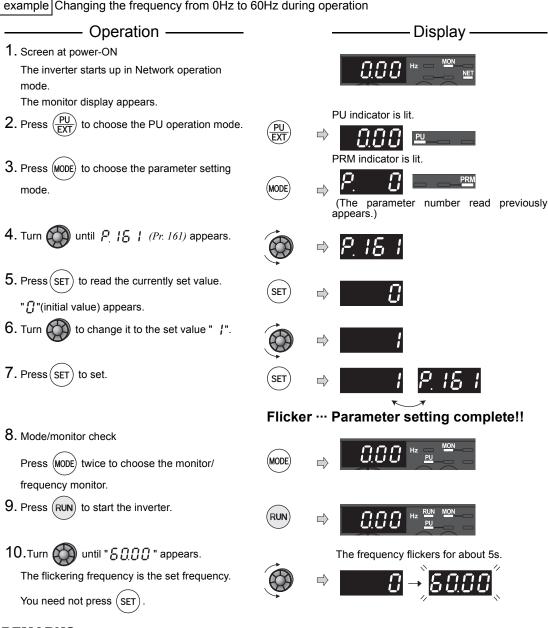
The setting dial of the operation panel can be used for setting like a potentiometer. The key operation of the operation panel can be disabled.

Parameter Number	Name	Initial Value	Setting Range	Description	
			0	Setting dial frequency setting	Key lock invalid
161	Frequency setting/key lock operation selection	0	1	Setting dial potentiometer	Rey lock invalid
101			10	Setting dial frequency setting	Key lock valid
			11	Setting dial potentiometer	Ney lock vallu

The above parameters can be set when Pr. 160 User group read selection = "0". (Refer to page 197)

(1) Using the setting dial like a potentiometer to set the frequency

Operation example Changing the frequency from 0Hz to 60Hz during operation



> REMARKS

- If the display changes from flickering "60.00" to "0.00", the setting of Pr. 161 Frequency setting/key lock operation selection may not
- Independently of whether the inverter is running or at a stop, the frequency can be set by merely turning the dial.
- When the frequency is changed, it will be stored in EEPROM as the set frequency after 10s.

NOTE

• When setting a frequency by turning the setting dial, the frequency goes up to the set value of Pr.1 Maximum frequency (initial value: 120Hz). Adjust Pr. 1 Maximum frequency setting according to the application.



(2) Disable the setting dial and key operation of the operation panel (Press [MODE] long (2s))

- Operation using the setting dial and key of the operation panel can be invalid to prevent parameter change, and unexpected start or frequency setting.
- •Set "10 or 11" in Pr. 161, then press (MODE) for 2s to make the setting dial and key operation invalid.
- •When the setting dial and key operation are invalid, #[][d appears on the operation panel. If dial or key operation is display appears.)
- •To make the setting dial and key operation valid again, press (MODE) for 2s.



(I) REMARKS



• Release the operation lock to release the PU stop by key operation.

5.22.3 Magnitude of frequency change setting (Pr. 295)

When setting the set frequency with the setting dial, frequency changes in 0.01Hz increments in the initial status. Setting this parameter increases the magnitude of frequency which changes according to the rotated amount of the setting dial, improving operability.

Parameter Number	Name	Initial Value	Setting Range	Description
			0	Function invalid
	Magnitude of frequency	0	0.01	The minimum varying width when the set
295			0.10	The minimum varying width when the set
	change setting		1.00	frequency is changed by the setting dial can be set.
			10.00	be set.

The above parameter can be set when Pr. 160 User group read selection = "0". (Refer to page 197)

(1) Basic operation

When a value other than "0" is set in Pr. 295, the minimum varying width when the set frequency is changed by the setting dial can be set.

For example, when "1.00Hz" is set in Pr. 295, one click (one dial gauge) of the setting dial changes the frequency in increments of 1.00Hz→2.00Hz→3.00Hz.

When Pr. 295 = "1"



*One rotation of the setting dial equals to 24 clicks (24 dial gauges).



REMARKS

- When machine speed display is selected with Pr. 37, the minimum increments of the magnitude of change is 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.
- When the set frequency (speed) is 100 or more, frequency is displayed in 0.1 increments. Therefore, the minimum varying width is 0.1 even when Pr. 295 < 0.1.
- When the machine speed setting is 1000 or more, frequency is displayed in 1 increments. Therefore, the minimum varying width is 1 even when Pr. 295 < 1.



NOTE

- For Pr. 295, unit is not displayed.
- · This parameter is valid only in the set frequency mode. When other frequency-related parameters are set, it is not
- When 10 is set, frequency setting changes in 10Hz increments. Note the excess speed (in potentiometer mode).

The above parameter allows its setting to be changed during operation in any operation mode even if "0" (initial value) is set in Pr. 77 Parameter write selection.



5.23 Parameter clear/ All parameter clear



POINT

- Set "1" in Pr.CL Parameter clear, ALLC all parameter clear to initialize all parameters. (Parameters are not cleared when "1" is set in Pr. 77Parameter write selection.)
- Refer to the extended parameter list on page 84 for parameters cleared with this operation.

Operation –

1. Screen at power-ON

The inverter starts up in Network operation mode.

The monitor display appears.

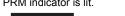
- 2. Press $\left(\frac{PU}{EXT}\right)$ to choose the PU operation mode.
- 3. Press (MODE) to choose the parameter setting mode.
- 4. Turn until Pr.[[(R[[]) appears.
- **5.** Press (SET) to read the currently set value. " [7] "(initial value) appears.
- 6. Turn to change it to the set value " /".
- $7. \, \mathsf{Press} \, \left(\mathsf{SET}\right) \, \mathsf{to} \, \mathsf{set}.$





PU indicator is lit.







(The parameter number read previously appears.)

Parameter clear









Parameter clear



Flicker ··· Parameter setting complete!!

- Turn to read another parameter.
- Press (SET) to show the setting again.
- Press (SET) twice to show the next parameter.

Setting	Description
0	Not executed.
	Set parameters back to the initial values. (Parameter clear sets back all parameters except
1	terminal function selection parameters to the initial values.) Refer to the parameter list on page 84 for
	availability of parameter clear and all parameter clear.

• REMARKS

- and Ery are displayed alternately ... Why?

 The inverter is not in the PU operation mode.
- 1. Press $\frac{PU}{EXT}$. [PU] is lit and the monitor (4-digit LED) displays "1". (When Pr: 79 = "0" (initial value))
- 2. Carry out operation from step 6 again.

5.24 Initial value change list

Displays and sets the parameters changed from the initial value.

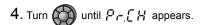
Operation -

1. Screen at power-ON

The inverter starts up in Network operation mode.

The monitor display appears.

- 2. Press $\frac{PU}{EXT}$ to choose the PU operation mode.
- 3. Press (MODE) to choose the parameter setting mode.



- Turning displays the parameter number changed.
 - ●Press (SET) to read the currently set value.

Turn and press SET to change the

(Refer to steps 6 and 7 on page 82)

- Turn to read another parameter.
- •The display returns to P - after all parameters are displayed.
- 7. Pressing (SET) in P. - status returns to the parameter setting mode.
 - Turning sets other parameters.
 - Pressing (SET) displays the change list again.

- Display -



PU indicator is lit.



PRM indicator is lit.



(MODE)

(The parameter number read previously appears.)



- SFT A CO
- It may take several seconds for creating the initial value change list. "P---" flickers while creating the list.









Flicker ··· Parameter setting complete!!









- Only simple mode parameter is displayed when simple mode is set ($Pr.\ 16\theta$ = 9999)
- Only user group is displayed when user group is set (Pr. 160 = "1").
- ullet Pr.~160 is displayed independently of whether the setting value is changed or not.
- When parameter setting is changed after creating the initial value change list, the setting will be reflected to the initial value change list next time.

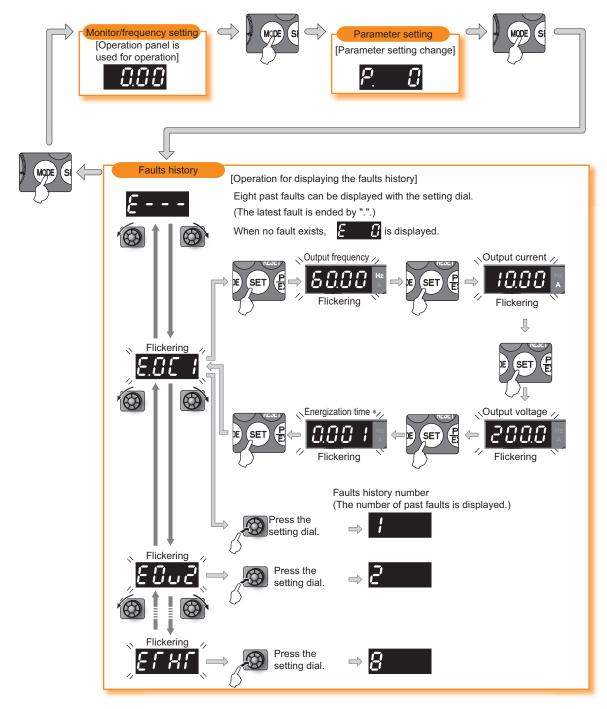


Parameters referred to

Pr. 160 User group read selection 🕮 Refer to page 197

5.25 Check and clear of the faults history

(1) Check for the faults history



* The cumulative energization time and actual operation time are accumulated from 0 to 65535 hours, then cleared, and accumulated again from 0. When the operation panel is used, the time is displayed up to 65.53 (65530h) in the indication of 1h = 0.001, and thereafter, it is added up from 0.

(2) Clearing procedure



POINT

• Set "1" in Er.CL Fault history clear to clear the faults history.

Operation –

1. Screen at power-ON

The inverter starts up in Network operation mode. The monitor display appears.

2. Press (MODE) to choose the parameter setting mode.

3. Turn until Er.EL (faults history clear)

appears

4. Press (SET) to read the currently set value. " \mathcal{G} " (initial value) appears.

5. Turn to change it to the set value " /".

6. Press (SET) to set.

—— Display -



PRM indicator is lit.



(The parameter number read previously appears.)









Flicker...Faults history clear complete!!

Turn to read another parameter.

• Press (SET) to show the setting again.

Press (SET) twice to show the next parameter.



Parameters referred to

Pr. 77 Parameter write selection 🎏 Refer to page 196

6 / TROUBLESHOOTING

This chapter provides the "TROUBLESHOOTING" of this product.

Always read the instructions before using the equipment.

6.1	Reset method of protective function	232
	List of fault or alarm indications	
6.3	Causes and corrective actions	234
6.4	Correspondences between digital and actual characters	243
	Check first when you have a trouble	

Reset method of protective function

When a fault occurs in the inverter, the inverter trips and the operation panel display automatically changes to one of the following fault or alarm indications.

If the fault does not correspond to any of the following faults or if you have any other problem, please contact your sales representative.

- Retention of fault output signal .. When the magnetic contactor (MC) provided on the input side of the inverter is opened when a fault occurs, the inverter's control power will be lost and the fault output will not be held.
- Fault or alarm indicationWhen a fault or alarm occurs, the operation panel display automatically switches to the fault or alarm indication.
- Resetting methodWhen a fault occurs, the inverter output is kept stopped. Unless reset, therefore, the inverter cannot restart. (Refer to page 232)
- When any fault occurs, take the appropriate corrective action, then reset the inverter, and resume operation. Not doing so may lead to the inverter fault and damage.

Inverter fault or alarm indications are roughly categorized as below.

- (1) Error message
 - A message regarding operational fault and setting fault by the operation panel is displayed. The inverter does not trip.
- (2) Warning
 - The inverter does not trip even when a warning is displayed. However, failure to take appropriate measures will lead to a fault.
- - The inverter does not trip. You can also output an alarm signal by making parameter setting.
- (4) Fault
 - When a fault occurs, the inverter trips and a fault signal is output.



REMARKS

• Past eight faults can be displayed using the setting dial.

6.1 Reset method of protective function

(1) Resetting the inverter

The inverter can be reset by performing any of the following operations. Note that the internal thermal integrated value of the electronic thermal relay function and the number of retries are cleared (erased) by resetting the inverter. Inverter recovers about 1s after the reset is released.

Operation 1: Using the operation panel, press (STOP) to reset the inverter.

(This may only be performed when a fault occurs (Refer to page 237 for

fault.))

Operation 2: Write HFD (inverter reset) to an instruction code of CC-Link communication.

> (Inverter reset though CC-Link communication is invalid during communication error.)

Operation 3: Switch power OFF once. After the indicator of the operation panel turns OFF, switch it ON again.





REMARKS

Use the operation 1 or 2 to reset when using the 24V external power supply.



OFF status of the start signal must be confirmed before resetting the inverter fault. Resetting inverter fault with the start signal ON restarts the motor suddenly.



6.2 List of fault or alarm indications

	Operation P		Name	Refer to Page
	E	E	Faults history	229
i	HOLd	HOLD	Operation panel lock	234
sage	F069	LOCD	Password locked	234
Error message	8r 1 8r2 8r4	Er1 Er2 Er4	Parameter write error	234
	Err.	Err.	Inverter reset	234
	OL	OL	Stall prevention (overcurrent)	235
	οL	oL	Stall prevention (overvoltage)	235
	rb	RB	Regenerative brake prealarm	236
ing	ſΗ	тн	Electronic thermal relay function prealarm	236
Warning	<i>P</i> 5	PS	PU stop	235
	nr	МТ	Maintenance signal output	236
	Uu	UV	Undervoltage	236
	SR	SA	Safety stop	236
	٤٠	EV	24V external power supply operation	237
Alarm	Fo	FN	Fan alarm	237
	E.DC 1	E.OC1	Overcurrent trip during acceleration	237
	8.002	E.OC2	Overcurrent trip during constant speed	237
	E.D.C.3	E.OC3	Overcurrent trip during deceleration or stop	238
	E.Du 1	E.OV1	Regenerative overvoltage trip during acceleration	238
ı#	8.Du2	E.OV2	Regenerative overvoltage trip during constant speed	238
Fault	<i>€.0</i> ∪3 E.OV 3		Regenerative overvoltage trip during deceleration or stop	238
	Е.Г.Н.Г	E.THT	Inverter overload trip (electronic thermal relay function)	239
	E.C.H.N	E.THM	Motor overload trip (electronic thermal relay function)	239
	8.81 n	E.FIN	Heatsink overheat	239

Operation Panel				Refer
	Indication		Name	to
	maioation			Page
	ELLE	E.ILF	Input phase loss	239
	E.DL F	E.OLT	Stall prevention stop	240
	Е. ЬЕ	E. BE	Brake transistor alarm detection	240
	E. 6F	E.GF	Output side earth (ground) fault overcurrent at start	240
	E. LF	E.LF	Output phase loss	240
	E.DP 1	E.OP1	Communication option fault	240
	E.0PT	E.OPT	Option fault	241
	ε. ι	E. 1	Option fault	241
	E. PE	E.PE	Parameter storage device fault	241
ult	<i>E.P.E.2</i>	E.PE2	Internal board fault	241
Fault	E E.C	E.RET	Retry count excess	241
	E. S E. 6 E.CPU	E. 5 E. 6 E. 7 E.CPU	CPU fault	241
	EJ 0H	E.IOH	Inrush current limit circuit fault	242
	8.856	E.USB	USB communication fault	242
	E.N64 to E.N69	E.MB4 to E.MB7	Brake sequence fault	242
	<i>E.SRF</i>	E.SAF	Safety circuit fault	242
	E. 13	E.13	Internal circuit fault	242

6.3 Causes and corrective actions

(1) Error message

A message regarding operational troubles is displayed. Output is not shutoff.

Operation panel indication	HOLD	HOLd		
Name	Operation par	Operation panel lock		
Description	Operation lock mode is set. Operation other than (STOP) is invalid. (Refer to page 225)			
Check point	_			
Corrective action	Press MODE for	r 2s to release lock.		

Operation panel	LOCD	LOCa	
indication	LOCD	L U L O	
Name	Password locked		
Description	Password function is active. Display and setting of parameter is restricted.		
Check point			
Corrective action	Enter the password in Pr. 297 Password lock/unlock to unlock the password function before operating. (Refer to page 199).		

Operation panel	Er1	Fr 1	
indication		LII	
Name	Write disable error		
Description	• You attempted to make parameter setting when Pr. 77 Parameter write selection has been set to disable parameter write.		
Description	Frequency j	ump setting range overlapped.	
Check point	Check the setting of Pr. 77 Parameter write selection. (Refer to page 196).		
Check point	Check the s	settings of Pr. 31 to Pr. 36 (frequency jump). (Refer to page 125)	

Operation panel indication	Er2	8-2		
Name	Write error du	ring operation		
Description	When parame	ter write was performed during operation with a value other than "2" (writing is enabled independently		
Description	of operation status in any operation mode) is set in Pr. 77 and the STF (STR) is ON.			
Check point	Check the I	Pr. 77 setting. (Refer to page 196).		
Check point	Check that the inverter is not operating.			
Corrective action	• Set "2" in P	r. 77.		
	After stoppi	ng operation, make parameter setting.		

Operation panel	Er4	F - 4	
indication	E14	כרי	
Name	Mode designa	tion error	
Description	Appears if a parameter setting is attempted in the NET operation mode with $Pr. 77 \neq$ "2".		
Check point	Check that operation mode is PU operation mode.		
Check point	• Check the Pr. 77 setting. (Refer to page 196).		
Corrective action	• After setting the operation mode to the "PU operation mode", make parameter setting. (Refer to page 103)		
	 After setting 	Pr. 77 = "2", make parameter setting.	

Operation panel indication	Err.	Err.
Name	Inverter reset	
Description	 Appears at the execution of a reset command, which is given via CC-Link communication or from (STOP) on the operation panel. Appears at powering OFF. 	
Corrective action	Turn OFF the reset command	



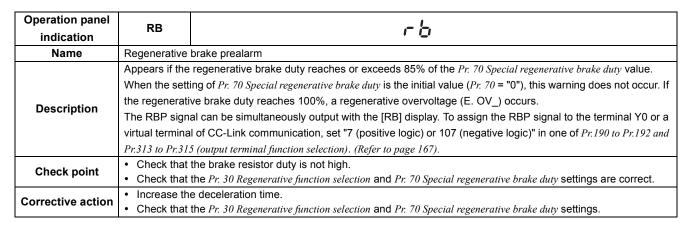
(2) Warning

When a warning occurs, the output is not shut off.

Operation panel	OL	OL .
indication		
Name	Stall prevention (overcurrent)	
Description	During acceleration	When the output current (output torque when <i>Pr. 277 Stall prevention current switchover</i> = "1") of the inverter exceeds the stall prevention operation level (<i>Pr. 22 Stall prevention operation level</i> , etc.), this function stops the increase in frequency until the overload current decreases to prevent the inverter from resulting in overcurrent trip. When the overload current has reduced below stall prevention operation level, this function increases the frequency again.
	During constant- speed operation	When the output current (output torque when $Pr. 277 Stall prevention current switchover = "1") of the inverter exceeds the stall prevention operation level (Pr. 22 Stall prevention operation level, etc.), this function reduces frequency until the overload current decreases to prevent the inverter from resulting in overcurrent trip. When the overload current has reduced below stall prevention operation level, this function increases the frequency up to the set value.$
	During deceleration	When the output current (output torque when <i>Pr. 277 Stall prevention current switchover</i> = "1") of the inverter exceeds the stall prevention operation level (<i>Pr. 22 Stall prevention operation level</i> , 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 has decreased below stall prevention operation level, this function decreases the frequency again.
Check point	Check thatCheck thatAre there aCheck that	the <i>Pr. 0 Torque boost</i> setting is not too large. the <i>Pr. 7 Acceleration time</i> and <i>Pr. 8 Deceleration time</i> settings are not too small. the load is not too heavy. ny failure in peripheral devices? the <i>Pr. 13 Starting frequency</i> is not too large. the <i>Pr. 22 Stall prevention operation level</i> is appropriate
Corrective action	Set a large Reduce the Try Advance Change the Set stall pre- acceleration operation le	reduce the <i>Pr. 0 Torque boost</i> setting 1% by 1% and check the motor status. (<i>Refer to page 113</i>) or value in <i>Pr. 7 Acceleration time</i> and <i>Pr. 8 Deceleration time</i> . (<i>Refer to page 135</i>) be load weight. The definition of the following that the deceleration time and <i>Pr. 8 Deceleration time</i> . (<i>Refer to page 135</i>) be load weight. The deceleration flux vector control and General-purpose magnetic flux vector control. The deceleration setting. The province of the initial value is 150%.) The initial value is 150%. The initial

Operation panel indication	oL	οL	
Name	Stall prevention	n (overvoltage)	
Description	During deceleration	 If the regenerative energy of the motor becomes excessive to exceed the regenerative energy consumption capability, this function stops the decrease in frequency to prevent overvoltage trip. As soon as the regenerative energy has reduced, deceleration resumes. If the regenerative energy of the motor becomes excessive when regeneration avoidance function is selected (<i>Pr.</i> 882 =1), this function increases the speed to prevent overvoltage trip. (<i>Refer to page 211</i>). 	
Check point		 Check for sudden speed reduction. Check that regeneration avoidance function (Pr. 882, Pr. 883, Pr. 885, Pr. 886) is used. (Refer to page 211). 	
Corrective action	The decelerat	ion time may change. Increase the deceleration time using Pr. 8 Deceleration time.	

Operation panel indication	PS	<i>P</i> 5
Name	PU stop	
Description	Stop with STOP	on the operation panel is set in <i>Pr. 75 Reset selection/PU stop selection</i> . (For <i>Pr. 75, refer to page 194</i> .)
Check point	Check for a st	op made by pressing (STOP) on the operation panel.
Corrective action	Turn the start	signal OFF and release with $\frac{PU}{EXT}$.



Operation panel	TII	f.H
indication	TH	ı n
Name	Electronic the	rmal relay function prealarm
Description	Appears if the cumulative value of the <i>Pr. 9 Electronic thermal O/L relay</i> reaches or exceeds 85% of the preset level. If it reaches 100% of the <i>Pr. 9 Electronic thermal O/L relay</i> setting, a motor overload trip (E. THM) occurs. The THP signal can be simultaneously output with the [TH] display. To assign the THP signal to the terminal Y0 or a virtual terminal of CC-Link communication, set "8 (positive logic) or 108 (negative logic)" in one of <i>Pr.190 to Pr.192 and</i>	
	Pr.313 to Pr.315 (output terminal function selection). (Refer to page 167).	
Check point	 Check for large load or sudden acceleration. Is the Pr. 9 Electronic thermal O/L relay setting is appropriate? (Refer to page 142) 	
Corrective action		e load and frequency of operation.
Set an appropriate value in Pr. 9 Electronic thermal O/L relay. (Refer to page 142)		opnate value in Pr. 9 Electronic thermal O/L relay. (Refer to page 142)

Operation panel indication	MT	ΠΓ
Name	Maintenance	signal output
Description		the cumulative energization time of the inverter has reached a given time. ing of <i>Pr. 504 Maintenance timer alarm output set time</i> is the initial value (<i>Pr. 504</i> = "9999"), this warning r.
Check point	The Pr. 503 Ma page 217).	aintenance timer setting is larger than the Pr. 504 Maintenance timer alarm output set time setting. (Refer to
Corrective action	Setting "0" in I	Pr. 503 Maintenance timer erases the signal.

Operation panel	UV	11.
indication	υv	UU
Name	Undervoltage	
Description	the motor torq decreases bel	apply voltage of the inverter decreases, the control circuit will not perform normal functions. In addition, ue will be insufficient and/or heat generation will increase. To prevent this, if the power supply voltage ow about 115VAC (about 230VAC for 400V class), this function stops the inverter output and displays set when the voltage returns to normal.
Check point	Check that the	power supply voltage is normal.
Corrective action	Check the pov	ver supply system equipment such as power supply.

Operation panel indication	SA	58
Name	Safety stop	
Description	Appears when	safety stop function is activated (during output shutoff). (Refer to page 24)
Check point	If the indication PC are connected	n appears when safety stop function is not used, check that shorting wires between S1 and PC, S2 and cted.
Corrective action	wire for the If 5月 is independent in the function (dri	sing the safety stop function, short across terminals S1 and PC and across S2 and PC with shorting inverter to run. dicated when across S1 and PC and across S2 and PC are both shorted while using the safety stop we enabled), internal failure might be the cause. Check the wiring of terminals S1, S2 and PC and sales representative if the wiring has no fault.



Operation panel	EV	C
indication	EV	Cυ
Name	24V external	power supply operation
Description	Flickers when	the main circuit power is not supplied and the 24V external power is supplied.
Check point	 Check if the 24V external power is supplied. Check if the power supply for the inverter (main circuit) is ON. Check if the power supply voltage is low. Check if the jumper between terminal P/+ and P1 is removed. 	
Corrective action	• If £_ app supplied, ch	e power supply for the inverter (main circuit). ears by turning ON the power supply of the inverter (main circuit) while the external 24V power is neck the power supply (for the main circuit). e jumper is installed securely between terminal P/+ and P1.

(3) Alarm

When an alarm occurs, the output is not shut off. You can also output an alarm signal by making parameter setting. (Set "98" in any of *Pr. 190 to Pr. 192, Pr. 313 to Pr. 315 (output terminal function selection). Refer to page 167*).

Operation panel	FN	٤a
indication		• • • • • • • • • • • • • • • • • • • •
Name	Fan alarm	
Description		er that contains a cooling fan, Γ_{\Box} appears on the operation panel when the cooling fan stops due to fferent operation from the setting of $Pr. 244$ Cooling fan operation selection.
Check point	Check the coo	oling fan for an alarm.
Corrective action	Check for fan	alarm. Please contact your sales representative.

(4) Fault

When a fault occurs, the inverter trips and a fault signal is output.

Operation panel indication	E.OC1	E.DC 1	
Name	Overcurrent tr	ip during acceleration	
Description		When the inverter output current reaches or exceeds approximately 230% of the rated current during acceleration, the protective circuit is activated and the inverter trips.	
Check point	Check thatCheck for oCheck that theCheck if theCheck if theCheck that	udden acceleration. the downward acceleration time is not long for lifts. utput short-circuit/ground fault. the <i>Pr. 3 Base frequency</i> setting is not 60Hz when the motor rated frequency is 50Hz. e stall prevention operation level is set too high. e fast-response current limit operation is disabled. regeneration is not performed frequently. (Check that the output voltage becomes larger than the V/F alue at regeneration and overcurrent occurs due to the high voltage.)	
Corrective action	 Increase the acceleration time. (Shorten the downward acceleration time for lifts.) When "E.OC1" is always lit at starting, disconnect the motor once and start the inverter. If "E.OC1" is still lit, contact your sales representative. Check the wiring to make sure that output short circuit/ground fault does not occur. Set 50Hz in <i>Pr. 3 Base frequency. (Refer to page 126)</i> Lower the setting of stall prevention operation level. Activate the fast-response current limit operation. (<i>Refer to page 120</i>) Set base voltage (rated voltage of the motor, etc.) in <i>Pr. 19 Base frequency voltage. (Refer to page 126</i>) 		

Operation panel	E.OC2	ENC 2
indication	E.002	C.U.L. C
Name	Overcurrent tr	ip during constant speed
Description	When the inve	erter output current reaches or exceeds approximately 230% of the rated current during constant speed
Description	operation, the	protective circuit is activated and the inverter trips.
	Check for sudden load change.	
Check point	Check for output short-circuit/ground fault.	
Check point	Check if the stall prevention operation level is set too high.	
	Check if the fast-response current limit operation is disabled.	
	Keep load s	stable.
Corrective action	 Check the v 	viring to make sure that output short circuit/ground fault does not occur.
Corrective action	Lower the setting of stall prevention operation level.	
	 Activate the 	fast-response current limit operation. (Refer to page 120)

Operation panel	E.OC3	8 N C 3	
indication	E.003	C.U.L. J	
Name	Overcurrent tr	ip during deceleration or stop	
Description	When the inverter output current reaches or exceeds approximately 230% of the rated inverter current during deceleration (other than acceleration or constant speed), the protective circuit is activated and the inverter trips.		
Check point	 Check for sudden speed reduction. Check for output short-circuit/ground fault. 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. 		
Corrective action	 Increase the deceleration time. Check the wiring to make sure that output short circuit/ground fault does not occur. Check the mechanical brake operation. Lower the setting of stall prevention operation level. Activate the fast-response current limit operation. (Refer to page 120) 		

Operation panel indication	E.OV1	E.O∪ 1	
Name	Regenerative	Regenerative overvoltage trip during acceleration	
Description	If regenerative energy causes the inverter's internal main circuit DC voltage to reach or exceed the specified value, the protective circuit is activated and the inverter trips. 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 setting of <i>Pr. 22 Stall prevention operation level</i> is not too small. 		
Corrective action	 Decrease the acceleration time. Check that regeneration avoidance function (<i>Pr. 882, Pr. 883, Pr. 885, Pr. 886</i>) is used. (<i>Refer to page 211</i>). Set the <i>Pr.22 Stall prevention operation level</i> correctly. 		

Operation panel	E.OV2	ይበፈራ	
indication		2.502	
Name	Regenerative	overvoltage trip during constant speed	
	If regenerative	e energy causes the inverter's internal main circuit DC voltage to reach or exceed the specified value,	
Description	the protective 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 point	Check that the setting of Pr. 22 Stall prevention operation level is not too small.		
	Keep load stable.		
Corrective action	• Check that regeneration avoidance function (Pr. 882, Pr. 883, Pr. 885, Pr. 886) is used. (Refer to page 211).		
Corrective action	Use the brake resistor or brake unit as required.		
	• Set the Pr.2	2 Stall prevention operation level correctly.	

Operation panel	E.OV3	£03	
indication	2.010	C.UU J	
Name	Regenerative	overvoltage trip during deceleration or stop	
	If regenerative	e energy causes the inverter's internal main circuit DC voltage to reach or exceed the specified value,	
Description	the protective	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.		
	Increase the deceleration time. (Set the deceleration time which matches the moment of inertia of the load)		
Corrective action	Longer the	Longer the brake cycle.	
Corrective action	• Use regeneration avoidance function (Pr. 882, Pr. 883, Pr. 885, Pr. 886). (Refer to page 211).		
	Use the brake resistor or brake unit as required.		



Operation panel	E.THT	ESHS	
indication	L.1111	L.I III	
Name	Inverter overlo	ad trip (electronic thermal relay function)	
	If the tempera	ture of the output transistor element exceeds the protection level under the condition that a current not	
Description	less than the r	ated inverter current flows and overcurrent trip does not occur (230% or less), the electronic thermal	
	relay activates	to stop the inverter output. (Overload capacity 150% 60s, 200% 3s)	
	Check that	acceleration/deceleration time is not too short.	
	Check that torque boost setting is not too large (small).		
Check point	Check that load pattern selection setting is appropriate for the load pattern of the using machine.		
	Check the motor for use under overload.		
	Check for too high surrounding air temperature.		
	Increase ac	celeration/deceleration time.	
	Adjust the torque boost setting.		
Corrective action	Set the load pattern selection setting according to the load pattern of the using machine.		
	Reduce the load weight.		
	Set the surr	ounding air temperature to within the specifications.	

Operation panel	E.THM	EC HO	
indication	E. I FINI	<u> </u>	
Name	Motor overloa	d trip (electronic thermal relay function) *1	
Description	The electronic thermal relay function in the inverter detects motor overheat due to overload or reduced cooling capability during constant-speed operation and pre-alarm (TH display) is output when the integrated value reaches 85% of the <i>Pr. 9 Electronic thermal O/L relay</i> setting and the protection circuit is activated to stop the inverter output when the integrated value reaches the specified value. When running a special motor such as a multi-pole motor or multiple motors, provide a thermal relay on the inverter output side since such motor(s) cannot be protected by the electronic thermal relay function.		
Check point	 Check the motor for use under overload. Check that the setting of <i>Pr. 71 Applied motor</i> for motor selection is correct. (<i>Refer to page 144</i>). Check that stall prevention operation setting is correct. 		
Corrective action		load weight. ant-torque motor, set the constant-torque motor in <i>Pr. 71 Applied motor</i> . stall prevention operation setting is correct. (<i>Refer to page 120</i>).	

^{*1} Resetting the inverter initializes the internal thermal integrated data of the electronic thermal relay function.

Operation panel	E.FIN	881 n	
indication	<u> </u>	<u>_,</u> , , , , ,	
Name	Heatsink over	heat	
	If the heatsink	overheats, the temperature sensor is actuated and the inverter trips.	
	The FIN signa	I can be output when the temperature becomes approximately 85% of the heatsink overheat protection	
Description	operation temperature. For the terminal used for the FIN signal output, assign the function by setting "26 (positive		
	logic) or 126 (negative logic)" in any of Pr. 190 to Pr. 192, Pr. 313 to Pr. 315 (output terminal function selection). (Refer to		
	page 167).		
	Check for too high surrounding air temperature.		
Check point	Check for heatsink clogging.		
	 Check that the cooling fan is not stopped (Check that F_n is not displayed on the operation panel). 		
	Set the surrounding air temperature to within the specifications.		
Corrective action	Clean the heatsink.		
	Replace the cooling fan.		

E 11 E	FI I F	
LILI	C. L	
nput phase lo	SS *	
nverter trips w	then function valid setting (=1) is selected in Pr. 872 Input phase loss protection selection and one phase of	
the three phase power input is lost. (Refer to page 190).		
It may be available if phase-to-phase voltage of the three-phase power input becomes largely unbalanced.		
Check for a break in the cable for the three-phase power supply input.		
Check that phase-to-phase voltage of the three-phase power input is not largely unbalanced.		
Wire the cables properly.		
Repair a break portion in the cable.		
Check the Pr. 872 Input phase loss protection selection setting.		
Set Pr. 872 =	"0" (without input phase loss protection) when three-phase input voltage is largely unbalanced.	
r	when three phase may be avail Check for a Check that provided the Check that provided the Check the	

^{*} Available only for three-phase power input model.

Operation panel indication	E.OLT	E.OL F	
Name	Stall prevention stop		
Description	If the output frequency has fallen to 1Hz by stall prevention operation and remains for 3s, a fault (E.OLT) appears and trips the inverter. OL appears while stall prevention is being activated. E.OLT may not occur if stall prevention (OL) is activated during output phase loss.		
Check point	Check the motor for use under overload. (Refer to page 121).		
Corrective action	Reduce the load weight. (Check the Pr. 22 Stall prevention operation level setting.)		

Operation panel indication	E.BE	€. 6€		
Name	Brake transist	Brake transistor alarm detection		
Description	When a brake transistor alarm has occurred due to the large regenerative energy from the motor etc., the brake transistor alarm is detected and the inverter trips. In this case, the inverter must be powered OFF immediately.			
Check point	Reduce the load inertia.Check that the frequency of using the brake is proper.			
Corrective action	Replace the inverter.			

Operation panel indication	E.GF	E. GF	
Name	Output side earth (ground) fault overcurrent at start		
Description	The inverter trips if an earth (ground) fault overcurrent flows at start due to an earth (ground) fault that occurred on the inverter's output side (load side). Whether this protective function is used or not is set with <i>Pr. 249 Earth (ground) fault detection at start</i> . When the setting of <i>Pr. 249 Earth (ground) fault detection at start</i> is the initial value (<i>Pr. 249 = "0"</i>), this warning does not occur.		
Check point	Check for a ground fault in the motor and connection cable.		
Corrective action	Remedy the ground fault portion.		

Operation panel	E.LF	£
indication	E.LF	L. LI
Name	Output phase	loss
Description	If one of the three phases (U, V, W) on the inverter's output side (load side) is lost during inverter operation (except during DC injection brake operation and when output frequency is under 1Hz), inverter stops the output. Whether the protective function is used or not is set with <i>Pr. 251 Output phase loss protection selection</i> .	
Check point	 Check the wiring. (Check that the motor is normal.) Check that the capacity of the motor used is not smaller than that of the inverter. 	
Corrective action	 Wire the cables properly. Check the Pr. 251 Output phase loss protection selection setting. 	

Operation panel	E.OP1	coo i
indication	E.OP1	C.U.P. i
Name	Communication	on option fault
Description	This function s	stops the inverter output when a communication line error occurs during CC-Link communication.
	Check if a fa	ault is displayed on the inverter LED display.
	 Check if the 	CC-Link dedicated cable has a break in it.
	Check if the	CC-Link dedicated cables between stations are within the specified length.
Check point	e instruction manual of CC-Link master module for the cable length between CC-Link Ver. 1.00	
		built-in terminating resistor of the end station is turned ON, or if the one-touch connector plug ith terminating resistor is attached properly.
	Refer to "Operation status indication LEDs" on page 75, and perform appropriate countermeasures.	
	Check the contact the con	connection of the CC-Link dedicated cable.
	Check that:	the CC-Link dedicated cables between stations are within the specified length.
Corrective action	(Refer to the	e instruction manual of CC-Link master module for the cable length between CC-Link Ver. 1.00
	stations.)	
	Turn ON the	e built-in terminating resistor of the end station. Alternatively, properly attach the one-touch connector
	plug equipped with terminating resistor.	

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Operation Panel Indication	E.OPT	E.DPT
Name	Option fault	
Description	Appears when a communication option is connected while <i>Pr. 296</i> = "0 or 100."	
Check point	Check if password lock is activated by setting Pr. 296 = "0, 100"	
Corrective action	 To apply the password lock when installing a communication option, set Pr.296 ≠ "0,100". (Refer to page 199). If the problem still persists after taking the above measure, please contact your sales representative. 	

Operation panel	E. 1	<u></u>	
indication	E. 1	C. /	
Name	Option fault		
Description	Stops the inve	rter output when excessive noise occurs around the inverter.	
Description	Appears if the switch for manufacturer setting has been changed.		
Check point	 Check for e 	xcess electrical noises around the inverter.	
Check point	Check the switch position for the manufacturer setting.		
	Take measures against noises if there are devices producing excess electrical noises around the inverter.		
Corrective action	Return the switch position for the manufacturer setting to the initial status.		
	If the proble	m still persists after taking the above measure, please contact your sales representative.	

Operation panel	E.PE	8 88
indication	E.PE	C. CC
Name	Parameter sto	rage device fault (control circuit board)
Description	Stops the inverter output if fault occurred in the parameter stored. (EEPROM fault)	
Check point	Check for too many number of parameter write times.	
	Please contact your sales representative.	
Corrective action	When performing parameter write frequently for communication purposes, set "1" in Pr. 342 to enable RAM write. Note	
	that powering OFF returns the inverter to the status before RAM write.	

Operation Panel	E.PE2	5952
Indication	E.PEZ	C.F C C
Name	Internal board fault	
Description	When the combination of the control board and the main circuit board is wrong, the inverter is tripped.	
Check point	_	
Corrective action	Please contact your sales representative.	

Operation panel indication	E.RET	E E	
Name	Retry count excess		
Description	If operation cannot be resumed properly within the number of retries set, this function trips the inverter. This function is available only when $Pr. 67 \ Number of retries at fault occurrence$ is set. When the initial value ($Pr. 67 = 0$) is set, this protective function is not available.		
Check point	Find the cause of fault occurrence.		
Corrective action	Eliminate the cause of the error preceding this error indication.		

Operation panel indication	E. 5	<i>€</i> . 5	
	E. 6	€. 6	
	E. 7	€. 7	
	E.CPU	E.C P U	
Name	CPU fault		
Description	Stops the inve	rter output if the communication fault of the built-in CPU occurs.	
Check point	Check for devices producing excess electrical noises around the inverter.		
Offeck point	Check if the terminal PC is shorted with the terminal SD. (E. 6/E. 7)		
Corrective action	Take measures against noises if there are devices producing excess electrical noises around the inverter.		
	Check the connection between the terminals PC and SD. (E. 6/E. 7)		
	 Please cont 	act your sales representative.	



Operation panel indication	E.MB4 to 7	Е.ПЬЧ to Е.ПЬП
Name	Brake sequence fault	
Description	• The inverter output is stopped when a sequence error occurs during use of the brake sequence function (<i>Pr. 278 to Pr. 283</i>). This protective function is not available in the initial status. (<i>Refer to page 160</i>).	
Check point	Find the cause of alarm occurrence.	
Corrective action	Check the set parameters and perform wiring properly.	

Operation panel	E.IOH	EJ OH
indication	E.IOH	C. UN
Name	Inrush current limit circuit fault	
Description	Stops the inverter output when the resistor of inrush current limit circuit overheated. The inrush current limit circuit fault	
Check point	Check that frequent power ON/OFF is not repeated.	
Corrective action Configure a circuit where frequent power ON/OFF is not repeated.		
Corrective action	If the problem still persists after taking the above measure, please contact your sales representative.	

Operation panel	E.USB	8.USb	
indication	L.00B	L.U J U	
Name	USB commun	ication fault	
Description	When communication has broken during the time set in Pr. 548 USB communication check time interval, this function		
Description	stops the inverter output.		
Check point	Check the USB communication cable.		
	Check the Pr. 548 USB communication check time interval setting.		
Corrective action	Check the USB communication cable.		
	Increase the	e Pr. 548 USB communication check time interval setting. Or, change the setting to 9999. (Refer to page 220).	

Operation panel	E.SAF	E.S.R.F
indication	L.JAI	C.30r
Name	Safety circuit t	ault
Appears when safety circuit is malfunctioning.		n safety circuit is malfunctioning.
Description	Appears wher	n one of the lines between S1 and PC, or between S2 and PC is opened.
Description	The indication	may appear when the start-up time of the 24V power supply is too long in the 24V external power
	supply operati	on.
If the indication appears when safety stop function is not used, check if shorting wires PC are connected.		tion appears when safety stop function is not used, check if shorting wires between S1 and PC, S2 and
Check point	 If the indication appears when safety stop function is used, check that the safety relay module or the connection has no fault. 	
	Check if the	e start up of the 24V external power supply is taking 500ms or longer.
	When not u wire. (Refer	sing the safety stop function, short across terminals S1 and PC and across S2 and PC with shorting to page 24).
	When using	the safety stop function, check that wiring of terminal S1, S2 and PC is correct and the safety stop
Corrective action	manual (BC	source such as safety relay module is operating properly. Refer to the Safety stop function instruction N-211508-004) for causes and countermeasures. (Refer to the front cover of the Instruction Manual now to obtain the manual.)
	` ,	t-up time of the 24V external power supply to be within 500ms.

Operation panel indication	E.13	E. 13
Name	Internal circuit	fault
Description	Stop the inver	ter output when an internal circuit fault occurred.
Corrective action	Please contac	t your sales representative.



NOTE

• If faults other than the above appear, contact your sales representative.



6.4 Correspondences between digital and actual characters

There are the following correspondences between the actual alphanumeric characters and the digital characters displayed on the operation panel:

Actual	Digital
0	
1	
2	<u></u>
3	<u> 3</u>
4	'- /
5	5
6	E)
7	7
8	
9	9

Actual	Digital
)
A	
В	
С	
D	
E	E
F	F
G	
Н	H
J	<u></u>
L	<u></u>

Actual	Digital
M	[7]
N	,-,
0	[7]
0	ø
Р	<u></u>
S	5
T	
U	<u>[</u>
V	
r	
-	-

6.5 Check first when you have a trouble



POINT

• If the cause is still unknown after every check, it is recommended to initialize the parameters (initial value) then set the required parameter values and check again.

6.5.1 Motor does not start

Check points	Possible Cause	Countermeasures	Refer to page
Main	Appropriate power supply voltage is not applied. (Operation panel display is not provided during operation with main circuit power supply.)	Power ON a moulded 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.	_
circuit	Motor is not connected properly.	Check the wiring between the inverter and the motor.	15
	The jumper across P/+ and P1 is disconnected.	Securely fit a jumper across P/+ and P1. When using a DC reactor (FR-HEL), remove the jumper across P/+ and P1, and then connect the DC reactor.	29
	Start signal is not input.	Check the start command source, and input a start signal. PU operation mode: RUN Network operation mode: STF/STR signal	103
	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). If STF and STR signals are turned ON simultaneously in the initial setting, a stop command is given.	20
	Frequency command is zero. (RUN LED on the operation panel is flickering.)	Check the frequency command source and enter a frequency command.	103
Input signal	Output stop signal (MRS) is ON. (RUN LED on the operation panel flickers while MRS signal is ON.)	Turn MRS signal OFF. Inverter starts the operation with a given start command and a frequency command after turning OFF MRS signal. Before turning OFF, ensure the safety.	166
	The shorting wires across S1 and PC and across S2 and PC are removed although the safety stop function is not being used.	When not using the safety stop function, short across terminals S1 and PC and across S2 and PC with shorting wires.	24
	(Operation panel indication is \$\frac{P}{5}\$ (PS).)	During the Network operation mode, check the method of restarting from a STOP input stop from the operation panel.	235
	Pr. 0 Torque boost setting is improper when V/F control is used.	Increase <i>Pr. 0</i> setting by 0.5% increments while observing the rotation of a motor. If that makes no difference, decrease the setting.	113
	Pr. 78 Reverse rotation prevention selection is set.	Check the <i>Pr. 78</i> setting. Set <i>Pr. 78</i> when you want to limit the motor rotation to only one direction.	197
Parameter setting	Pr. 13 Starting frequency setting is greater than the running frequency.	Set running frequency higher than <i>Pr.</i> 13. The inverter does not start if the frequency setting signal is less than the value set in <i>Pr.</i> 13.	138
	Frequency settings of various running frequency (such as multi-speed operation) are zero. Especially, <i>Pr. 1 Maximum frequency</i> is zero.	Set the frequency command according to the application. Set <i>Pr. 1</i> higher than the actual frequency used.	124
	<i>Pr. 15 Jog frequency</i> setting is lower than <i>Pr. 13 Starting frequency</i> .	Set Pr. 15 Jog frequency higher than Pr. 13 Starting frequency.	201



Check points	Possible Cause	Countermeasures	Refer to
	Inverter decelerated to a stop when power failure deceleration stop function is selected.	When power is restored, ensure the safety, and turn OFF the start signal once, then turn ON again to restart. Inverter restarts when <i>Pr. 261</i> ="2".	page 186
Parameter setting	Performing auto tuning. Automatic restart after instantaneous power failure	When offline auto tuning ends, press (RESET) on the operation panel for the PU operation. For the Network operation, turn OFF the start signal (STF or STR). This operation resets the offline auto tuning, and the operation panel monitor display returns to the normal indication. (Without this operation, next operation cannot be started.) • Disable the automatic restart after instantaneous power failure function and power failure stop function.	146
	function or power failure stop function is activated. (Performing overload operation with single-phase power input model may cause voltage insufficiency, and results in a detection of power failure.)	 Reduce the load. Increase the acceleration time if the automatic restart after instantaneous power failure function or power failure stop function occurred during acceleration. 	180, 186
Load	Load is too heavy.	Reduce the load.	_
Loud	Shaft is locked. The program, which starts inverter operation, has not been designed correctly.	Inspect the machine (motor). Design the program correctly.	67
Others	The program, which starts inverter operation, has not been executed correctly.	Execute the program correctly.	67
	Operation panel display shows an error (e.g. E.OC1).	When any fault occurs, take an appropriate corrective action, then reset the inverter, and resume the operation.	233

6.5.2 Motor or machine is making abnormal acoustic noise

Check	Possible Cause	Countermeasures	Refer to
points	Possible Cause	Countermeasures	page
	No carrier frequency noises (metallic noises) are generated.	In the initial setting, <i>Pr. 240 Soft-PWM operation selection</i> is enabled to change motor noise to an unoffending complex tone. Therefore, no carrier frequency noises (metallic noises) are generated. Set <i>Pr. 240</i> = "0" to disable this function.	192
	Resonance occurs. (output frequency)	Set <i>Pr. 31 to Pr. 36 (Frequency jump)</i> . When it is desired to avoid resonance attributable to the natural frequency of a mechanical system, these parameters allow resonant frequencies to be jumped.	125
Parameter setting	Resonance occurs. (carrier frequency)	Change <i>Pr. 72 PWM frequency selection</i> setting. Changing the PWM carrier frequency produces an effect on avoiding the resonance frequency of a mechanical system or a motor.	192
	Auto tuning is not performed under Advanced magnetic flux vector control or General-purpose magnetic flux vector control.	Perform offline auto tuning.	146
	Gain adjustment during PID control is insufficient.	To stabilize the measured value, change the proportional band (<i>Pr. 129</i>) to a larger value, the integral time (<i>Pr. 130</i>) to a slightly longer time, and the differential time (<i>Pr. 134</i>) to a slightly shorter time. Check the calibration of set point and measured value.	203
Others	Mechanical looseness	Adjust machine/equipment so that there is no mechanical looseness.	_
Motor	Operating with output phase loss	Check the motor wiring.	_
otor	Contact the motor manufacturer.		

6.5.3 Inverter generates abnormal noise

Check points	Possible Cause	Countermeasures	Refer to page
Fan	Fan cover was not correctly installed when a cooling fan was replaced.	Install a fan cover correctly.	257

6.5.4 Motor generates heat abnormally

Check points	Possible Cause	Countermeasures	Refer to page
	Motor fan is not working	Clean the motor fan.	
Motor	(Dust is accumulated.)	Improve the environment.	
	Phase to phase insulation of the motor is insufficient.	Check the insulation of the motor.	_
Main	T	Check the output voltage of the inverter.	253
circuit	The inverter output voltage (U, V, W) are unbalanced.	Check the insulation of the motor.	233
Parameter	The Du 71 Auglis I waster cetting in urong	Check the Du 71 Auglin Lundon cetting	1.1.1
setting	The Pr. 71 Applied motor setting is wrong.	Check the Pr. 71 Applied motor setting.	144
_	Motor current is large.	Refer to "6.5.11 Motor current is too large"	249



6.5.5 Motor rotates in the opposite direction

Check points	Possible Cause	Countermeasures	Refer to page
Main circuit	Phase sequence of output terminals U, V and W is incorrect.	Connect phase sequence of the output cables (terminal U, V, W) to the motor correctly	15
Parameter	Frequency command with sign ($Pr. 541 = "1"$) is selected for CC-Link communication.	Check the <i>Pr. 541 Frequency command sign selection (CC-Link)</i> setting.	105
setting	<i>Pr. 40 RUN key rotation direction selection</i> setting is incorrect.	Check the Pr. 40 setting.	223

6.5.6 Speed greatly differs from the setting

Check			Refer
	Possible Cause	Countermeasures	to
points			page
Parameter	Dr. 1 Dr. 2 Dr. 19 pottings are improper	Check the settings of Pr. 1 Maximum frequency, Pr. 2	124
	Pr. 1, Pr. 2, Pr. 18 settings are improper.	Minimum frequency, Pr. 18 High speed maximum frequency.	
setting	Pr. 31 to Pr. 36 (frequency jump) settings are improper.	Narrow down the range of frequency jump.	125
Load		Reduce the load weight.	_
Parameter	Stell provention function is activated due to a heavy	Set Pr. 22 Stall prevention operation level higher according	
	Stall prevention function is activated due to a heavy	to the load. (Setting Pr. 22 too large may result in	120
setting	load.	frequent overcurrent trip (E.OC□).)	
Motor		Check the capacities of the inverter and the motor.	_

6.5.7 Acceleration/deceleration is not smooth

Check			Refer
points	Possible Cause	Countermeasures	to
politis			page
		For V/F control, set Pr. 3 Base frequency and Pr. 47 Second	126
	The base frequency does not match the motor	V/F (base frequency).	120
	characteristics.	For Advanced magnetic flux vector control or General-	
	Characteristics.	purpose magnetic flux vector control, set Pr. 84 Rated	146
		motor frequency.	
	Stall prevention function is activated due to a heavy load.	Reduce the load weight.	_
		Set Pr. 22 Stall prevention operation level higher according	
Parameter		to the load. (Setting Pr. 22 too large may result in	120
setting		frequent overcurrent trip (E.OC□).)	
		Check the capacities of the inverter and the motor.	_
	Acceleration/deceleration time is too short.	Increase acceleration/deceleration time.	135
	Torque boost (Pr. 0, Pr. 46) setting is improper under V/F	Increase/decrease Pr. 0 Torque boost setting value by	113
	control, so the stall prevention function is activated.	0.5% increments to the setting.	113
		If the frequency becomes unstable during regeneration	
	Regeneration avoidance operation is performed	avoidance operation, decrease the setting of Pr. 886	211
		Regeneration avoidance voltage gain.	

6.5.8 Speed varies during operation

When Advanced magnetic flux vector control or the slip compensation is selected, the output frequency varies between 0 and 2Hz as load fluctuates. This is a normal operation and not a fault.

Check points	Possible Cause	Countermeasures	Refer to page
Load	Load varies during an operation.	Select Advanced magnetic flux vector control or General-purpose magnetic flux vector control.	114
Input signal	Frequency setting signal is varying.	Check the frequency setting signal.	_
Parameter setting	Pr. 80 Motor capacity and Pr. 81 Number of motor poles settings are improper for the capacities of the inverter and the motor for Advanced magnetic flux vector control or General-purpose magnetic flux vector control.	Check the Pr. 80 Motor capacity and Pr. 81 Number of motor poles settings.	114
	Fluctuation of power supply voltage is too large.	Change the <i>Pr. 19 Base frequency voltage</i> setting (about 3%) under V/F control.	126
	Hunting occurs by the generated vibration, for example, when structural rigidity at load side is insufficient.	Disable automatic control functions, such as energy saving operation, fast-response current limit function, regeneration avoidance function, Advanced magnetic flux vector control, General-purpose magnetic flux vector control, and stall prevention. During the PID control, set smaller values to <i>Pr.129 PID proportional band</i> and <i>Pr.130 PID integral time</i> . Lower the control gain, and adjust to increase the stability. Change <i>Pr. 72 PWM frequency selection</i> setting.	
Others	Wiring length exceeds 30m when Advanced magnetic flux vector control or General-purpose magnetic flux vector control is performed.	Perform offline auto tuning.	146
	Wiring length is too long for V/F control, and a voltage	Adjust <i>Pr. 0 Torque boost</i> by increasing with 0.5% increments for low-speed operation.	113
	drop occurs.	Change to Advanced magnetic flux vector control or General-purpose magnetic flux vector control.	114

6.5.9 Operation mode is not changed properly

Check points	Possible Cause	Countermeasures	Refer to page
Input signal	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.	103
Parameter setting	Pr. 79 setting is improper.	When <i>Pr. 79 Operation mode selection</i> setting is "0" (initial value), the inverter is placed in the Network operation mode at input power ON. To switch to the PU operation mode, press (PU EXT) on the operation panel. Switchover mode is selected with the setting value "6".	103
	<i>Pr. 542 Communication station number (CC-Link)</i> is set incorrectly. (Unmatched with the program, overlapping station number, out-of-range station number, etc.)	Set Pr. 542 Communication station number (CC-Link) correctly.	105
Others	The CC-Link dedicated cable is not installed correctly. (having contact faults and breaks, etc.)	Install the CC-Link dedicated cable correctly.	52
	The operation mode switching program is not designed correctly.	Design the operation mode switching program correctly.	69
	The operation mode switching program has not been executed.	Execute the operation mode switching program.	69



6.5.10 Operation panel display is not operating

Check			Refer
points	Possible Cause	Countermeasures	to
points			page
Main		Check for the wiring and the installation.	
circuit	Wiring or installation is improper.	Make sure that the connector is fitted securely across	14
Circuit		terminals P/+ and P1.	
Main			
circuit	Device is not invest	Land the control	
control	Power is not input.	Input the power.	14
circuit			
	Command sources at the PU operation mode is not at		
Parameter	the operation panel.	Check the setting of Pr. 551 PU mode operation command	220
setting	(None of the operation mode indicators (PU_EXT_NET)	source selection.	220
	is lit.)		

6.5.11 Motor current is too large

Check			Refer
points	Possible Cause	Countermeasures	to
Parameter setting	Torque boost (<i>Pr. 0, Pr. 46</i>) setting is improper under V/F control, so the stall prevention function is activated.	Increase/decrease Pr. 0 Torque boost setting value by 0.5% increments to the setting.	page 113
	V/F pattern is improper when V/F control is performed. (<i>Pr. 3, Pr. 14, Pr. 19</i>)	Set rated frequency of the motor to <i>Pr. 3 Base frequency</i> . Use <i>Pr. 19 Base frequency voltage</i> to set the base voltage (e.g. rated motor voltage).	126
		Change <i>Pr. 14 Load pattern selection</i> according to the load characteristic.	128
	Stall prevention function is activated due to a heavy load.	Reduce the load weight.	_
		Set $Pr. 22$ Stall prevention operation level higher according to the load. (Setting $Pr. 22$ too large may result in frequent overcurrent trip (E.OC \square).)	120
		Check the capacities of the inverter and the motor.	_
	Auto tuning is not performed under Advanced magnetic flux vector control or General-purpose magnetic flux vector control.	Perform offline auto tuning.	146

6.5.12 Speed does not accelerate

Check			Refer		
points	Possible Cause	Countermeasures	to		
politis			page		
		Check the settings of Pr. 1 Maximum frequency and Pr. 2			
	Pr. 1, Pr. 2, Pr. 18 settings are improper.	Minimum frequency. If you want to run the motor at 120Hz	124		
		or higher, set Pr. 18 High speed maximum frequency.			
	Torque boost (Pr. 0, Pr. 46) setting is improper under V/F	Increase/decrease Pr. 0 Torque boost setting value by	113		
	control, so the stall prevention function is activated.	0.5% increments so that stall prevention does not occur.	113		
		Set rated frequency of the motor to <i>Pr. 3 Base frequency</i> .			
	V/F pattern is improper when V/F control is performed.	Use Pr. 19 Base frequency voltage to set the base voltage	126		
	(Pr. 3, Pr. 14, Pr. 19)	(e.g. rated motor voltage).			
Parameter	(11. 3, 11. 14, 11. 17)	Change Pr. 14 Load pattern selection according to the load	128		
setting		characteristic.			
Setting		Reduce the load weight.			
	Stall prevention function is activated due to a heavy	Set Pr. 22 Stall prevention operation level higher according			
	load.	to the load. (Setting Pr. 22 too large may result in	120		
	loau.	frequent overcurrent trip (E.OC□).)			
		Check the capacities of the inverter and the motor.			
	Auto tuning is not performed under Advanced magnetic				
	flux vector control or General-purpose magnetic flux	Perform offline auto tuning.	146		
	vector control.				
	During PID control, output frequency is automatically cor	ntrolled to make measured value = set point.	203		
Main	Brake resistor is connected between terminal P/+ and	Connect an optional brake transistor (MRS type, MYS	26		
circuit	P1 or between terminal P1 and PR by mistake.	type, FR-ABR) between terminal P/+ and PR.	20		

6.5.13 Unable to write parameter setting

Check points	Possible Cause	Countermeasures	Refer to page
Input signal	Operation is being performed (signal STF or STR is ON).	Stop the operation. When $Pr. 77 = "0"$ (initial value), write is enabled only during a stop.	196
Parameter	You are attempting to set the parameter in the Network operation mode.	Choose the PU operation mode. Or, set <i>Pr.</i> 77 = "2" to enable parameter write regardless of the operation mode.	196
setting	Parameter is disabled by the <i>Pr. 77 Parameter write</i> selection setting.	Check Pr. 77 Parameter write selection setting.	196
	Key lock is activated by the <i>Pr. 161 Frequency setting/key lock operation selection</i> setting.	Check Pr. 161 Frequency setting/key lock operation selection setting.	224

PRECAUTIONS FOR MAINTENANCE AND INSPECTION

This chapter provides the "PRECAUTIONS FOR MAINTENANCE AND INSPECTION" of this product.

Always read the instructions before using the equipment.

7.1	Inspection items	252
7 2	Measurement of main circuit voltages currents and nowers	250

2

3

5

6

8

Inspection items

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

For some short time after the power is switched OFF, a high voltage remains in the smoothing capacitor. When accessing the inverter for inspection, wait for at least 10 minutes after the power supply has been switched OFF, and then make sure that the voltage across the main circuit terminals P/+ and N/- of the inverter is not more than 30VDC using a tester, etc. If "EV" is displayed on the operation panel, turn off the 24V external power supply before an inspection.

7.1 Inspection items

7.1.1 Daily inspection

Basically, check for the following faults during operation.

- (1) Motor operation fault
- (2) Improper installation environment
- (3) Cooling system fault
- (4) Abnormal vibration, abnormal noise
- (5) Abnormal overheat, discoloration

7.1.2 Periodic inspection

Check the areas inaccessible during operation and requiring periodic inspection.

For a periodic inspection, contact your sales representative.

- (1) Check for cooling system fault......Clean the air filter, etc.
- (2) Tightening check and retightening.....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 17).

- (3) Check the conductors and insulating materials for corrosion and damage.
- (4) Measure insulation resistance.
- (5) Check and change the cooling fan and relay.

When using the safety stop function, periodic inspection is required to confirm that safety function of the safety system operates correctly.

For more details, refer to the Safety stop function instruction manual (BCN-A211508-004). (Refer to the front cover of the Instruction Manual (Basic) for how to obtain the manual.)



7.1.3 Daily and periodic inspection

Area of	Inspection Item			Inte	erval	Corrective Action of	Customer's
Inspection			Description	Daily	Periodic *2	Corrective Action at Alarm Occurrence	Check
	Surrounding environment		Check the surrounding air temperature, humidity, dirt, corrosive gas, oil mist, etc.	0		Improve environment	
General	Ove	rall unit	Check for unusual vibration and noise.	0		Check alarm location and retighten	
	Pow	er supply voltage	Check that the main circuit voltages are normal.*1	0		Inspect the power supply	
			(1) Check with megger (across main circuit terminals and earth (ground) terminal).		0	Contact the manufacturer	
	Gen	eral	(2) Check for loose screws and bolts.		0	Retighten	
			(3) Check for overheat traces on the parts.		0	Contact the manufacturer	
			(4) Check for stain.		0	Clean	
			(1) Check conductors for distortion.		0	Contact the manufacturer	
	Con	ductors, cables	(2) Check cable sheaths for breakage and deterioration (crack, discoloration, etc.).		0	Contact the manufacturer	
Main circuit	Term	ninal block	Check for damage.		0	Stop the device and contact the manufacturer.	
			(1) Check for liquid leakage.		0	Contact the manufacturer	
	Smoothing aluminum electrolytic capacitor		(2) Check for safety valve projection and		0	Contact the manufacturer	
			(3) Visual check and judge by the life check of the main circuit capacitor. (Refer to page 254)		0		
	Relay		Check that the operation is normal and no chatter is heard.		0	Contact the manufacturer	
	Operation check		(1) Check that the output voltages across phases with the inverter operated alone is balanced.		0	Contact the manufacturer	
Control			(2) Check that no fault is found in protective and display circuits in a sequence protective operation test.		0	Contact the manufacturer	
circuit, Protective		Overall	(1) Check for unusual odor and discoloration.		0	Stop the device and contact the manufacturer.	
circuit	충		(2) Check for serious rust development.		0	Contact the manufacturer	
	arts check	Aluminum	(1) Check for liquid leakage in a capacitor and deformation trace.		0	Contact the manufacturer	
	₫.	electrolytic capacitor	(2) Visual check and judge by the life check of the main circuit capacitor. (Refer to page 254)		0		
			(1) Check for unusual vibration and noise.	0		Replace the fan	
Cooling	Cool	ing fan	(2) Check for loose screws and bolts.		0	Fix with the fan cover fixing screws	
system			(3) Check for stain.		0	Clean	
			(1) Check for clogging.		0	Clean	
	Heat	sink	(2) Check for stain.		0	Clean	
			(1) Check that display is normal.	0		Contact the manufacturer	
Display	Indic	ation	(2) Check for stain.		0	Clean	
	Mete	er	Check that reading is normal.	0		Stop the device and contact the manufacturer.	
Load motor	Operation check		Check for vibration and abnormal increase in operation noise.	0		Stop the device and contact the manufacturer.	

^{*1} It is recommended to install a device to monitor voltage for checking the power supply voltage to the inverter.

^{*2} One to two years of periodic inspection cycle is recommended. However, it differs according to the installation environment. For a periodic inspection, contact your sales representative.

7.1.4 Display of the life of the inverter parts

The self-diagnostic alarm is output when the life span of the control circuit capacitor, cooling fan and each parts of the inrush current limit circuit is near its end. It gives an indication of replacement time.

The life alarm output can be used as a guideline for life judgement.

Parts	Judgement 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	Less than 50% of the predetermined speed



POINT

Refer to page 214 to perform the life check of the inverter parts.

7.1.5 Checking the inverter and converter modules

<Preparation>

- (1) Disconnect the external power supply cables (R/L1, S/L2, T/L3) and motor cables (U, V, W).
- (2) Prepare a tester. (Use 100Ω 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 for electric continuity.

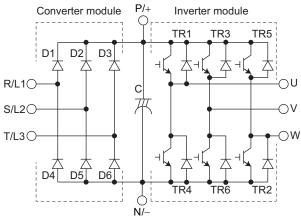


NOTE

- 1. Before measurement, check that the smoothing capacitor is discharged.
- 2. 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 continuity, the measured value is several to several tens-of ohms depending on the module type, circuit tester type, etc. If all measured values are almost the same, the modules are without fault.

<Module device numbers and terminals to be checked>

		Tester Polarity		Measured		Tester I	Polarity	Measured
		(+)	$\overline{\bigcirc}$	Value		+	$\overline{\bigcirc}$	Value
	D1	R/L1	P/+	Discontinuity	D4	R/L1	N/-	Continuity
<u>_</u>	וט	P/+	R/L1	Continuity	D4	N/-	R/L1	Discontinuity
Converter module	D2	S/L2	P/+	Discontinuity	D5	S/L2	N/-	Continuity
on Moc	DZ	P/+	S/L2	Continuity	DS	N/-	S/L2	Discontinuity
0 -	D3*	T/L3*	P/+	Discontinuity	D6*	T/L3*	N/-	Continuity
	D3*	P/+	T/L3*	Continuity	D0*	N/-	T/L3*	Discontinuity
	TR1	U	P/+	Discontinuity	TR4	U	N/-	Continuity
	IKI	P/+	U	Continuity	11114	N/-	U	Discontinuity
ter	TR3	V	P/+	Discontinuity	TR6	V	N/-	Continuity
Inverter module	INS	P/+	V	Continuity	INO	N/-	V	Discontinuity
η		W	P/+	Discontinuity		W	N/-	Continuity
	TR5	P/+	W	Continuity	TR2	N/-	W	Discontinuity



(Assumes the use of an analog meter.)

 $[\]ast\,\,$ T/L3, D3 and D6 are only for the three-phase power input models.



7.1.6 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.



NOTE

Do not use solvent, such as acetone, benzene, toluene and alcohol, as they will cause the inverter surface paint to peel off. The display, etc. of the operation panel are vulnerable to detergent and alcohol. Therefore, avoid using them for cleaning.

7.1.7 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	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

^{*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 rated current

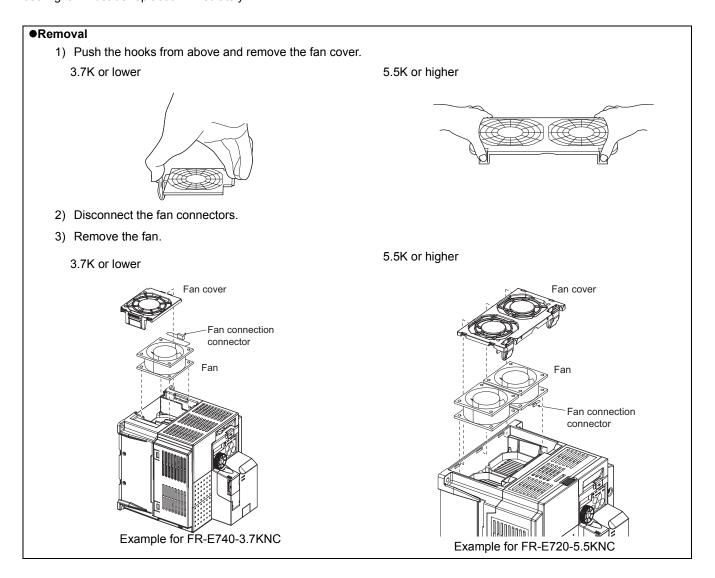


NOTE

For parts replacement, consult the nearest Mitsubishi FA Center.

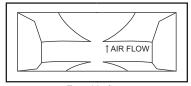
(1) Cooling fan

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 is noticed during inspection, the cooling fan must be replaced immediately.



Reinstallation

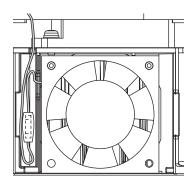
 After confirming the orientation of the fan, reinstall the fan so that the arrow on the left of "AIR FLOW" faces up.



<Fan side face>

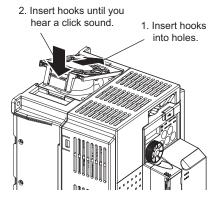
- 2) Reconnect the fan connectors.
- 3) When wiring, avoid the cables being caught by the fan.

3.7K or lower



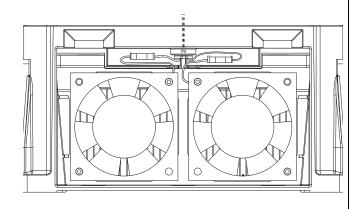
4) Reinstall the fan cover.

3.7K or lower

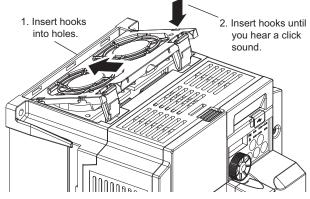


Example for FR-E740-3.7KNC

5.5K or higher



5.5K or higher



Example for FR-E720-5.5KNC



NOTE

- Installing the fan in the opposite of air flow direction can cause the inverter life to be shorter.
- Prevent the cable from being caught when installing a fan.
- Switch the power OFF before replacing fans. Since the inverter circuits are charged with voltage even after power OFF, replace fans only when the inverter cover is on the inverter to prevent an electric shock accident.

(2) Smoothing capacitors

A large-capacity aluminum electrolytic capacitor is used for smoothing in the main circuit DC section, and an aluminum electrolytic capacitor is used for stabilizing the control power in the control circuit. Their characteristics are deteriorated by the adverse effects of ripple currents, etc. The replacement intervals greatly vary with the surrounding air temperature and operating conditions. When the inverter is operated in air-conditioned, normal environment conditions, replace the capacitors about every 10 years.

When a certain period of time has elapsed, the capacitors will deteriorate more rapidly. Check the capacitors at least every year (less than six months if the life will be expired soon).

The appearance criteria for inspection are as follows:

- 1) Case: Check the side and bottom faces for expansion
- 2) Sealing plate: Check for remarkable warp and extreme crack.
- 3) Check for external crack, discoloration, liquid leakage, etc. Judge that the capacitor has reached its life when the measured capacitance of the capacitor reduced below 80% of the rating.



POINT

Refer to page 214 to perform the life check of the main circuit capacitor.

(3) Relays

To prevent a contact fault, etc., relays must be replaced according to the cumulative number of switching times (switching life).



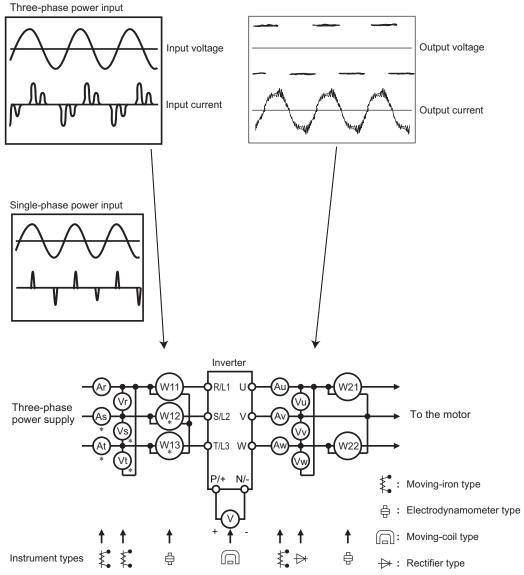
7.2 Measurement of main circuit voltages, currents and powers

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 large, especially in the 400V 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.



* At, As, Vt, Vs, W12, W13 are only for the three-phase power input specification models.

Examples of Measuring Points and Instruments

Measuring Points and Instruments

Item	Measuring Point	Measuring Instrument	Remarks (Reference Measured Value)
Power supply voltage V1	R/L1 and S/L2 S/L2 and T/L3 T/L3 and R/L1 *3	Moving-iron type AC voltmeter *4	Commercial power supply Within permissible AC voltage fluctuation (Refer to page 266)
Power supply side current	R/L1, S/L2, T/L3 line current *3	Moving-iron type AC ammeter *4	
Power supply side power P1 R/L1, S/L2, T/L3 and R/L1 and S/L2, S/L2 and T/L3, T/L3 and R/L1 *3		Digital power meter (designed for inverter) or electrodynamic type single- phase wattmeter	P1=W11+W12+W13 (3-wattmeter method)
Power supply side power factor Pf1	Calculate after measuring posupply side current and pow [Three-phase power supply] $Pf_1 = \frac{P_1}{\sqrt{3}V_1 \times I_1} \times 100$	er supply side power.	[Single-phase power supply] $Pf_1 = \frac{P_1}{V_1 \times I_1} \times 100 \%$
Output side voltage V2	Across U and V, V and W, W and U	Rectifier type AC voltage meter *1, *4 (moving-iron type cannot measure)	Difference between the phases is within 1% of the maximum output voltage.
Output side current	U, V and W line currents	Moving-iron type AC ammeter *2, *4	Difference between the phases is 10% or lower of the rated inverter current.
Output side power P2	U, V, W and U and V, V and W	Digital power meter (designed for inverter) or electrodynamic type single- phase wattmeter	P2 = W21 + W22 2-wattmeter method (or 3-wattmeter method)
Output side power factor Pf2	Calculate in similar manner of the Pf ₂ = $\frac{P_2}{\sqrt{3}V_2 \times I_2} \times 100$	to power supply side power factors	or.
Converter output	Across P/+ and N/-	Moving-coil type (such as tester)	Inverter LED display is lit. 1.35 × V1 380V maximum during regeneration for 200V class 760V maximum during regeneration for 400V class

^{*1} Use an FFT to measure the output voltage accurately. An FA tester or general measuring instrument cannot measure accurately.

^{*2} When the carrier frequency exceeds 5kHz, do not use this instrument since using it may increase eddy-current losses produced in metal parts inside the instrument, leading to burnout. In this case, use an approximate-effective value type.

^{*3} T/L3 is only for the three-phase power input models.

^{*4} A digital power meter (designed for inverter) can also be used to measure.



7.2.1 Measurement of powers

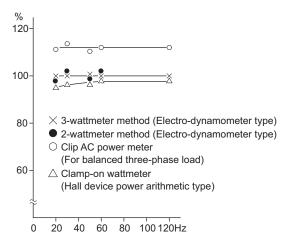
Use electro-dynamometer type meters (for inverter) for the both of inverter input and output side. Alternatively, measure using electrodynamic type single-phase wattmeters for the both of inverter input and output side in two-wattmeter or threewattmeter method. As the current is liable to be imbalanced especially in the input side, it is recommended to use the threewattmeter method.

Examples of process value differences produced by different measuring meters are shown below.

An error will be produced by difference between measuring instruments, e.g. power calculation type and two- or threewattmeter type three-phase wattmeter. When a CT is used in the current measuring side or when the meter contains a PT on the voltage measurement side, an error will also be produced due to the frequency characteristics of the CT and PT.

[Measurement conditions]

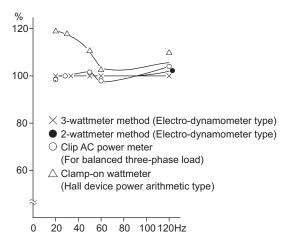
Constant-torque (100%) load, note that 60Hz or more should be constantly output 3.7kW, 4-pole motor, value indicated in 3-wattmeter method is 100%.



Example of **Measuring Inverter Input Power**

[Measurement conditions]

Constant-torque (100%) load, note that 60Hz or more should be constantly output 3.7kW, 4-pole motor, value indicated in 3-wattmeter method is 100%.



Example of **Measuring Inverter Output Power**

7.2.2 Measurement of voltages and use of PT

(1) Inverter input side

As the input side voltage has a sine wave and it is extremely small in distortion, accurate measurement can be made with an ordinary AC meter.

(2) Inverter output side

Since the output side voltage has a PWM-controlled rectangular wave, always use a rectifier type voltmeter. A needle type tester can not be used to measure the output side voltage as it indicates a value much greater than the actual value. A moving-iron type meter indicates an effective value which includes harmonics and therefore the value is larger than that of the fundamental wave. The value monitored on the operation panel is the inverter-controlled voltage itself. Hence, that value is accurate and it is recommended to monitor values using the operation panel.

No PT can be used in the output side of the inverter. Use a direct-reading meter. (A PT can be used in the input side of the inverter.)

7.2.3 Measurement of currents

Use a moving-iron type meter on both the input and output sides of the inverter. However, if the carrier frequency exceeds 5kHz, do not use that meter since an overcurrent losses produced in the internal metal parts of the meter will increase and the meter may burn out. In this case, use an approximate-effective value type.

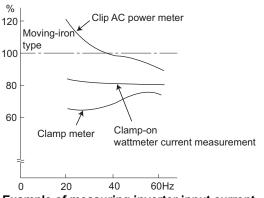
Since current on the inverter input side tends to be unbalanced, measurement of three phases is recommended. Correct value can not be obtained by measuring only one or two phases. On the other hand, the unbalanced ratio of each phase of the output side current should be within 10%.

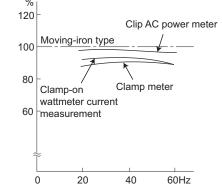
When a clamp ammeter is used, always use an effective value detection type. A mean value detection type produces a large error and may indicate an extremely smaller value than the actual value. The value monitored on the operation panel is accurate if the output frequency varies, and it is recommended to monitor values (provide analog output) using the operation panel. Examples of process value differences produced by different measuring meters are shown below.

[Measurement conditions]

[Measurement conditions]

Value indicated by moving-iron type ammeter is 100%. Value indicated by moving-iron type ammeter is 100%.





Example of measuring inverter input current

Example of measuring inverter output current

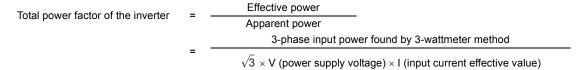
7.2.4 Use of CT and transducer

A CT may be used in both the input and output sides of the inverter, but the one used should have the largest possible VA ability because an error will increase if the frequency gets lower.

When using a transducer, use the effective value calculation type which is immune to harmonics.

7.2.5 Measurement of inverter input power factor

Calculate using effective power and apparent power. A power-factor meter can not indicate an exact value.



7.2.6 Measurement of converter output voltage (across terminals P/+ and N/-)

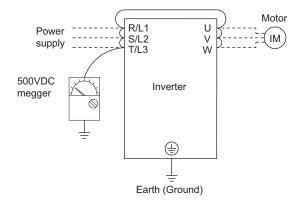
The output voltage of the converter is developed across terminals P/+ and N/- and can be measured with a moving-coil type meter (tester). Although the voltage varies according to the power supply voltage, approximately 270VDC to 300VDC (540VDC to 600VDC for the 400V class) is output when no load is connected and voltage decreases during driving load operation.

When energy is regenerated from the motor during deceleration, for example, the converter output voltage rises to nearly 400VDC to 450VDC (800VDC to 900VDC for the 400V class) maximum.



7.2.7 Insulation resistance test using megger

• For the inverter, conduct the insulation resistance test on the main circuit only as shown below and do not perform the test on the control circuit. (Use a 500VDC megger.)



(1)

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 electric 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

8 / SPECIFICATIONS

This chapter provides the "SPECIFICATIONS" of this product. Always read the instructions before using the equipment.

8.1	Rating	. 266
	Common specifications	
8.3	Outline dimension drawings	269

8.1 Rating

Three-phase 200V power supply

	Model FR-E720-□KNC		0.2	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15		
App	licable motor capacity (kW) *1	0.1	0.2	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15		
	Rated capacity (kVA) *2	0.3	0.6	1.2	2.0	3.2	4.4	7.0	9.5	13.1	18.7	23.9		
Output	Rated current (A) *7	0.8 (0.8)	1.5 (1.4)	3 (2.5)	5 (4.1)	8 (7)	11 (10)	17.5 (16.5)	24 (23)	33 (31)	47 (44)	60 (57)		
ont	Overload current rating *3			15	60% 60s,	200% 3s	(inverse-	time cha	racteristic	s)				
	Rated voltage *4					Three-p	hase 200	to 240V						
	Regenerative braking torque *5	150	150%		0%	50%	50% 20%							
supply	Rated input AC (DC) voltage/frequency		Three-phase 200 to 240V 50Hz/60Hz (283 to 339VDC *8)											
Power sup	Permissible AC (DC) voltage fluctuation		170 to 264V 50Hz/60Hz (240 to 373VDC *8)											
Pov	Permissible frequency fluctuation						±5%							
	Power supply capacity (kVA) *6	0.4	0.8	1.5	2.5	4.5	5.5	9	12	17	20	28		
Pro	tective structure (JEM1030)					Оре	n type (II	P00)						
Cod	Cooling system		Self-c	ooling				Forc	ed air co	oling				
App	proximate mass (kg)	0.5	0.5	0.7	1.0	1.4	1.4	1.7	4.3	4.3	6.5	6.5		

Three-phase 400V power supply

	Model FR-E740-□KNC		0.75	1.5	2.2	3.7	5.5	7.5	11	15
App	olicable motor capacity (kW)*1	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15
	Rated capacity (kVA)*2	1.2	2.0	3.0	4.6	7.2	9.1	13.0	17.5	23.0
Output	Rated current (A)*7	1.6 (1.4)	2.6 (2.2)	4.0 (3.8)	6.0 (5.4)	9.5 (8.7)	12	17	23	30
Out	Overload current rating*3			150% 60	s, 200% 3s	s (inverse-t	ime charac	teristics)		
	Rated voltage*4				Three-phase 380 to 480V					
	Regenerative braking torque *5	100% 50% 20%								
<u>></u>	Rated input voltage/frequency			Th	ree-phase	380 to 480	V 50Hz/60	Hz		
supply	Permissible AC voltage fluctuation				325 to	528V 50Hz	z/60Hz			
er s	Permissible frequency fluctuation					±5%				
Power	Power supply capacity (kVA)*6	1.5	2.5	4.5	5.5	9.5	12	17	20	28
Pro	tective structure (JEM1030)				Ор	en type (IP	00)			
Cod	oling system	Self-c	ooling		•	For	ced air coc	ling	•	
App	proximate mass (kg)	1.4	1.4	1.9	1.9	1.9	3.2	3.2	6.0	6.0

- *1 The applicable motor capacity indicated is the maximum capacity applicable for use of the Mitsubishi 4-pole standard motor.
- *2 The rated output capacity indicated assumes that the output voltage is 230V for three-phase 200V class and 440V for three-phase 400V class.
- *3 The % value of the overload current rating indicated 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 pulse voltage value of the inverter output side voltage remains unchanged at about $\sqrt{2}$ that of the power supply.
- *5 The braking torque indicated is a short-duration average torque (which varies with motor loss) when the motor alone is decelerated from 60Hz in the shortest time and is not a continuous regenerative torque. When the motor is decelerated from the frequency higher than the base frequency, the average deceleration torque will reduce. Since the inverter does not contain a brake resistor, use the optional brake resistor when regenerative energy is large. (Option brake resistor cannot be used for 0.1K and 0.2K.) A brake unit (FR-BU2) may also be used.
- *6 The power supply capacity varies with the value of the power supply side inverter impedance (including those of the input reactor and cables).
- *7 Setting 2kHz or more in *Pr. 72 PWM frequency selection* to perform low acoustic noise operation in the surrounding air temperature exceeding 40°C (totally-enclosed structure is 30°C), the rated output current is the value in parentheses.
- *8 Connect DC power supply to terminal P/+ and N/-. Connect the plus side of the power supply to terminal P/+ and minus side to terminal N/-.
 - Since the voltage between P/+ and N/- may increase due to the regeneration energy from the motor and exceeds 415V temporarily, select the DC power supply which can withstand the voltage/energy during regeneration. If using the power supply which can not withstand voltage/energy during regeneration, insert diodes in series for reverse current prevention.
 - Although the FR-E700 series has the built-in inrush current limit circuit, select the DC power supply considering the inrush current at powering ON as the
 inrush current four times of the rated inverter flows at powering ON.
 - Since the power supply capacity depends on the output impedance of the power, select the power supply capacity which has enough allowance according to the AC power supply system capacity.

Single-phase 200V power supply

	Model FR-E720S-□KNC	0.1	0.2	0.4	0.75	1.5	2.2			
App	olicable motor capacity (kW)*1	0.1	0.2	0.4	0.75	1.5	2.2			
	Rated capacity (kVA)*2	0.3	0.6	1.2	2.0	3.2	4.4			
	Rated current (A)*7	0.8	1.5	3.0	5.0	8.0	11.0			
put	Rated current (A)*/	(8.0)	(1.4)	(2.5)	(4.1)	(7.0)	(10.0)			
Output	Overload current rating*3	15	50% 60s, 20	00% 3s (inv	erse-time cl	naracteristic	es)			
	Rated voltage*4		T	hree-phase 200 to 240V						
	Regenerative braking torque *5	150% 100			0%	50%	20%			
<u></u>	Rated input AC voltage/frequency		Single-phase 200 to 240V 50Hz/60Hz							
supply	Permissible AC voltage fluctuation		•	170 to 264V	50Hz/60Hz	Z				
er s	Permissible frequency fluctuation			Withir	า ±5%					
Power	Power supply capacity (kVA)*6	0.5	0.9	1.5	2.5	4.0	5.2			
Pro	tective structure (JEM1030)			Open typ	e (IP00)					
Cod	oling system		Self-cooling	1	For	ced air coo	ling			
App	proximate mass (kg)	0.6	0.6	0.9	1.4	1.5	2.0			

- The applicable motor capacity indicated is the maximum capacity applicable for use of the Mitsubishi 4-pole standard motor.
- *2 The rated output capacity indicated assumes that the output voltage is 230V.
- The % value of the overload current rating indicated 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. If the automatic restart after instantaneous power failure function (Pr. 57) or power failure stop function (Pr. 261) is set and power supply voltage is low while load becomes bigger, the bus voltage decreases to power failure detection level and load of 100% or more may not be available.
- The maximum output voltage does not exceed the power supply voltage. The maximum output voltage can be changed within the setting range. However, the pulse voltage value of the inverter output side voltage remains unchanged at about $\sqrt{2}$ that of the power supply.
- The braking torque indicated is a short-duration average torque (which varies with motor loss) when the motor alone is decelerated from 60Hz in the shortest time and is not a continuous regenerative torque. When the motor is decelerated from the frequency higher than the base frequency, the average deceleration torque will reduce. Since the inverter does not contain a brake resistor, use the optional brake resistor when regenerative energy is large. (Option brake resistor cannot be used for 0.1K and 0.2K.) A brake unit (FR-BU2) may also be used.
- The power supply capacity varies with the value of the power supply side inverter impedance (including those of the input reactor and cables).
- Setting 2kHz or more in Pr. 72 PWM frequency selection to perform low acoustic noise operation with the surrounding air temperature exceeding 40°C, the rated output current is the value in parentheses.

Common specifications 8.2

_				
	Control method		Soft-PWM control/high carrier frequency PWM control (V/F control, Advanced magnetic flux vector control, General-purpose magnetic flux vector control, Optimum excitation control are available)	
	Output frequency range		0.2 to 400Hz	
ations	Frequency setting resolution (Digital input)		0.01Hz	
Control specifications	Frequency accuracy (Digital input)		Within 0.01% of the set output frequency	
	Voltage/frequency of	haracteristics	Base frequency can be set from 0 to 400Hz, constant-torque/variable-torque pattern can be selected	
	Starting torque		200% or more (at 0.5Hz)when Advanced magnetic flux vector control is set (3.7K or lower)	
	Torque boost		Manual torque boost	
Co	Acceleration/deceleration time setting		0.01 to 360s, 0.1 to 3600s (acceleration and deceleration can be set individually), linear or S-pattern acceleration/deceleration modes are available.	
	DC injection brake		Operation frequency (0 to 120Hz), operation time (0 to 10s), operation voltage (0 to 30%) can be changed.	
	Stall prevention ope	eration level	Operation current level can be set (0 to 200% adjustable), whether to use the function or not can be selected.	
	Frequency setting signal (Digital input)		The signal can be input from the operation panel or via CC-Link communication. Frequency setting increment can be set.	
	Start signal		Forward and reverse rotation can be selected.	
tions	Input signal (assigned to the input virtual terminals of CC-Link communication)		The following signals can be assigned to <i>Pr.</i> 180 to <i>Pr.</i> 184 (input terminal function selection): multi-speed selection, remote setting, stop-on contact selection, second function selection, PID control valid terminal, brake opening completion signal, V/F switchover, output stop	
Operation specifications	Operational functions		Maximum/minimum frequency setting, frequency jump operation, automatic restart after instantaneous power failure operation, forward/reverse rotation prevention, remote setting, brake sequence, second function, multispeed operation, stop-on contact control, droop control, regeneration avoidance, slip compensation, operation mode selection, offline auto tuning function, PID control	
ation	Safety stop function		Safety shutoff signal can be input from terminals S1 and S2. (compliant with EN ISO 13849-1 Category 3 / PLd EN62061 / IEC61508 SIL2)	
Opera	Output signal Open collector output (One terminal) Operating status		The following signals can be assigned to <i>Pr.190 to Pr.192</i> , <i>Pr.313 to Pr.315 (output terminal function selection)</i> : inverter running, up-to-frequency, overload alarm, output frequency detection, regenerative brake prealarm, electronic thermal relay function prealarm, inverter operation ready, output current detection, zero current detection, PID lower limit, PID upper limit, PID forward/reverse rotation output, brake opening request, fan alarm*2, heatsink overheat pre-alarm, deceleration at an instantaneous power failure, PID control activated, during retry, life alarm, current average value monitor, remote output, alarm output, fault output, fault output 3, maintenance timer alarm, safety monitor output, safety monitor output2.	
	Operation panel indication		The following operating statuses can be displayed: output frequency, motor current (steady), output voltage, frequency setting, cumulative energization time, actual operation time, motor torque, converter output voltage, regenerative brake duty, electronic thermal relay function load factor, output current peak value, converter output voltage peak value, motor load factor, PID set point, PID measured value, PID deviation, output power, cumulative power, motor thermal load factor, and inverter thermal load factor.	
		Fault record	Fault record is displayed when a fault occurs. Past 8 fault records (output voltage/current/frequency/cumulative energization time right before the fault occurs) are stored.	
	tective/warning ction	Protective functions	Overcurrent during acceleration, overcurrent during constant speed, overcurrent during deceleration, overvoltage during acceleration, overvoltage during acceleration, overvoltage during deceleration, inverter protection thermal operation, motor protection thermal operation, heatsink overheat, input phase failure*5, stall prevention stop, output side earth (ground) fault overcurrent at start*4, output phase failure, option fault, parameter error, retry count excess *4, CPU fault, brake transistor alarm, inrush resistance overheat, communication error, USB communication fault, brake sequence error 4 to 7 *4, safety circuit fault	
		Warning functions	Fan alarm*2, overcurrent stall prevention, overvoltage stall prevention, PU stop, parameter write error, regenerative brake prealarm *4, electronic thermal relay function prealarm, maintenance output *4, undervoltage, operation panel lock, password locked*4, inverter reset, safety stop, 24V external power supply operation	
Ħ	Surrounding air temperature		-10°C to +50°C (non-freezing) *3	
Environment	Ambient humidity		90%RH or less (non-condensing)	
on	Storage temperature*1		-20°C to +65°C	
ž	Atmosphere		Indoors (without corrosive gas, flammable gas, oil mist, dust and dirt etc.)	
Ш	Altitude/vibration		Maximum 1000m above sea level, 5.9m/s ² or less at 10 to 55Hz (directions of X, Y, Z axes)	
_	1 Towns 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			

- Temperatures applicable for a short time, e.g. in transit.

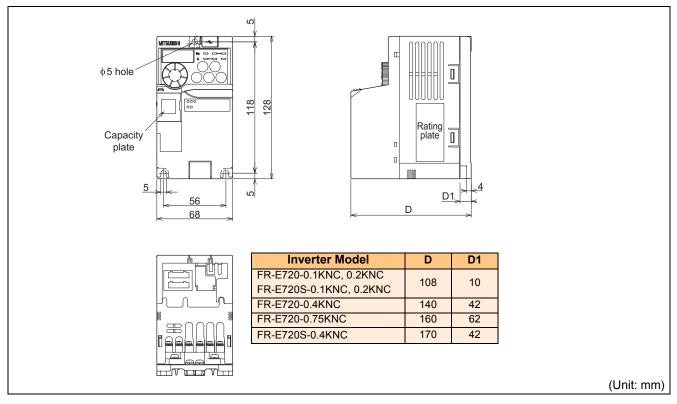
 As the FR-E720-0.1KNC to 0.75KNC, FR-E740-0.4KNC and 0.75KNC, FR-E720S-0.1KNC to 0.4KNC are not provided with the cooling fan, this alarm is not
- When using the inverters at the surrounding air temperature of 40°C or less, the inverters can be installed closely attached (0cm clearance). This protective function is not available in the initial status.

 This protective function is available with the three-phase power input model only.

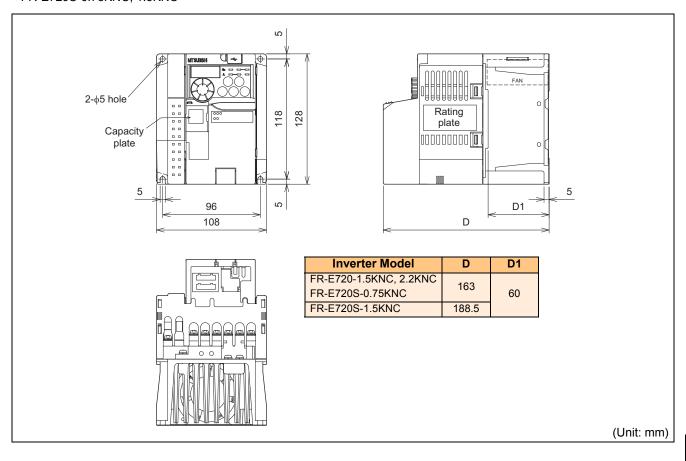
SPECIFICATIONS

8.3 Outline dimension drawings

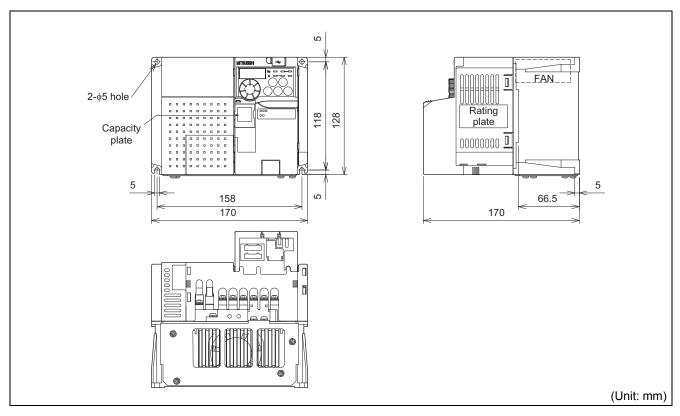
- ●FR-E720-0.1KNC to 0.75KNC
- ●FR-E720S-0.1KNC to 0.4KNC



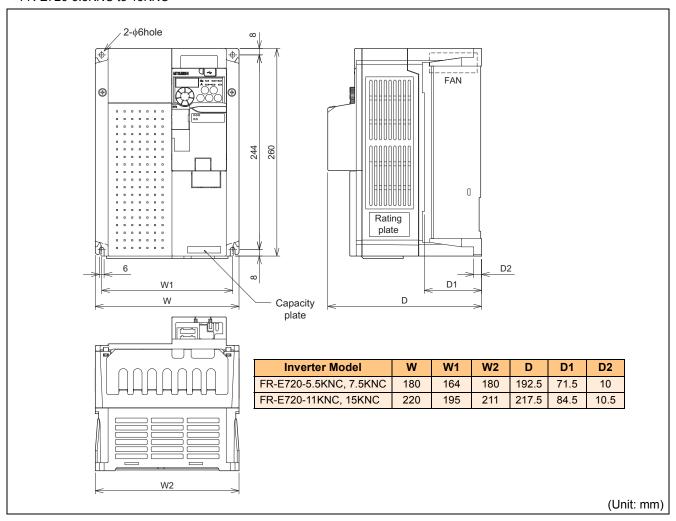
- ●FR-E720-1.5KNC, 2.2KNC
- ●FR-E720S-0.75KNC, 1.5KNC



●FR-E720-3.7KNC



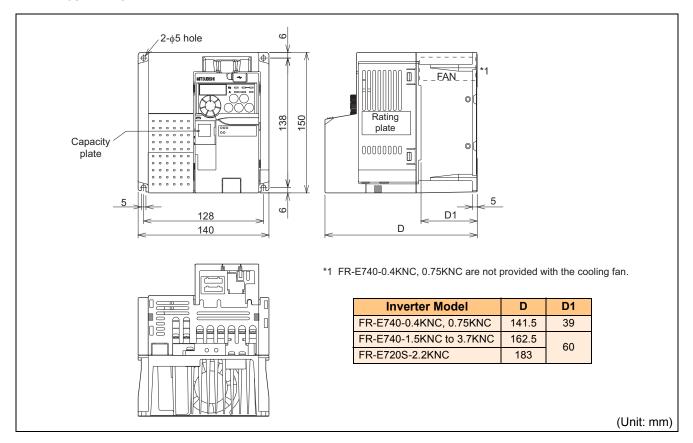
●FR-E720-5.5KNC to 15KNC



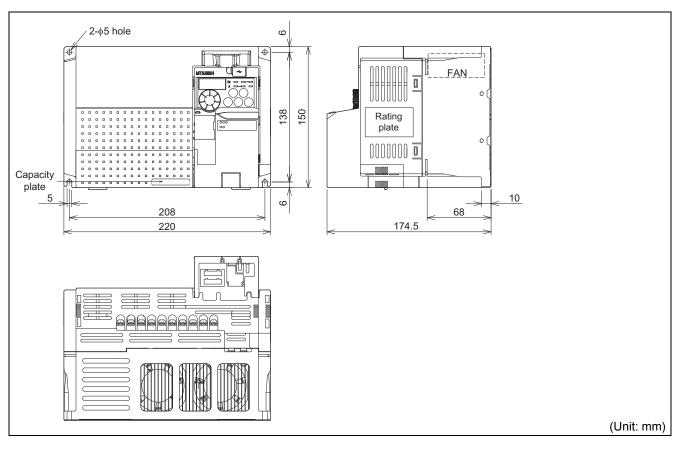
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●FR-E740-0.4KNC to 3.7KNC

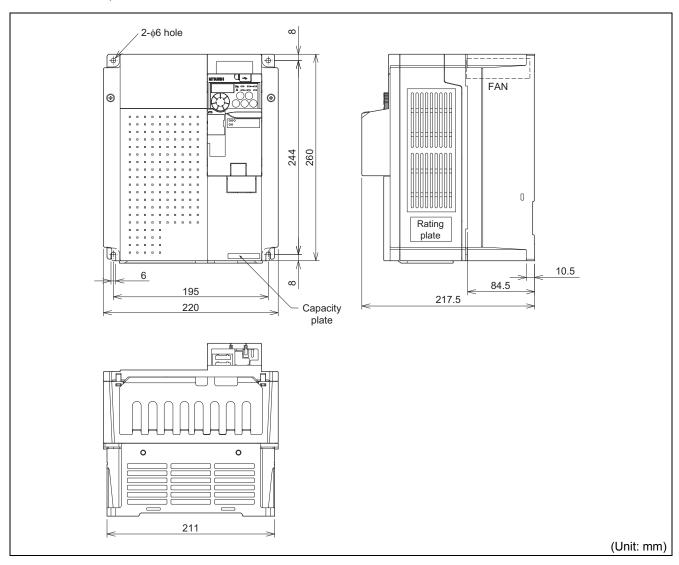
●FR-E720S-2.2KNC



●FR-E740-5.5KNC, 7.5KNC



●FR-E740-11KNC, 15KNC



APPENDIX

This chapter provides the "APPENDIX" of this product. Always read the instructions before using the equipment.

Appendix 1 Main differences with the FR-E500(N) CC-Link model

Item		FR-E500 (N)	FR-E700 (NC)	
Control method		V/F control General-purpose magnetic flux vector control	V/F control General-purpose magnetic flux vector control Advanced magnetic flux vector control Optimum excitation control	
	Shape	Terminal block connection (removable from the inverter front)	Two one-touch connectors dedicated to CC-Link communication	
	Connectable units	Up to 42 units (one unit occupies one station). Other models can also be used.	Up to 42 units. (<i>Refer to page 105</i> for the number of occupied stations). Other models can also be used.	
_	Station type	Remote de	evice station	
CC-Link specification	Number of occupied stations	One inverter occupies one station.	CC-Link Ver. 1: Occupies one station. CC-Link Ver. 2: Occupies one station (double, quadruple, and octuple settings are selectable). (Pr. 544)	
s Xc	Connection cable	CC-Link dedicated cable, CC-Link Ver.	1.10 compatible CC-Link dedicated cable	
CC-Lir	Station number setting	Set with the rotary switch	Set with the parameter (Pr. 542)	
	Transmission baud rate setting	Set with the rotary switch Set with the parameter (Pr. 543)		
	Communication by the 24V external power supply	Not available	Available	
		Torque boost (Pr. 0) initial value FR-E520-1.5KNC to 7.5KNC: 6%	FR-E720-1.5KNC to 3.7KNC: 4% FR-E720-5.5KNC, 7.5KNC: 3%	
		DC injection brake operation voltage (<i>Pr. 12</i>) initial value 0.4K to 7.5K: 6%	0.4K to 7.5K: 4%	
		Second electronic thermal O/L relay (Pr. 48) Shortest acceleration/ deceleration mode (Pr. 60)	Parameter numbers changed (Pr. 51 Second electronic thermal O/L relay) (Pr. 60 Energy saving control selection) (Pr. 292 Automatic acceleration/deceleration)	
		Second applied motor Pr. 71 = 100 to 123	Pr. 450 Second applied motor	
Cha	nged/cleared functions	Operation mode selection (<i>Pr. 79</i>) Initial value 2: CC-Link operation mode Setting range: 0 to 2	Initial value 0: CC-Link operation mode is selected at power ON Setting range: 0 to 4,6,7	
		Setting General-purpose magnetic flux vector $Pr. 80 \neq 9999$	<i>Pr.</i> 80 ≠ 9999, <i>Pr.</i> 81 ≠ 9999, <i>Pr.</i> 800 = 30	
		User group 1 (16), user group 2 (16) (Pr. 160, Pr. 173 to Pr. 175)	User group (16) only, setting methods were partially changed (<i>Pr. 160, Pr. 172, Pr. 173</i>)	
	Input terminal function selection (<i>Pr. 180 to Pr. 183</i>) setting 6: MRS signal (output stop)		Pr. 180 to Pr. 184 Input terminal function selection setting 6: None 24: MRS signal (output stop)	
		Cooling fan operation selection (<i>Pr. 244</i>) initial setting 0: Cooling fan operates in power-on status.	1: Cooling fan on/off control valid	
		Stop selection (<i>Pr. 250</i>) setting increments 1s	0.1s	
Inru	ush current limit circuit	Provided for the 2.2K or higher	Provided for the all capacity	
Control terminals	Terminal block specification	Fixed terminal block (cannot be removed) Screw type terminal block (Phillips screw M2.5) Length of recommended blade terminal is 7mm	Removable terminal block Spring clamp terminal block (The spring pressure inside locks the wire.) Length of recommended blade terminal is 10mm	
trol	Input terminal	MRS (can be assigned), RES (can be assigned)	S1 and S2 (cannot be assigned)	
Cont	Output terminal	ABC (can be assigned), relay output	Y0 (can be assigned), open collector output	
Operation panel		Not available	Integrated operation panel (can not be removed)	
	Parameter unit	FR-PU04	Cannot be used	
RS	S-485 communication	Available	Not available	
	Option unit	FR-HC and FR-CV are connectable.	FR-HC and FR-CV are not connectable (because FR-E700-NC do not have the terminal MRS.)	
	Installation size	Installation siz	ze is compatible	

Appendix 2 Specification change

Appendix 2-1 SERIAL number check

Check the SERIAL number indicated on the inverter rating plate or package. (Refer to page 2)

Rating plate example



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

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

Appendix 2-2 Changed functions

(1) Operating conditions for the SAFE signal and SAFE2 signal

This change applies to the inverters having the following SERIAL or later. (Refer to page 24.)

Туре	SERIAL (Serial No.)
FR-E720-0.1KNC to 15KNC	D0000000
FR-E740-0.4KNC to 15KNC	A0000000
FR-E720S-0.1KNC to 2.2KNC	A0000000

• The operating conditions (E.6, E.7, and E.CPU) are added for the SAFE signal and SAFE2 signal, which are used in the safety stop function.

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MEMO

*The manual number is given on the bottom left of the back cover.

Print Date	*Manual Number	Revision
Nov. 2011	IB(NA)-0600402ENG-A	First edition

1 For Maximum Safety

- Mitsubishi inverters are not designed or manufactured to be used in equipment or systems in situations that can affect or endanger human life.
- When considering this product for operation in special applications such as machinery or systems used in passenger transportation, medical, aerospace, atomic power, electric power, or submarine repeating applications, please contact your nearest Mitsubishi sales representative.
- Although this product was manufactured under conditions of strict quality control, you are strongly advised to
 install safety devices to prevent serious accidents when it is used in facilities where breakdowns of the product
 are likely to cause a serious accident.
- Please do not use this product for loads other than three-phase induction motors.

FR-E700-NC Series Instruction Manual Supplement

1 For the terminating resistor selection switch

Please make corrections to the following error in this manual.

Connection of several inverters

• Instruction Manual (Basic) : page 17

• Instruction Manual (Applied): page 50

(Incorrect)

*2 Set "1" and "2" of the terminating resistor selection switch (SW1) to OFF (without terminating resistor) in the middle units.

	1	2	Description
1 0 0 2 0 N	OFF	OFF	Without terminating resistor (initial setting)
1 🗀 0 2 🗔 N	ON	OFF	Do not use.
TINO OFF ON 130Ω	130Ω		
1 🛄 0 2 🔟 N	ON	ON	110Ω

 130Ω is a resistance value for the CC-Link Ver. 1.00 dedicated high performance cable

(Correct)

*2 Set "1" and "2" of the terminating resistor selection switch (SW1) to OFF (without terminating resistor) in the middle units.

	1	2	Description
1 0 0 2 0 N	OFF	OFF	Without terminating resistor (initial setting)
1 🛄 0 2 🗔 N	ON	OFF	130Ω
OFF ON		ON	Do not use.
10 2N	ON	ON	110Ω

 130Ω is a resistance value for the CC-Link Ver. 1.00 dedicated high performance cable

2 Additional notes for instructions for UL and cUL

• Instruction Manual (Basic) : page 43

General precaution

CAUTION - Risk of Electric Shock -

The bus capacitor discharge time is 10 minutes. Before starting wiring or inspection, switch power off, wait for more than 10 minutes.

ATTENTION - Risque de choc électrique -

La durée de décharge du condensateur de bus est de 10 minutes. Avant de commencer le câblage ou l'inspection, mettez l'appareil hors tension et attendez plus de 10 minutes.

Motor overload protection

When using the electronic thermal relay function as motor overload protection, set the rated motor current to *Pr. 9 "Electronic thermal O/L relay"*.



NOTE

Motor over temperature sensing is not provided by the drive.

