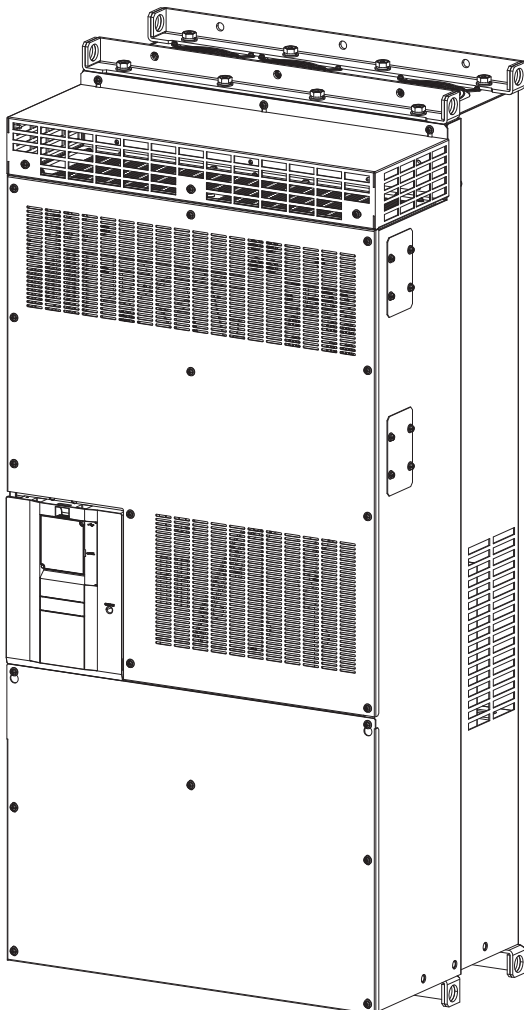




INVERTER CC2 INSTRUCTION MANUAL

Converter Unit

FR-CC2-C355K to C560K



INTRODUCTION	1
INSTALLATION AND WIRING	2
PRECAUTIONS FOR USE OF THE CONVERTER UNIT	3
PARAMETER	4
PROTECTIVE FUNCTIONS	5
PRECAUTIONS FOR MAINTENANCE AND INSPECTION	6
SPECIFICATIONS	7

Thank you for choosing this Mitsubishi converter unit.

This Instruction Manual provides handling information and precautions for use of the FR-CC2 series.

Incorrect handling might cause an unexpected fault. Before using this product, always read this Instruction Manual carefully to use this product correctly.

Safety instructions

Do not attempt to install, operate, maintain or inspect the product until you have read through this 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.

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

- A person who possesses a certification in regard with electric appliance handling, or person took a proper engineering training.

Such training may be available at your local Mitsubishi office. Contact your local sales office for schedules and locations.

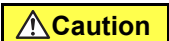
- A person who can access operating manuals for the protective devices (e.g. light curtain) connected to the safety control system. A person who has read and familiarized himself/herself with the manuals.

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.

Even items that are marked with the  icon may lead to a potentially critical situation, depending on the circumstances. Both instruction levels must be followed because these are important to personal safety.

Electric Shock Prevention



Warning

- While the converter unit power is ON, do not open the front cover. Do not run the converter unit with the front cover removed. Otherwise you may access the exposed high voltage 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. Accidentally touching the charged converter circuits will result in electric shock.
- Before wiring or inspection, the power lamp must be switched 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.
- Any person who is involved in wiring or inspection of this equipment shall be fully competent to do the work.
- The converter unit 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. Otherwise you may get 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. Doing so may cause an electric shock.

Fire Prevention



Caution

- The converter unit must be installed on a nonflammable wall without holes (so that nobody touches the converter unit heatsink on the rear side, etc.). Mounting it to or near flammable material may cause a fire.
- If the converter unit becomes faulty, the converter power must be switched OFF. A continuous flow of large current may cause a fire.
- Be sure to perform daily and periodic inspections as specified in the Instruction Manual. There is a possibility of explosion, damage, or fire if this product is used without inspection.

Injury Prevention



Caution

- The voltage applied to each terminal must be the ones specified in the Instruction Manual. Otherwise an explosion or damage may occur.
- The cables must be connected to the correct terminals. Otherwise an explosion or damage may occur.
- The polarity (+ and -) must be correct. Otherwise an explosion or damage may occur.
- While power is ON or for some time after power OFF, do not touch the converter unit as it will be extremely hot. Touching these devices may cause burns.

Additional instructions

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



Caution

Transportation and mounting

- Any person who is opening a package using a sharp object, such as a knife and cutter, must wear gloves to prevent injuries caused by the edge of the sharp object.
- The product must be transported in correct method that corresponds to the weight. Failure to do so may lead to injuries.
- Do not stand or rest heavy objects on the product.
- Do not stack the boxes containing converters higher than the number recommended.
- When carrying the converter unit, do not hold it by the front cover or setting dial; it may fall off or fail.
- During installation, caution must be taken not to drop the converter unit as doing so may cause injuries.
- The product must be installed on a surface that withstands the weight of the converter unit.
- Do not install the product on a hot surface.
- The mounting orientation of the converter unit must be correct.
- The converter unit must be installed on a strong surface securely with screws so that it will not drop.
- Do not install or operate the converter unit if it is damaged or has parts missing.
- Foreign conductive objects must be prevented from entering the converter unit. That includes screws and metal fragments or other flammable substance such as oil.
- As the converter unit is a precision instrument, do not drop or subject it to impact.
- The surrounding air temperature must be -10 to +50°C (nonfreezing). (The temperature range depends on the inverter rating. Refer to [page 17](#).) Otherwise the converter unit may be damaged.
- The ambient humidity must be 95%RH or less (non-condensing). Otherwise the converter unit may be damaged. (For the details, refer to [page 17](#).)

⚠ Caution

Transportation and mounting

- The storage temperature (applicable for a short time, e.g. during transit) must be between -20 and +65°C. Otherwise the converter unit may be damaged.
- The converter unit must be used indoors (without corrosive gas, flammable gas, oil mist, dust and dirt etc.) Otherwise the converter unit may be damaged.
- The converter unit must be used at an altitude of 2500 m or less above sea level, with 2.9 m/s² or less vibration at 10 to 55 Hz (directions of X, Y, Z axes). Otherwise the converter unit may be damaged. (For the details, refer to [page 17](#).)
- If halogens (including fluorine, chlorine, bromine, and iodine) contained in fumigants for wood packages enter this product, the product may be damaged. Prevent the entry of fumigant residuals or use an alternative method such as heat disinfection. Note that sterilization or disinfection of wood packages should be performed before packing the product.

Test run

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

⚠ Warning

Usage

- Everyone must stay away from the equipment when the retry function is set as it will restart suddenly after a trip.
- Since pressing a STOP/RESET key of the operation panel 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 an inverter fault. Resetting an converter unit fault with the start signal ON restarts the motor suddenly.
- 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

Usage

- Do not use a magnetic contactor on the input side for frequent starting/stopping of the inverter. Otherwise the life of the inverter and the converter unit 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 precautions must be taken to suppress harmonics. Otherwise power supply harmonics from the inverter or the converter unit may heat/damage the power factor correction capacitor and generator.
- When parameter clear or all parameter clear is performed, the required parameters must be set again before starting operations. because all parameters return to their initial values.
- Before running a converter unit which had been stored for a long period, inspection and test operation must be performed.
- Static electricity in your body must be discharged before you touch the product.
- To maintain the security (confidentiality, integrity, and availability) of the Converter unit, drive unit and the system against unauthorized access, DoS *1 attacks, computer viruses, and other cyberattacks from external devices via network, take appropriate measures such as firewalls, virtual private networks (VPNs), and antivirus solutions. We shall have no responsibility or liability for any problems involving Converter unit, drive unit trouble and system trouble by DoS attacks, unauthorized access, computer viruses, and other cyberattacks.
- When the emergency drive function is enabled, the operation is continued or the retry operation (automatic reset and restart) is repeated even if a fault occurs, which may damage or burn the inverter, the converter unit, or the motor. Before restarting the normal operation after the operation using the emergency drive function, make sure that the inverter, the converter unit, and the motor have no fault.

Emergency stop

- A safety backup such as an emergency brake must be provided to prevent hazardous conditions to the machine and equipment in case of converter unit failure.
- When the breaker on the converter unit's input side trips, check for wiring faults (such as short circuits) damage to internal parts of the converter unit, etc. The cause of the trip must be identified and removed before turning ON the power of the breaker.
- When a protective function is activated, take an appropriate corrective action, then reset the converter unit (inverter), and resume the operation.

Maintenance, inspection and parts replacement

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

Disposal

- The converter unit must be treated as industrial waste.

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

General instruction

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

CONTENTS

1	INTRODUCTION	7
1.1	Product checking	8
1.2	Component names	9
1.3	Related manuals	10
2	INSTALLATION AND WIRING	11
2.1	Peripheral devices	12
2.1.1	Converter unit and peripheral devices	12
2.1.2	Peripheral devices	14
2.2	Removal and reinstallation of the front cover	15
2.3	Installation of the converter unit and enclosure design	17
2.3.1	Converter unit installation environment	17
2.3.2	Cooling system types for converter unit enclosure	20
2.3.3	Installation of the converter unit	21
2.3.4	Protruding the heatsink	23
2.4	Terminal connection diagrams	25
2.5	Main circuit terminals	27
2.5.1	Details on the main circuit terminals	27
2.5.2	Terminal layout of the main circuit terminals, wiring of the power supply and the inverter	27
2.5.3	Applicable cables	29
2.5.4	Earthing (grounding) precautions	30
2.6	Control circuit	31
2.6.1	Details on the control circuit terminals	31
2.6.2	Control logic (sink/source) change	33
2.6.3	Wiring of control circuit	35
2.6.4	Wiring precautions	37
2.6.5	When using separate power supplies for the control circuit and the main circuit	38
2.6.6	When supplying 24 V external power to the control circuit	39
2.7	Communication connectors and terminals	41
2.7.1	PU connector	41
2.7.2	RS-485 terminal block	42
3	PRECAUTIONS FOR USE OF THE CONVERTER UNIT	43
3.1	Electro-magnetic interference (EMI) and leakage currents	44
3.1.1	Leakage currents and countermeasures	44
3.1.2	Countermeasures against EMI generated by the inverter or the converter unit	45
3.2	Power supply harmonics	48
3.3	Installation of a reactor	48

3.4	Power-OFF and magnetic contactor (MC)	49
3.5	Checklist before starting operation	51

4 PARAMETER **53**

4.1	Parameter list	54
4.1.1	Parameter list (by parameter number)	54
4.1.2	Parameter list (by function group)	57
4.2	(E) Environment setting parameters	59
4.2.1	Real time clock function	60
4.2.2	Reset selection / disconnected PU detection / reset limit.....	62
4.2.3	Buzzer control	63
4.2.4	Parameter write selection	63
4.2.5	Password function	64
4.2.6	Free parameter.....	66
4.2.7	Converter unit parts life display	66
4.2.8	Maintenance timer alarm.....	68
4.3	(H) Protective function parameter	69
4.3.1	Initiating a protective function.....	69
4.3.2	Input phase loss protection selection	69
4.3.3	Retry function	70
4.3.4	Cooling fan ON/OFF control.....	72
4.3.5	Emergency drive	73
4.4	(M) Monitor display and monitor output signal	77
4.4.1	Monitor display selection using operation panel or via communication.....	77
4.4.2	Output terminal function selection	81
4.4.3	Detection of control circuit temperature.....	84
4.5	(T) Multi-function input terminal parameters	85
4.5.1	Input terminal function selection.....	85
4.5.2	Operation selection for the external thermal relay input (Pr.876).....	86
4.6	(A) Application parameters	87
4.6.1	Self power management	87
4.6.2	Automatic restart after instantaneous power failure selection	89
4.6.3	Power failure time deceleration-to-stop function	90
4.7	(N) Operation via communication and its settings	92
4.7.1	Wiring and configuration of PU connector.....	92
4.7.2	Wiring and configuration of RS-485 terminals.....	94
4.7.3	Initial setting of operation via communication.....	97
4.7.4	Initial settings and specifications of RS-485 communication.....	98
4.7.5	Mitsubishi inverter protocol (computer link communication).....	100
4.7.6	MODBUS RTU communication specification	111

5 PROTECTIVE FUNCTIONS **125**

5.1	Converter unit fault and alarm indications	126
5.2	Reset method for the protective functions	126

5.3	Faults history and the list of fault displays	127
5.4	Causes and corrective actions	128
5.5	Check first when you have trouble	134
5.5.1	Converter unit does not operate properly	134
5.5.2	The power lamp is OFF	134
5.5.3	The charge lamp is OFF	134
5.5.4	Operation panel display is not operating	134
5.5.5	Inverter cannot be operated.....	135
5.5.6	Unable to write parameter setting	135
5.5.7	Breaker trips	135
5.5.8	Converter unit generates abnormal noise.....	135

6 PRECAUTIONS FOR MAINTENANCE AND INSPECTION **137**

6.1	Inspection item	138
6.1.1	Daily inspection.....	138
6.1.2	Periodic inspection.....	138
6.1.3	Daily and periodic inspection	139
6.1.4	Checking the converter semiconductor devices	141
6.1.5	Cleaning.....	141
6.1.6	Replacement of parts.....	142
6.1.7	Converter unit replacement	144
6.2	Measurement of main circuit voltages, currents and powers	145
6.2.1	Measurement of powers	145
6.2.2	Measurement of voltages	146
6.2.3	Measurement of currents.....	146
6.2.4	Example of measuring converter unit input power factor.....	146
6.2.5	Measurement of converter output voltage (across terminals P and N).....	146
6.2.6	Insulation resistance test using megger	146
6.2.7	Withstand voltage test	146

7 SPECIFICATIONS **147**

7.1	Converter unit rating	148
7.2	Common specifications	148
7.3	Outline dimension drawings	149
7.3.1	Converter unit outline dimension drawings.....	149

APPENDIX **151**

Appendix 1	Instruction code list	152
Appendix 2	Instructions for UL and cUL (Standard to comply with: UL 508C, CSA C22.2)	154
Appendix 3	Instructions for UL and cUL (Standard to comply with: UL 61800-5-1, CSA C22.2 No. 274).	155
Appendix 4	Restricted Use of Hazardous Substances in Electronic and Electrical Products.....	157

Appendix 5 Referenced Standard (Requirement of Chinese standardized law)..... 157
Appendix 6 UL-certified combinations of converter units and inverters 157

1 INTRODUCTION

This chapter contains the descriptions that must be read before using this product.

Always read the instructions before using the equipment.

1.1	Product checking.....	8
1.2	Component names.....	9
1.3	Related manuals	10

<Abbreviations>

Operation panel Operation panel (FR-LU08)

DU..... Operation panel (FR-LU08)

PU..... Operation panel (FR-LU08)

Converter unit Converter unit FR-CC2 series

FR-CC2..... Converter unit FR-CC2 series

Pr. Parameter number (Number assigned to function)

<Trademarks>

- Microsoft and Visual C++ are registered trademarks of Microsoft Corporation in the United States and other countries.
- Other company and product names herein are the trademarks and registered trademarks of their respective owners.

<Notes on descriptions in this Instruction Manual>

- Connection diagrams in this Instruction Manual suppose that the control logic of the input terminal is the sink logic, unless otherwise specified. (For the control logic, refer to [page 33](#).)

1.1 Product checking

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

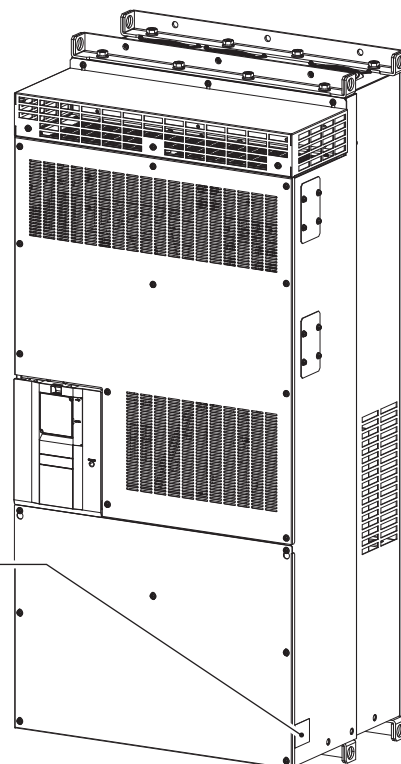
● Converter unit model

Symbol	Voltage class
C	600V class

Symbol	Description
355K to 560K	Rated converter unit capacity (kW)

FR-CC2-C 355K -60

Symbol	Circuit board coating (conforming to IEC60721-3-3:1994 3C2/3S2)	Plated conductor
-60	With	Not used
-06	With	With

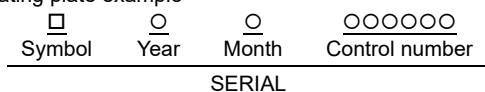


Rating plate

Converter unit model Input rating Output rating SERIAL Country of origin	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;"> MITSUBISHI ELECTRIC </td> <td style="text-align: center;"> INVERTER </td> <td style="text-align: center;"> PASSED </td> </tr> <tr> <td colspan="3"> MODEL FR-CC2-C355K-60 </td> </tr> <tr> <td colspan="3"> INPUT : XXXXX </td> </tr> <tr> <td colspan="3"> OUTPUT : XXXXX </td> </tr> <tr> <td colspan="3"> SERIAL : XXXXXXXXX </td> </tr> <tr> <td colspan="3"> MADE IN XXXXX </td> </tr> </table>	MITSUBISHI ELECTRIC	INVERTER	PASSED	MODEL FR-CC2-C355K-60			INPUT : XXXXX			OUTPUT : XXXXX			SERIAL : XXXXXXXXX			MADE IN XXXXX		
MITSUBISHI ELECTRIC	INVERTER	PASSED																	
MODEL FR-CC2-C355K-60																			
INPUT : XXXXX																			
OUTPUT : XXXXX																			
SERIAL : XXXXXXXXX																			
MADE IN XXXXX																			

● How to read the SERIAL number

Rating plate example

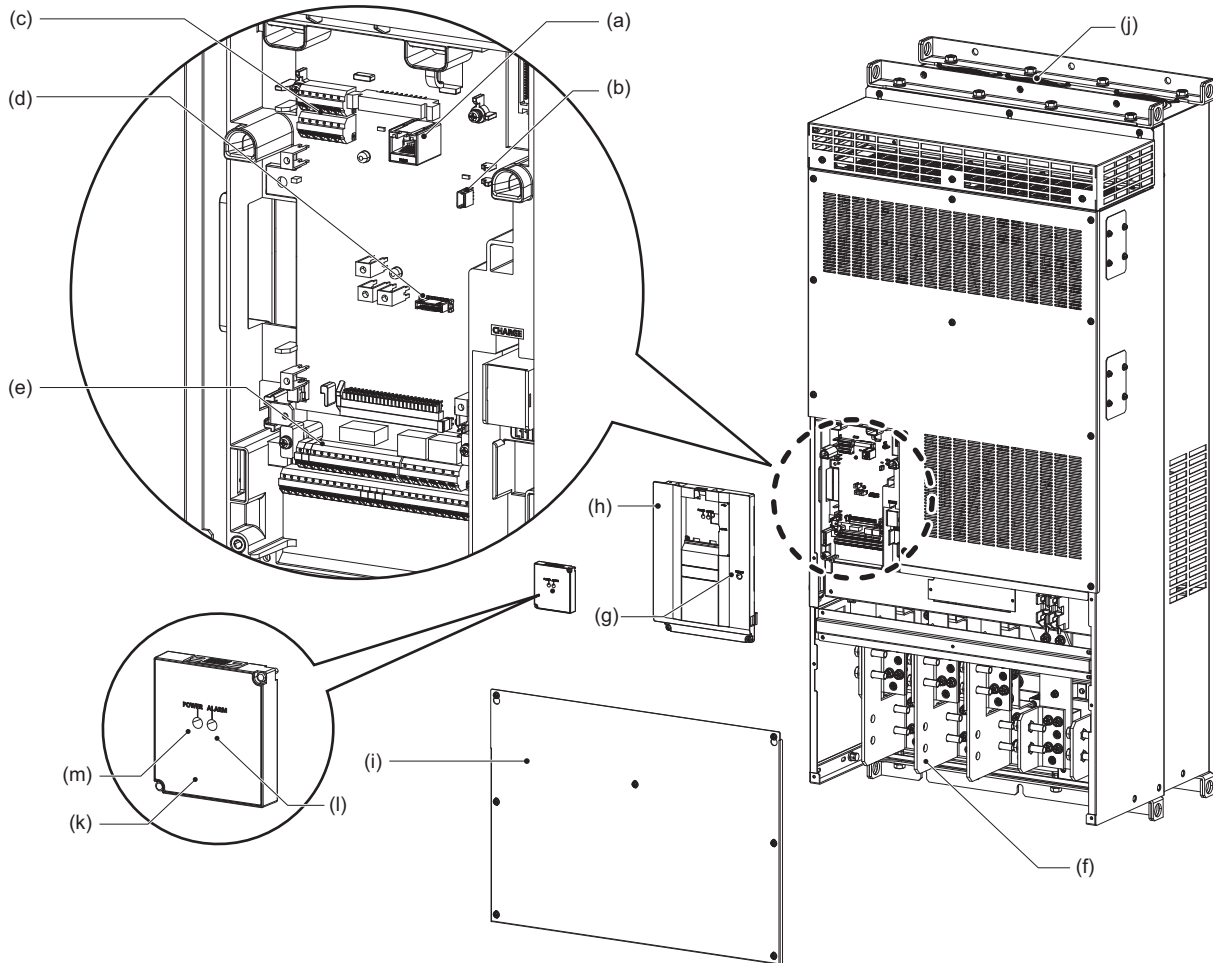


The SERIAL consists of one symbol, two characters indicating the production year and month, and six characters indicating the control number.

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

1.2 Component names

Component names are shown below.



Symbol	Name	Description	Refer to page
(a)	PU connector	Connects the operation panel. This connector also enables the RS-485 communication.	41
(b)	For manufacturer setting. Do not use. If the setting is changed, a protective function (E.SAF) may be activated.		—
(c)	RS-485 terminals	Enables RS-485 and MODBUS RTU communication.	42
(d)	For manufacturer setting. Do not use. If the setting is changed, a protective function (E.SAF) may be activated.		—
(e)	Control circuit terminal block	Connects cables for the control circuit.	31
(f)	Main circuit conductor	Connects cables for the main circuit.	27
(g)	Charge lamp	Stays ON while the power is supplied to the main circuit.	27
(h)	Front cover (upper side)	Remove this cover for the installation of the product, RS-485 terminal wiring, etc.	15
(i)	Front cover (lower side)	Remove this cover for wiring.	15
(j)	Cooling fan	Cools the converter unit.	143
(k)	Accessory cover	Remove this cover to use the PU connector.	41
(l)	Alarm lamp	Turns ON when the protective function of the converter unit is activated.	27
(m)	Power lamp	Stays ON while the power is supplied to the control circuit (R1/L11, S1/L21).	27

1.3 Related manuals

Manuals related to the FR-CC2 converter unit are shown in the following table.

name	Manual number
FR-A862 Instruction Manual (Hardware)	IB-0600571ENG
FR-A860 Instruction Manual (Detailed)	IB-0600563ENG
FR-F862 Instruction Manual (Hardware)	IB-0600689ENG
FR-F860 Instruction Manual (Detailed)	IB-0600688ENG

2 **INSTALLATION AND WIRING**

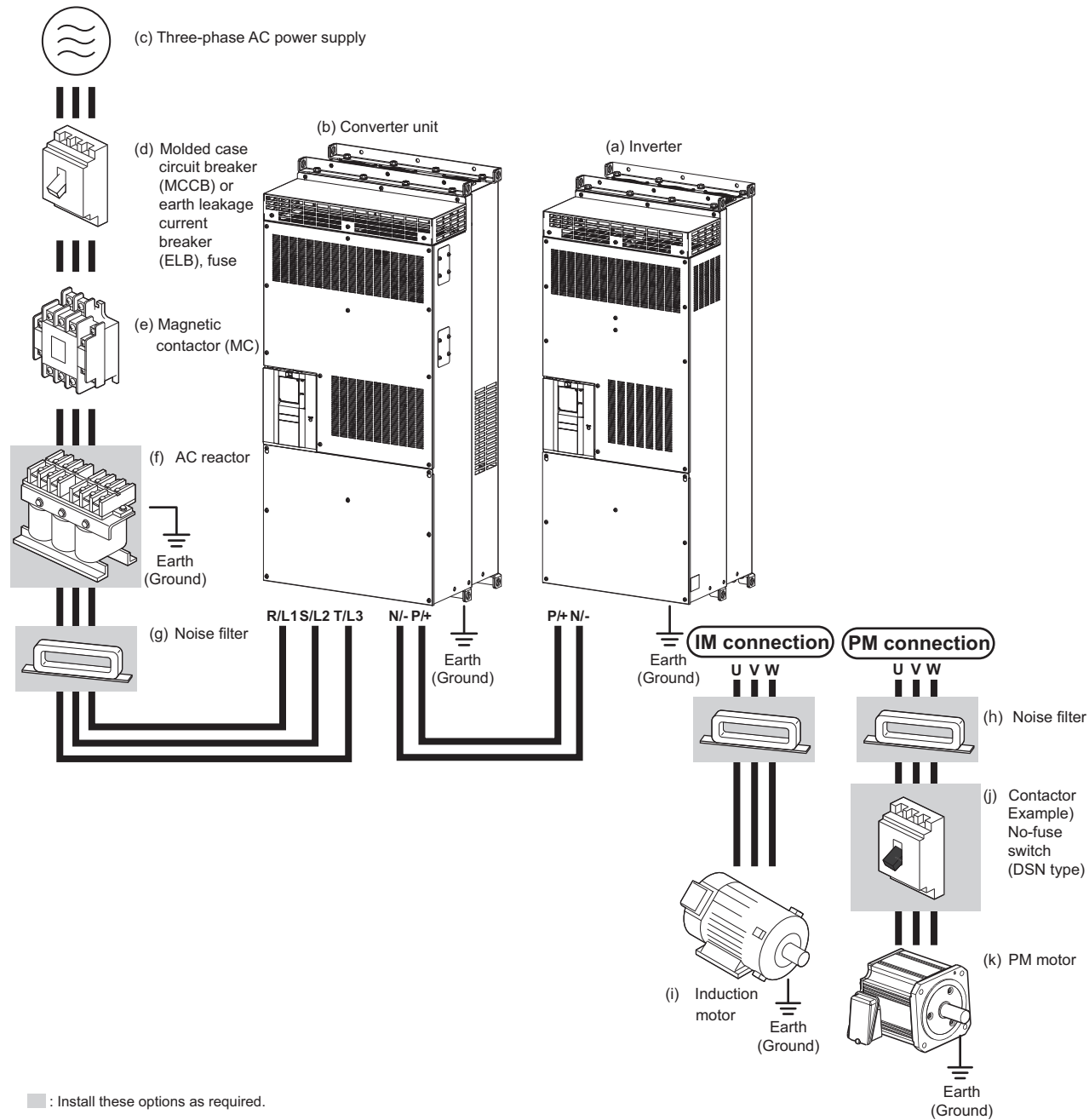
This chapter explains the "installation" and the "wiring" of this product.

Always read the instructions before using the equipment.

2.1	Peripheral devices	12
2.2	Removal and reinstallation of the front cover.....	15
2.3	Installation of the converter unit and enclosure design	17
2.4	Terminal connection diagrams	25
2.5	Main circuit terminals	27
2.6	Control circuit	31
2.7	Communication connectors and terminals	41

2.1 Peripheral devices

2.1.1 Converter unit and peripheral devices



 **NOTE**

- To prevent an electric shock, always earth (ground) the converter unit, the inverter, and the motor.
- Do not install a power factor correction capacitor or surge suppressor or capacitor type filter on the inverter's output side. Doing so will cause the inverter to trip or the capacitor and surge suppressor to be damaged. If any of the above devices is connected, immediately remove it. When installing a molded case circuit breaker on the output side of the inverter, contact the manufacturer of the molded case circuit breaker.
- Electromagnetic wave interference
The input/output (main circuit) of the inverter or the converter unit includes high frequency components, which may interfere with the communication devices (such as AM radios) used near the inverter or the converter unit. Refer to [page 45](#) for countermeasures.
- For details of options and peripheral devices, refer to the respective Instruction Manual.
- A PM motor cannot be driven by the commercial power supply.
- A PM motor is a motor with permanent magnets embedded inside. High voltage is generated at the motor terminals while the motor is running even after the inverter power is turned OFF. Before closing the contactor at the output side, make sure that the inverter power is ON and the motor is stopped.

Symbol	Name	Overview	Refer to page
(a)	Inverter (FR-A862/FR-F862)	The life of the inverter and the converter unit is influenced by the surrounding air temperature. The surrounding air temperature should be as low as possible within the permissible range. This must be noted especially when the inverter is installed in an enclosure. Incorrect wiring may lead to damage of the inverter and the converter unit. The control signal lines must be kept fully away from the main circuit lines to protect them from noise.	17 25
(b)	Converter unit (FR-CC2)		
(c)	Three-phase AC power supply	Must be within the permissible power supply specifications of the converter unit.	148
(d)	Molded case circuit breaker (MCCB), earth leakage circuit breaker (ELB), or fuse	Must be selected carefully since an inrush current flows in the converter unit at power ON.	14
(e)	Magnetic contactor (MC)	Install this to ensure safety. Do not use this to start and stop the inverter. Doing so will shorten the life of the inverter and the converter unit.	49
(f)	AC reactor	Install this to suppress harmonics and to improve the power factor. An AC reactor is required when installing the inverter near a large power supply system (1000 kVA or more). The inverter or the converter unit may be damaged if you do not use a reactor. Select a reactor according to the applicable motor capacity.	48
(g)	Noise filter	Suppresses the noise radiated from the power supply side of the converter unit.	45
(h)	Noise filter	Install this to reduce the electromagnetic noise generated from the inverter or the converter unit. The noise filter is effective in the range from about 0.5 MHz to 5 MHz.	45
(i)	Induction motor	Connect a squirrel-cage induction motor.	—
(j)	Contactor Example) No-fuse switch (DSN type)	Connect this for an application where a PM motor is driven by the load even while the inverter power is OFF. Do not open or close the contactor while the inverter is running (outputting).	—
(k)	PM motor	Drives a PM motor. A PM motor cannot be driven by the commercial power supply.	—

2.1.2 Peripheral devices

◆ Selecting the converter unit (FR-CC2)

Select the capacity of the FR-CC2 converter unit according to the connected motor capacity.

- FR-A800 series

Converter unit FR-CC2-[]	Inverter			
	Model FR-A862-[]	Rated current (A)	Motor capacity (kW) *1	
C355K	05450	SLD	545	400
		LD	496	355
		ND	402	280
		HD	304	220
C400K	06470	SLD	647	450
		LD	589	400
		ND	496	355
		HD	402	280
C560K	08500	SLD	850	630
		LD	773	560
		ND	663	450
		HD	589	400

- FR-F800 series

Converter unit FR-CC2-[]	Inverter			
	Model FR-F862-[]	Rated current (A)	Motor capacity (kW) *1	
C355K	05450	SLD	545	400
		LD	496	355
C400K	06470	SLD	647	450
		LD	589	400
C560K	08500	SLD	850	630
		LD	773	560

*1 The applicable motor capacity indicated is the maximum capacity applicable for use of the 4-pole standard motor.

◆ Selecting the breaker/magnetic contactor

Check the model of the inverter and the converter unit you purchased. Appropriate peripheral devices must be selected according to the capacity.

Refer to the table below to prepare appropriate peripheral devices.

Motor output (kW)*1	Applicable converter unit model	Applicable inverter model	Molded case circuit breaker (MCCB)*2 or earth leakage circuit breaker (ELB) (NF, NV type)	Input-side magnetic contactor*3
280	FR-CC2-C355K	FR-A862-05450 / FR-F862-05450	600A	373A
355	FR-CC2-C400K	FR-A862-06470 / FR-F862-06470	800A	469A
450	FR-CC2-C560K	FR-A862-08500 / FR-F862-08500	1000A	617A

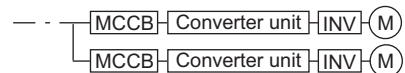
*1 Assumes the use of a 4-pole standard motor with the power supply voltage of 575 VAC 50 Hz.

*2 Select an MCCB according to the power supply capacity. Install one MCCB per converter unit.

For the use in the United States or Canada, provide the appropriate UL and cUL listed fuse that is suitable for branch circuit protection. (Refer to [page 154](#).)

*3 The 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 stops during motor driving, the electrical durability is 25 times.

If using an MC for emergency stop during driving the motor, select an MC regarding the converter unit input side current as JEM1038-AC-3 class rated current. When providing an MC to use the commercial power supply during general-purpose motor operation, select an MC regarding the rated motor current as JEM1038-AC-3 class rated current.

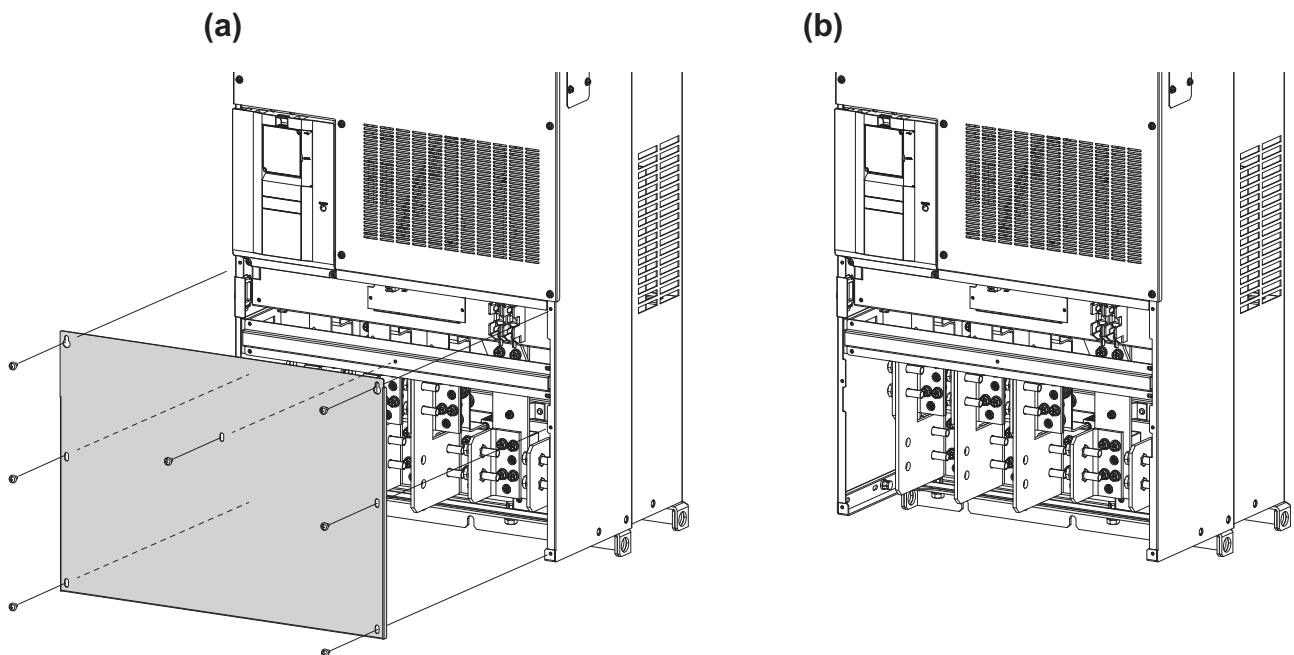


NOTE

- When the converter unit capacity is larger than the motor capacity, select an MCCB and a magnetic contactor according to the converter unit model, and select cables and reactors according to the motor output.
- When the breaker on the converter unit's input side trips, check for the wiring fault (short circuit), damage to internal parts of the inverter or the converter unit, etc. The cause of the trip must be identified and removed before turning ON the power of the breaker.

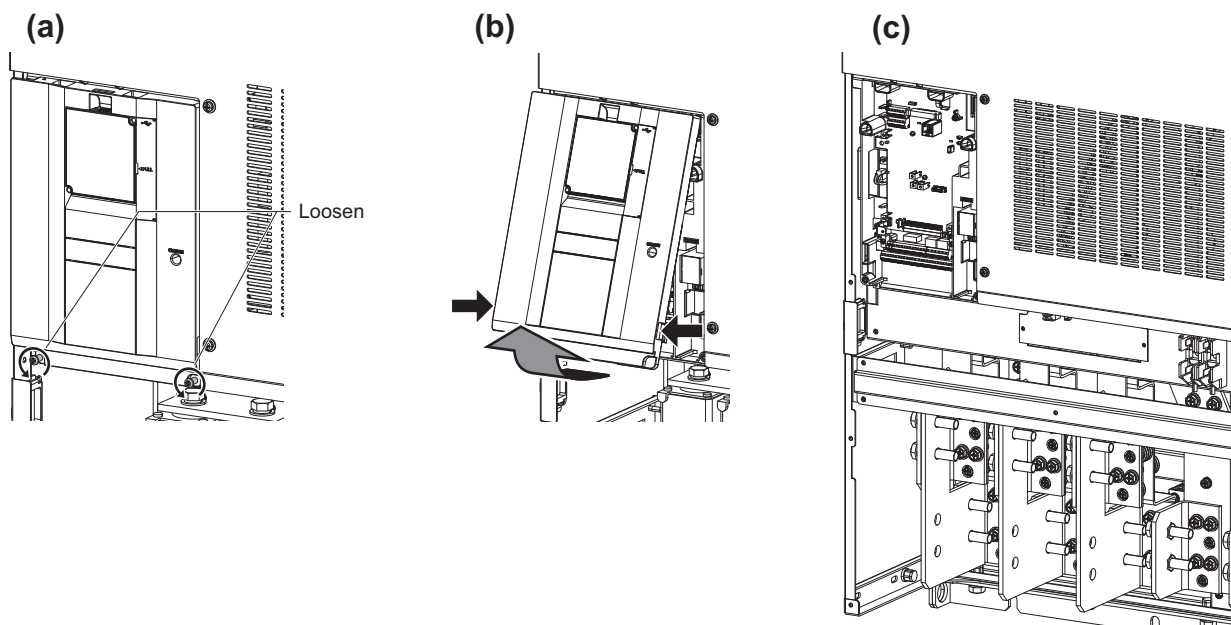
2.2 Removal and reinstallation of the front cover

◆ Removal of the front cover (lower side)



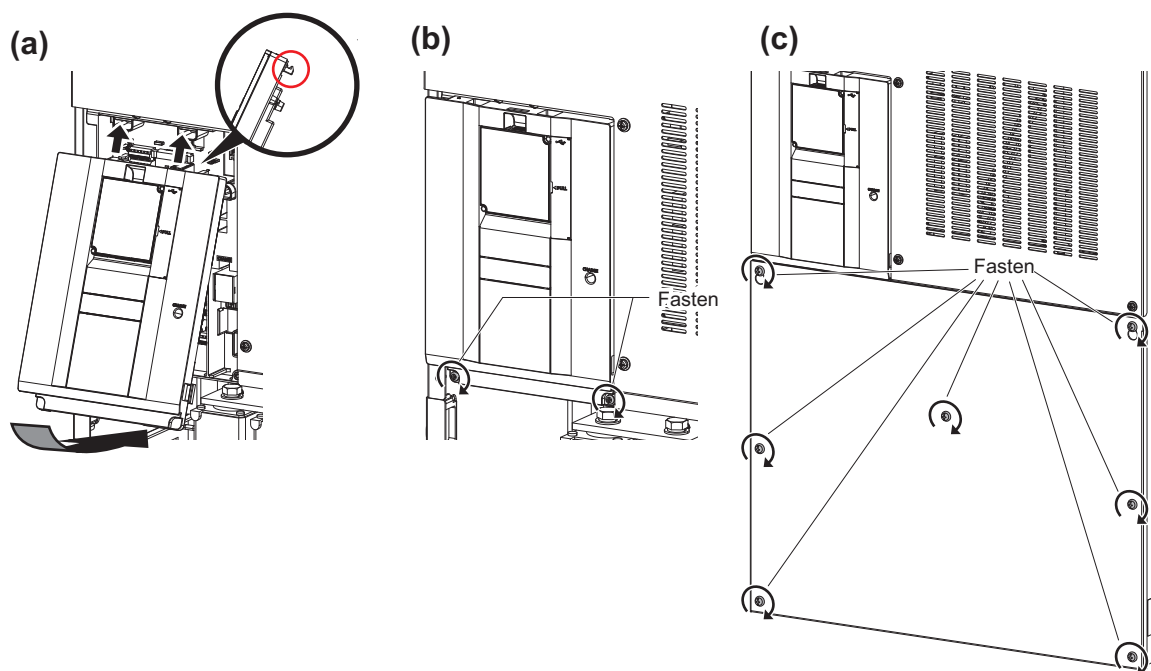
- (a) Remove the mounting screws to remove the front cover (lower side).
 (b) With the front cover (lower side) removed, wiring of the main circuit terminals can be performed.

◆ Removal of the front cover (upper side)



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

◆ Reinstallation of the front cover



- (a) Insert the upper hooks of the front cover (upper side) into the sockets of the converter unit.
Insert the upper hooks of the front cover (upper side) into the sockets of the converter unit.
- (b) Tighten the mounting screw at the lower part of the front cover (upper side).
- (c) Fasten the front cover (lower side) with the mounting screws.

NOTE

- Fully make sure that the front cover is installed securely. Always tighten the mounting screws of the front cover.

2.3 Installation of the converter unit and enclosure design

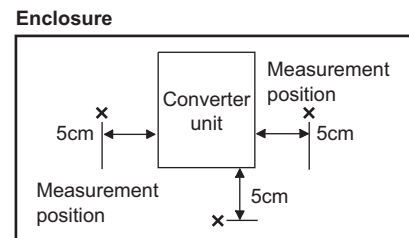
When designing or manufacturing an enclosure to contain the converter unit, determine the structure, size, and device layout of the enclosure by fully considering the conditions such as heat generation of the contained devices and the operating environment. A converter unit uses many semiconductor devices.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

2.3.1 Converter unit installation environment

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

◆ Standard environmental specifications of the converter unit

Item	Inverter rating*4	Description	
Surrounding air temperature*3	LD/ND rating	-10 to +50°C (non-freezing)	
	SLD/HD rating	-10 to +40°C (non-freezing)	
Surrounding air humidity		With circuit board coating (conforming to IEC60721-3-3:1994 3C2/3S2): 95% RH or less (non-condensing)	
Storage temperature		-20 to +65°C*1	
Atmosphere		Indoors (free from corrosive gas, flammable gas, oil mist, dust and dirt)	
Altitude		Maximum 2,500 m above sea level*2	
Vibration		2.9 m/s ² or less at 10 to 55 Hz (directions of X, Y, Z axes)	



- *1 Temperature applicable for a short time, e.g. in transit.
- *2 For the installation in an altitude above 1000 m (up to 2500 m), derate the rated current 3% per 500 m.
- *3 The surrounding air temperature is a temperature measured at a measurement position in an enclosure. The ambient temperature is a temperature outside an enclosure.
- *4 For the details of the multiple rating of the inverter, refer to the Instruction Manual (Detailed) of the inverter.

◆ Temperature

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

(a) Measures against high temperature

- Use a forced ventilation system or similar cooling system. (Refer to [page 20](#).)
- Install the enclosure in an air-conditioned electric chamber.
- Block direct sunlight.
- Provide a shield or similar plate to avoid direct exposure to the radiated heat and wind of a heat source.
- Ventilate the area around the enclosure well.

(b) Measures against low temperature

- Provide a space heater in the enclosure.
- Do not power OFF the converter unit.

(c) 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.

◆ Humidity

Operate the converter unit within the ambient air humidity of usually 45 to 95%. Too high humidity will pose problems of reduced insulation and metal corrosion. On the other hand, too low humidity may cause a spatial electrical breakdown. The insulation distance defined in JEM1103 "Control Equipment Insulator" is humidity of 45 to 85%.

(a) Measures against high humidity

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

(b) Measures against low humidity

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

(c) Measures against condensation

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

Condensation causes such faults as reduced insulation and corrosion.

- Take the measures against high humidity in (a).
- Do not power OFF the converter unit.

◆ Dust, dirt, oil mist

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

Countermeasure

- Place the inverter in a totally enclosed enclosure.
Take measures if the in-enclosure temperature rises. (Refer to [page 20](#).)
- Purge air.
Pump clean air from outside to make the in-enclosure air pressure higher than the outside air pressure.

◆ Corrosive gas, salt damage

If the converter unit 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 above-mentioned measures.

◆ Explosive, flammable gases

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

◆ High altitude

Use the converter unit at an altitude of within 1000 m. For use at an altitude above 1000 m (up to 2500 m), derate the rated current 3% per 500 m.

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

◆ Vibration, impact

The vibration resistance of the converter unit is up to 2.9m/s^2 at 10 to 55 Hz frequency and 1 mm amplitude for the directions of X, Y, Z axes. Applying vibration and impacts for a long time may loosen the structures and cause poor contacts of connectors, even if those vibration and impacts are within the specified values.

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

Countermeasure

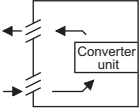
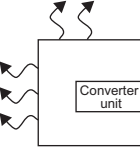
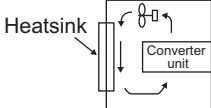
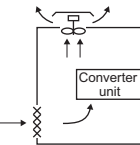
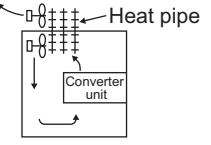
- Provide the enclosure with rubber vibration isolators.
- Strengthen the structure to prevent the enclosure from resonance.
- Install the enclosure away from the sources of the vibration.

2.3.2 Cooling system types for converter unit enclosure

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

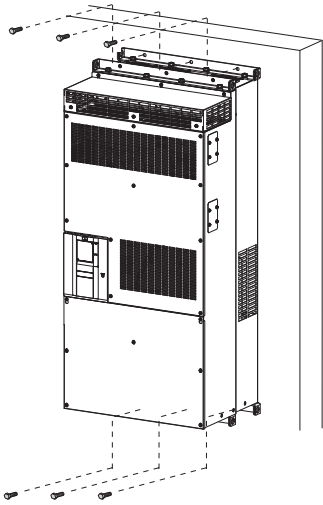
The cooling systems are classified as follows in terms of the cooling calculation method.

- (a) Cooling by natural heat dissipation from the enclosure surface (totally enclosed type)
- (b) Cooling by heatsink (aluminum fin, etc.)
- (c) Cooling by ventilation (forced ventilation type, pipe ventilation type)
- (d) Cooling by heat exchanger or cooler (heat pipe, cooler, etc.)

Cooling system		Enclosure structure	Comment
Natural cooling	Natural ventilation (enclosed, open type)		This system is low in cost and generally used, but the enclosure size increases as the converter unit capacity increases. This system is for relatively small capacities.
	Natural ventilation (totally enclosed type)		Being a totally enclosed type, this system is the most appropriate for hostile environment having dust, dirt, oil mist, etc. The enclosure size increases depending on the converter unit capacity.
Forced cooling	Heatsink cooling		This system has restrictions on the heatsink mounting position and area. This system is for relatively small capacities.
	Forced ventilation		This system is for general indoor installation. This is appropriate for enclosure downsizing and cost reduction, and often used.
	Heat pipe		This is a totally enclosed for enclosure downsizing.

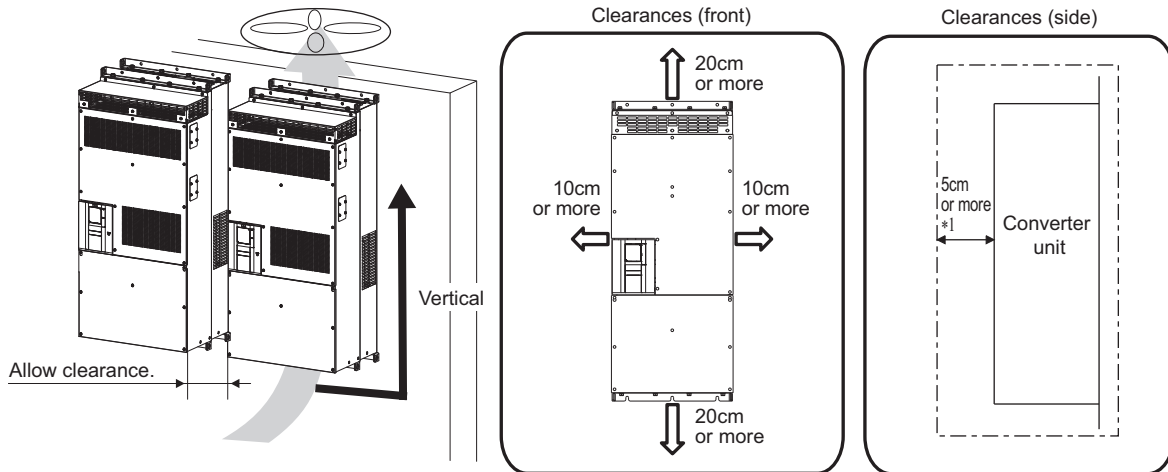
2.3.3 Installation of the converter unit

◆ Installation of the converter unit



Fix six positions.

- Install the converter unit on a strong surface securely with screws.
- Leave enough clearances and take cooling measures.
- Avoid places where the converter unit is subjected to direct sunlight, high temperature and high humidity.
- Install the converter unit on a nonflammable wall surface.
- When encasing multiple converter units in an enclosure, install them in parallel as a cooling measure.
- For heat dissipation and maintenance, keep clearance between the converter unit and the other devices or enclosure surface. The clearance below the converter unit is required as a wiring space, and the clearance above the converter unit is required as a heat dissipation space.



*1 For replacing the cooling fan, 30 cm or more of space is necessary in front of the converter unit. Refer to [page 143](#) for fan replacement.

◆ Installation orientation of the converter unit

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

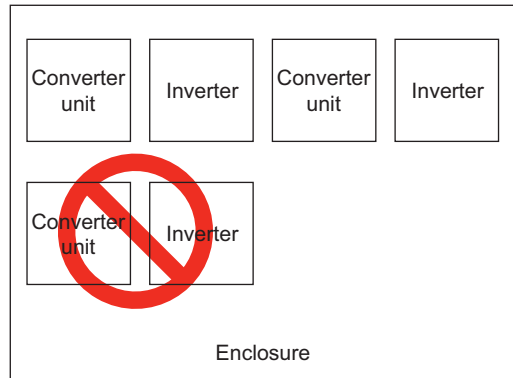
◆ Above the converter unit

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

◆ Encasing multiple inverters and converter units

When multiple inverters and converter units are placed in the same enclosure, generally arrange them horizontally as shown in the figure on the right. Do not place multiple converter units or the converter unit and the inverter vertically. The exhaust air temperature of the converter unit may be increased.

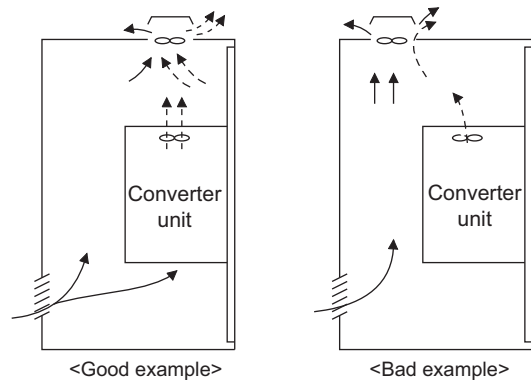
When mounting multiple inverters and converter units, fully take caution not to make the surrounding air temperature of the inverter and the converter unit higher than the permissible value by providing ventilation and increasing the enclosure size.



Arrangement of multiple inverters and converter units

◆ Arrangement of the ventilation fan and the converter unit

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



Arrangement of the ventilation fan and the converter unit

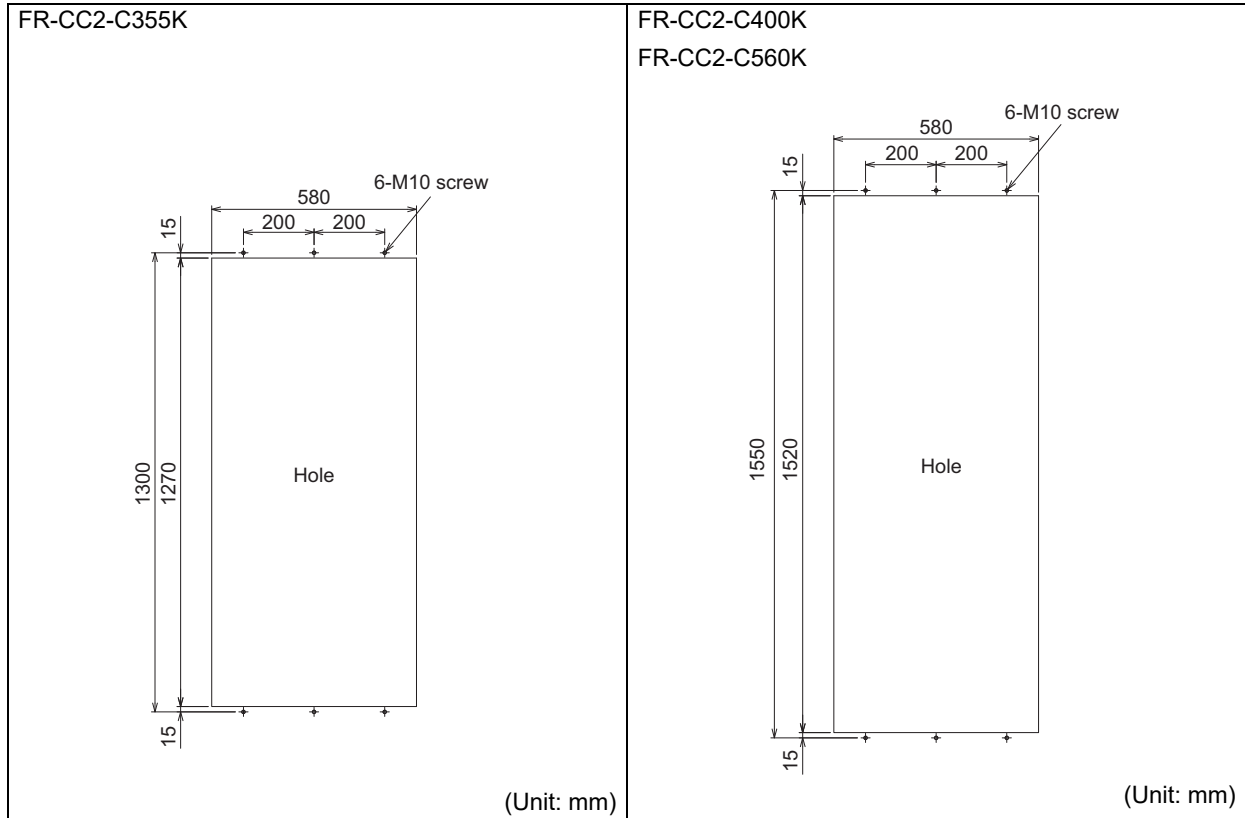
2.3.4 Protruding the heatsink

When encasing an converter unit to an enclosure, the heat generated in the enclosure can be greatly reduced by protruding the heatsink of the converter unit.

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

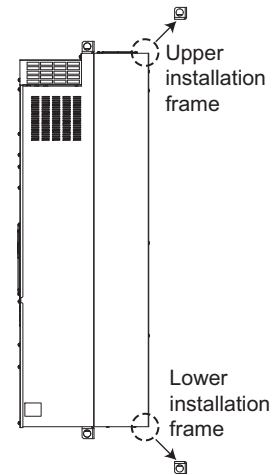
◆ Panel cutting

Cut the panel of the enclosure according to the converter unit capacity.



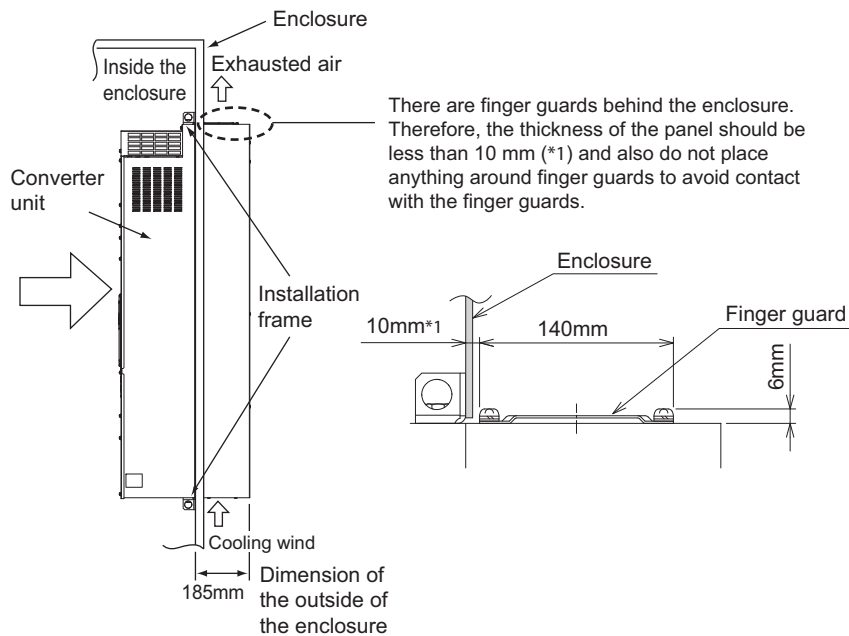
◆ Shift and removal of a rear side installation frame

One installation frame is attached to each of the upper and lower parts of the converter unit. Remove the rear side installation frame on the top and bottom sides of the converter unit as shown on the right.



◆ Installation of the converter unit

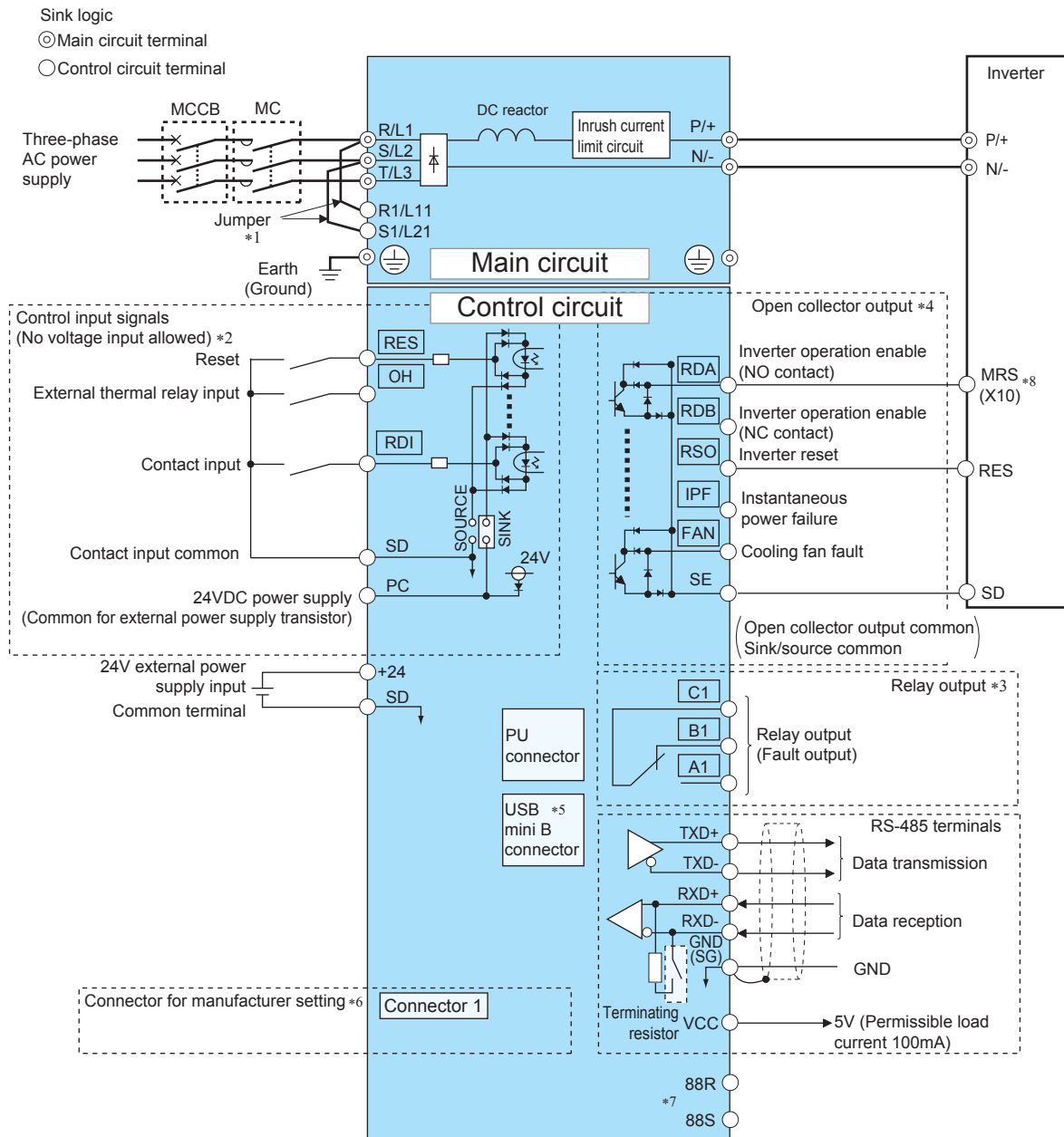
Push the converter unit heatsink portion outside the enclosure and fix the enclosure and converter unit with upper and lower installation frame.



NOTE

- Having a cooling fan, the cooling section which comes out of the enclosure cannot be used in the environment of water drops, oil, mist, dust, etc.
- Be careful not to drop screws, dust etc. into the converter unit and cooling fan section.

2.4 Terminal connection diagrams



- *1 When using separate power supply for the control circuit, remove the jumpers from R1/L11 and S1/L21.
- *2 The function of these terminals can be changed with the input terminal assignment (Pr.178, Pr.187, Pr.189).
- *3 The function of these terminals can be changed with the output terminal assignment (Pr.195).
- *4 The function of these terminals can be changed with the output terminal assignment (Pr.190 to Pr.194).
- *5 The connector is for manufacturer setting. Do not use.
- *6 Plug-in options cannot be used.
- *7 For manufacturer setting. Do not use.
- *8 To use RDA signal of the converter unit, select the NC contact input specification for the input logic of MRS signal or X10 signal of the inverter. To use RDB signal of the converter unit, select the NO contact input specification for the input logic of MRS signal or X10 signal of the inverter. (For changing the input logic, refer to the Instruction Manual of the inverter.)

NOTE

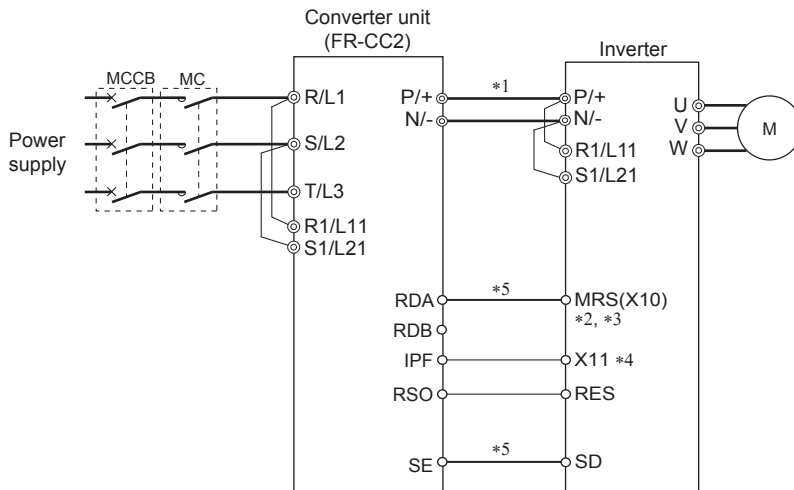
- To prevent a malfunction due to noise, keep the signal cables 10 cm or more away from the power cables. Also, separate the main circuit cables at the input side from the main circuit cables at the output side.
- After wiring, wire offcuts must not be left in the inverter or the converter unit. Wire offcuts can cause an alarm, failure or malfunction. Always keep the inverter and the converter unit clean. When drilling mounting holes in an enclosure etc., take caution not to allow chips and other foreign matter to enter the inverter or the converter unit.

◆ Connection and wiring length between the converter unit and the inverter

- Perform wiring so that the commands sent from the converter unit are transmitted to the inverter without fail. Incorrect connection may damage the converter unit and the inverter.
- For the wiring length, refer to the table below.

Total wiring length	Across the terminals P and P and the terminals N and N	50 m or lower
	Other signal cables	30 m or lower


- For the cable gauge of the cable across the main circuit terminals P/+ and N/- (P and P, N and N), refer to [page 29](#).



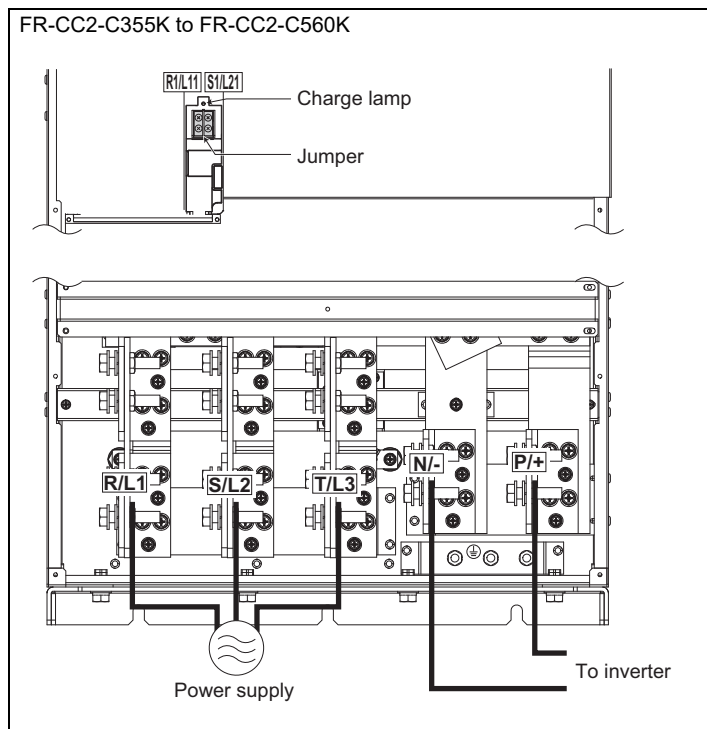
- *1 Do not install an MCCB across the terminals P/+ and N/- (across terminals P and P/+ or across N and N/-). Connecting the opposite polarity of terminals N/- and P/+ will damage the inverter.
- *2 For the terminal used for the X10 signal input, set "10" in any of **Pr.178 to Pr.189 (input terminal function selection)** to assign the function.
- *3 To use RDA signal of the converter unit, select the NC contact input specification for the input logic of MRS signal or X10 signal of the inverter. To use RDB signal of the converter unit, select the NO contact input specification for the input logic of MRS signal or X10 signal of the inverter. (For changing the input logic, refer to the Instruction Manual of the inverter.)
- *4 For the terminal used for the X11 signal input, set "11" in any of **Pr.178 to Pr.189 (input terminal function selection)** to assign the function. For RS-485 or any other communication where the start command is only transmitted once, use the X11 signal to save the operation mode at the time of an instantaneous power failure.
- *5 Always connect the terminal RDA of the converter unit and the terminal MRS (X10) of the inverter, and the terminal SE of the converter unit and the terminal SD (sink logic) of the inverter. Not connecting these terminals may damage the converter unit.

2.5 Main circuit terminals

2.5.1 Details on the main circuit terminals

Terminal symbol	Terminal name	Terminal function description	Refer to page
R/L1, S/L2, T/L3	AC power input	Connect these terminals to the commercial power supply.	—
R1/L11, S1/L21	Power supply for the control circuit	Connected to the AC power supply terminals R/L1 and S/L2. To retain the fault display and fault output, remove the jumpers across terminals R/L1 and R1/L11 and across S/L2 and S1/L21 and supply external power to these terminals. The power capacity necessary when separate power is supplied from R1/L11 and S1/L21 is 80 VA.	38
P/+, N/-	Inverter connection	Connect to terminals P/+ and N/- of the inverter.	25
	Earth (ground)	For earthing (grounding) the converter unit chassis. This must be earthed (grounded).	30

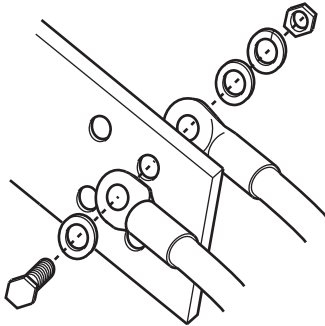
2.5.2 Terminal layout of the main circuit terminals, wiring of the power supply and the inverter



Main circuit terminals

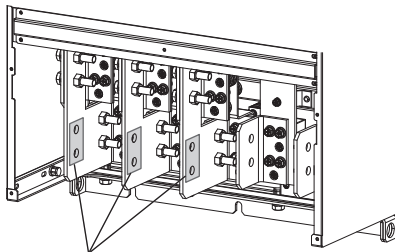
NOTE

- Make sure the power cables are connected to the R/L1, S/L2, and T/L3. (Phase need not be matched.)
- When wiring the main circuit conductor, tighten a nut from the right side of the conductor.
When wiring two wires, place wires on both sides of the conductor. (Refer to the drawing below.)
For wiring, use bolts (nuts) provided with the converter unit.



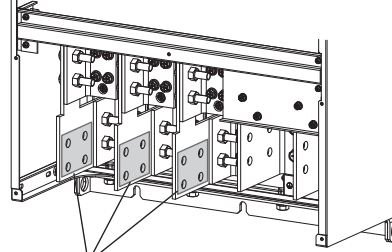
- When wiring cables to the main circuit conductor (R/L1, S/L2, T/L3) of the converter unit, use the bolts (nuts) for main circuit wiring, which are provided on the front side of the conductor.

FR-CC2-C355K



Connect the cables here.

FR-CC2-C400K, C560K



Connect the cables here.

2.5.3 Applicable cables

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

The following table indicates a selection example for the wiring length of 20 m (575 V input power supply, 150% overload current rating for 1 minute).

Converter unit model FR-CC2-□	Terminal screw size*2	Tightening torque N•m	Crimping terminal			Cable gauge*1					
						HIV cables, etc. (mm ²)			AWG/MCM		
			R/L1, S/L2, T/L3	P/+, N/-	Earthing (grounding) cable	R/L1, S/L2, T/L3	P/+, N/-	Earthing (grounding) cable	R/L1, S/L2, T/L3	P/+, N/-	Earthing (grounding) cable
C355K	M12 (M10)	46	2×80-12	2×100-12	100-10	2×80	2×100	100	2×4/0	2×300	4/0
C400K	M12 (M10)	46	2×125-12	2×150-12	100-10	2×125	2×150	100	2×300	2×350	300
C560K	M12 (M10)	46	2×200-12	2×250-12	100-10	2×200	2×250	100	2×400	2×500	300

*1 The cables used should be 75°C copper cables.

*2 The terminal screw size indicates the size of a terminal screw for R/L1, S/L2, T/L3, P/+, N/-, and a screw for earthing (grounding). Screw size for earthing (grounding) is indicated in parentheses.

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

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

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.

NOTE

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

2.5.4 Earthing (grounding) precautions

- Always earth (ground) the converter unit.

◆ Purpose of earthing (grounding)

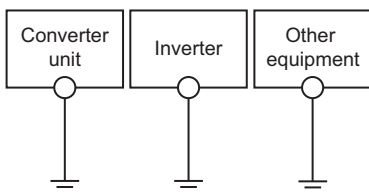
Generally, an electrical apparatus has an earth (ground) terminal, which must be connected to the ground before use. An electrical circuit is usually insulated by an insulating material and encased. However, it is impossible to manufacture an insulating material that can shut off a leakage current completely,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

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

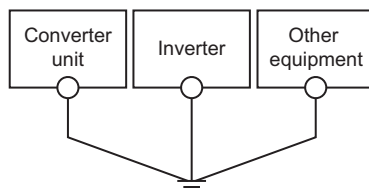
◆ Earthing (grounding) methods and earthing (grounding) work

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

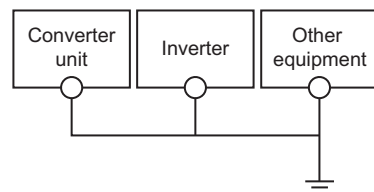
- Whenever possible, use the independent earthing (grounding) for the converter unit.
 - If independent earthing (grounding) (I) is not available, use (II) common earthing (grounding) in the figure below where the converter unit is connected with the other equipment at an earthing (grounding) point. Do not use the other equipment's earthing (grounding) cable to earth (ground) the converter unit as shown in (III).
- A leakage current containing many high frequency components flows into the earthing (grounding) cables of the converter unit. Because of this, the converter unit must be earthed (grounded) separately from EMI-sensitive devices.
- 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.
- 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 the thickest possible earthing (grounding) cable. The earthing (grounding) cable should be the size indicated in the table on [page 29](#).
- The earthing (grounding) point should be as close as possible to the converter unit, and the earth (ground) wire length should be as short as possible.
- Run the earthing (grounding) cable as far away as possible from the I/O wiring of equipment sensitive to noises and run them in parallel in the minimum distance.



(I) Separate earthing (grounding): Good




(II) Common (single-point) earthing (grounding): OK



(III) Inadequate common (single-point) earthing (grounding): Bad

2.6 Control circuit

2.6.1 Details on the control circuit terminals

The input signal function of the terminals in  can be selected by setting Pr.178, Pr.187, Pr.189 to Pr.195 (I/O terminal function selection). (Refer to [page 81, 85](#).)

◆ Input signal

Type	Terminal Symbol	Common	Terminal name	Terminal function description	Rate Specification
Contact input	RES	SD (sink(negative common)) PC (source (positive common))	Reset	Use this signal to reset a fault output provided when a protective function is activated. Turn ON the RES signal for 0.1 s or longer, then turn it OFF. In the initial setting, reset is always enabled. By setting Pr.75 , reset can be set enabled only at fault occurrence of the converter unit. The inverter recovers about 1 s after the reset is released.	Input resistance 4.7 kΩ Voltage when contacts are open: 21 to 27 VDC When contacts are short-circuited: 4 to 6 mADC
	OH		External thermal relay input	The external thermal relay input (OH) signal is used when using an external thermal relay or a thermal protector built into the motor to protect the motor from overheating. When the thermal relay is activated, the inverter trips by the external thermal relay operation (E.OHT).	
	RDI		Contact input	No function is assigned in the initial setting. The function can be assigned by setting Pr.178 .	
External power supply input	+24		24 V external power supply input	For connecting a 24 V external power supply. If a 24 V external power supply is connected, power is supplied to the control circuit while the main power circuit is OFF.	Input voltage 23 to 25.5 VDC Input current 1.4 A or less

◆ Output signal

Type	Terminal Symbol	Common	Terminal name	Terminal function description	Rate Specification
Relay	A1, B1, C1	-	Relay output 1 (fault output)	1 changeover contact output that indicates that the protective function of the converter unit has been activated and the outputs are stopped. Fault: discontinuity across B and C (continuity across A and C), Normal: continuity across B and C (discontinuity across A and C)	Contact capacity 230 VAC 0.3 A (power factor = 0.4) 30 VDC 0.3 A
	88R, 88S	-	For manufacturer setting. Do not use.		
Open collector	RDA	SE	Inverter operation enable (NO contact)	Switched to LOW when the converter unit operation is ready. Assign the signal to the terminal MRS (X10) of the inverter. The inverter can be started when the RDA status is LOW.	Permissible load 24 VDC (maximum 27 VDC) 0.1 A (The voltage drop is 2.8 V at maximum while the signal is ON.) LOW is when the open collector output transistor is ON (conducted). HIGH is when the transistor is OFF (not conducted).
	RDB	SE	Inverter operation enable (NC contact)	Switched to LOW when a converter unit fault occurs or the Converter unit is reset. The inverter can be started when the RDB status is HIGH.	
	RSO	SE	Inverter reset	Switched to LOW when the Converter unit is reset (RES-ON). Assign the signal to the terminal RES of the inverter. The inverter is reset when it is connected with the RSO status LOW.	
	IPF	SE	Instantaneous power failure	Switched to LOW when an instantaneous power failure is detected.	
	FAN	SE	Cooling fan fault	Switched to LOW when a cooling fan fault occurs.	

◆ Common terminal

Terminal Symbol	Common	Terminal name	Terminal function description	Rate Specification
SD	-	Contact input common (sink)	Common terminal for contact input terminal (sink logic).	—
		External transistor common (source)	Connect this terminal to the power supply common terminal of a transistor output (open collector output) device, such as a programmable controller, in the source logic to avoid malfunction by undesirable current.	
		24 VDC power supply common	Common terminal for the 24 VDC power supply (terminal PC, terminal +24) Isolated from terminals 5 and SE.	
PC	-	External transistor common (sink)	Connect this terminal to the power supply common terminal of a transistor output (open collector output) device, such as a programmable controller, in the source logic to avoid malfunction by undesirable current.	Power supply voltage range 19.2 to 28.8 VDC Permissible load current 100 mA
		Contact input common (source)	Common terminal for contact input terminal (source logic).	
	SD	24 VDC power supply common	Can be used as a 24 VDC 0.1 A power supply.	
SE	-	Open collector output common	Common terminal for terminals RDA, RDB, RSO, IPF, FAN	—

◆ Communication

Type	Terminal symbol	Terminal name	Terminal function description	
RS-485	—	PU connector	With the PU connector, communication can be made through RS-485. (For connection on a 1:1 basis only) Conforming standard: EIA-485 (RS-485) Transmission format: Multidrop link Communication speed: 4800 to 115200 bps Wiring length: 500 m	
	RS-485 terminals	TXD+	Converter unit transmission terminal	The RS-485 terminals enable the communication by RS-485. Conforming standard: EIA-485 (RS-485) Transmission format: Multidrop link Communication speed: 300 to 115200 bps Overall length: 500 m
		TXD-		
		RXD+	Converter unit reception terminal	
		RXD-		
GND(SG)	Earthing (grounding)			

 **Caution**

- Do not use the empty terminals (NC) of the control circuit. Doing so may lead to damage of the converter unit and the inverter.
- Always connect the terminal RDA of the converter unit and the terminal MRS (X10) of the inverter, and the terminal SE of the converter unit and the terminal SD (terminal PC in the source logic) of the inverter. Not doing so may lead to damage of the converter unit.

2.6.2 Control logic (sink/source) change

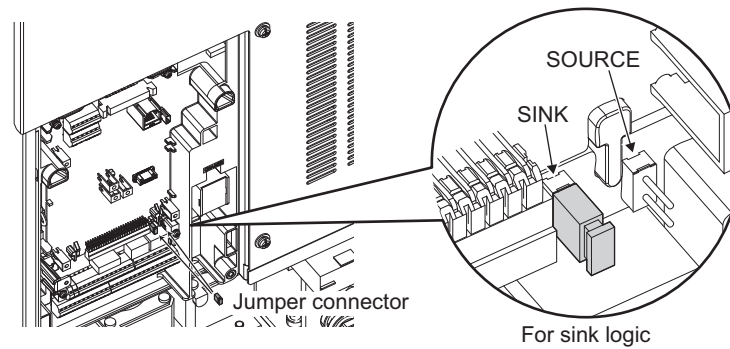
Change the control logic of input signals as necessary.

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

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

The jumper connector is in the sink logic (SINK) when shipped from the factory.

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



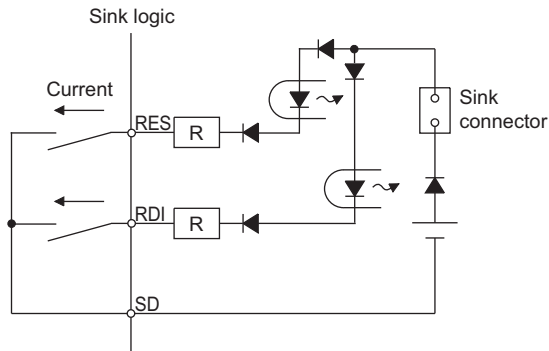
NOTE

- Make sure that the jumper connector is installed correctly.
- Never change the control logic while power is ON.

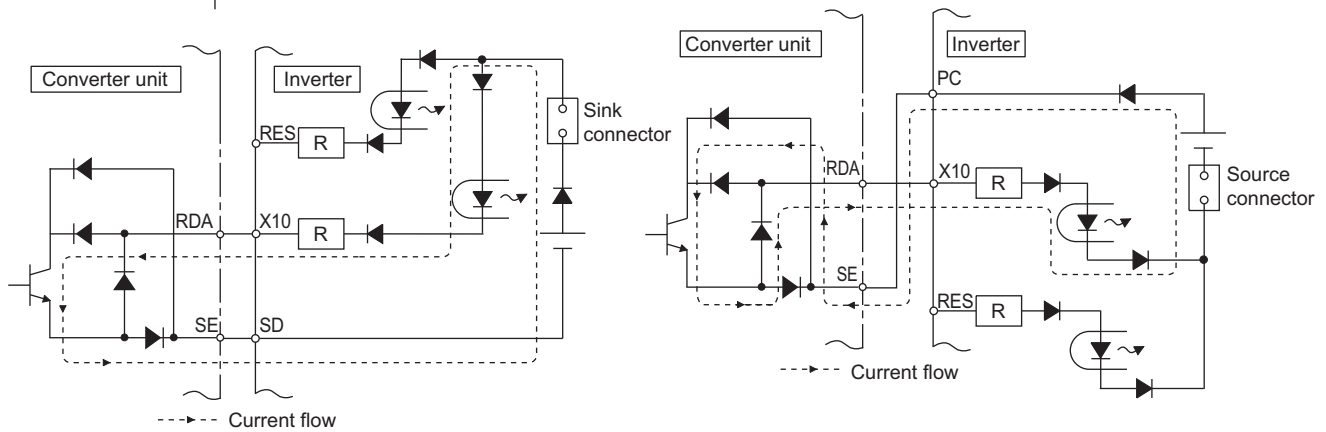
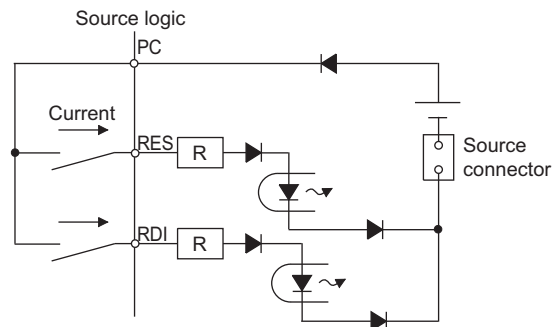
◆ Sink logic and source logic

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

● Current flow concerning the input/output signal when sink logic is selected



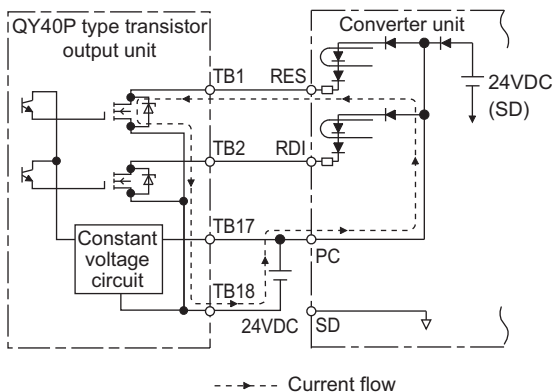
● Current flow concerning the input/output signal when source logic is selected



- When using an external power supply for transistor output

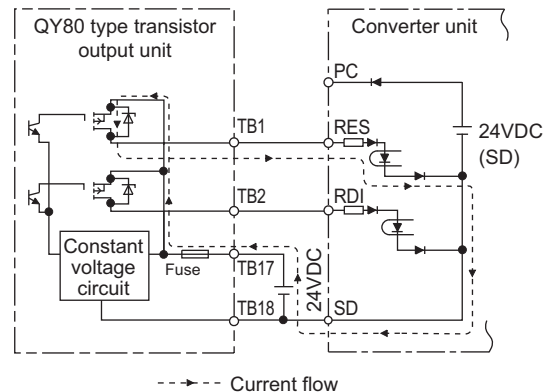
Sink logic

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



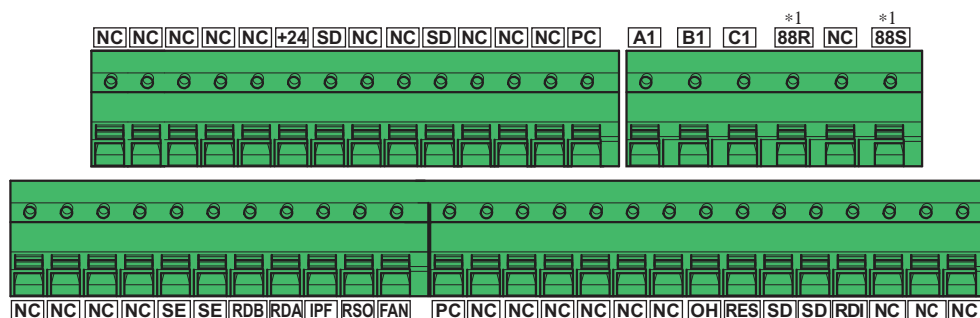
Source logic

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



2.6.3 Wiring of control circuit

◆Control circuit terminal layout



*1 For manufacturer setting. Do not use.

Caution

- Do not use the empty terminals (NC) of the control circuit. Doing so may lead to damage of the converter unit and the inverter.

◆Wiring method

- Wiring connection

For the control circuit wiring, strip off the sheath of a cable, and use it with a crimp terminal. For a single wire, strip off the sheath of the wire and apply directly.

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

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

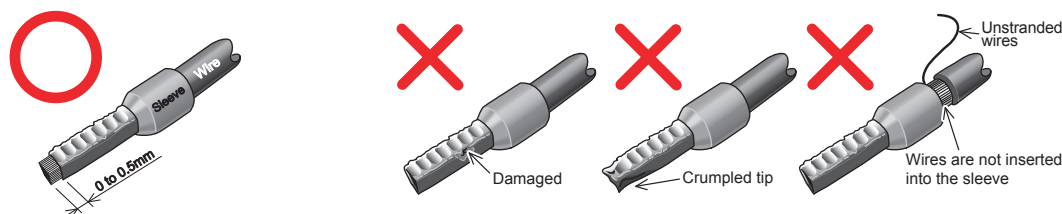
Twist the stripped end of wires to prevent them from fraying. Do not solder them.

Wire strip length



- Crimp the terminals on the wire.

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



- Crimp terminals commercially available (as of April 2023)

PHOENIX CONTACT GmbH & Co. KG

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

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

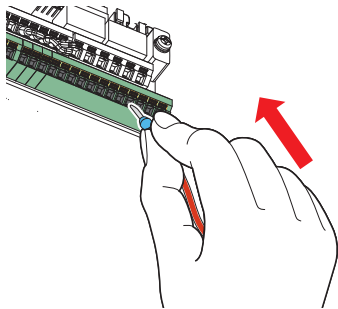
*2 Applicable for the terminals A1, B1, C1, A2, B2, and C2 only.

Control circuit

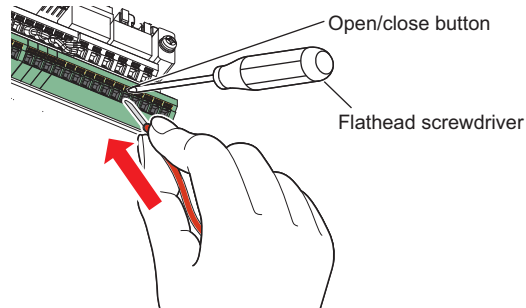
NICHIFU Co.,Ltd.

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

(3) Insert the wires into a socket.



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

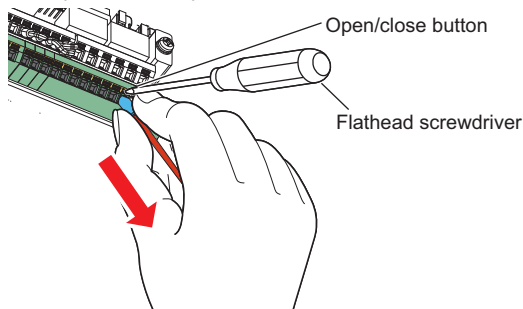


NOTE

- When using stranded wires without a crimp terminal, twist enough to avoid short circuit with a nearby terminals or wires.
- Never change the control logic while power is ON.

• Wire removal

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



NOTE

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

Commercially available products (as of April 2023)

Name	Model	Manufacturer
Driver	SZF 0- 0,4 × 2,5	PHOENIX CONTACT GmbH & Co. KG

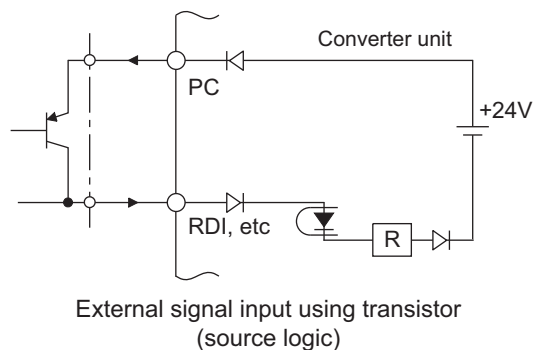
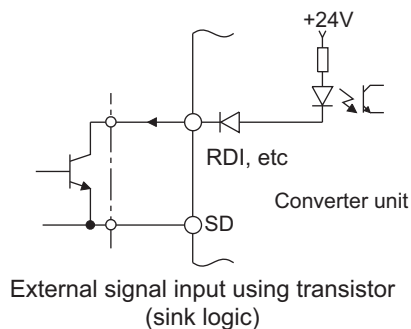
- Place the flathead screwdriver vertical to the open/close button. In case the blade tip slips, it may cause an inverter damage or injury.

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

- Terminals SD (sink logic), PC (source logic), and SE are common terminals (0 V) for I/O signals. (All common terminals are isolated from each other.) Do not earth (ground) these terminals.
- In the sink logic, terminal SD is a common terminal for the contact input terminals (RES, OH, RDI). The open collector circuit is isolated from the internal control circuit by photocoupler.
- In the source logic, terminal PC is a common terminal for the contact input terminals (RES, OH, RDI). The open collector circuit is isolated from the internal control circuit by photocoupler.
- Terminal SE is a common terminal for the open collector output terminals (RDA, RDB, RSO, IPF, FAN). The contact input circuit is isolated from the internal control circuit by photocoupler.

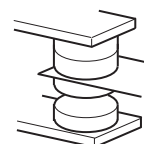
◆ Signal inputs by contactless switches

The contact input terminals of the converter unit (RES, OH, RDI) can be controlled using a transistor instead of a contact switch as shown below.

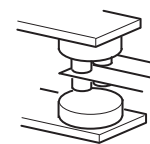


2.6.4 Wiring precautions

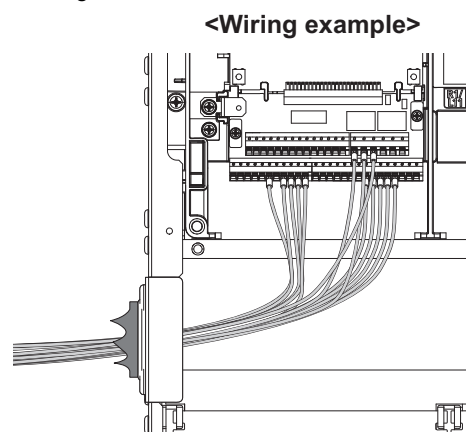
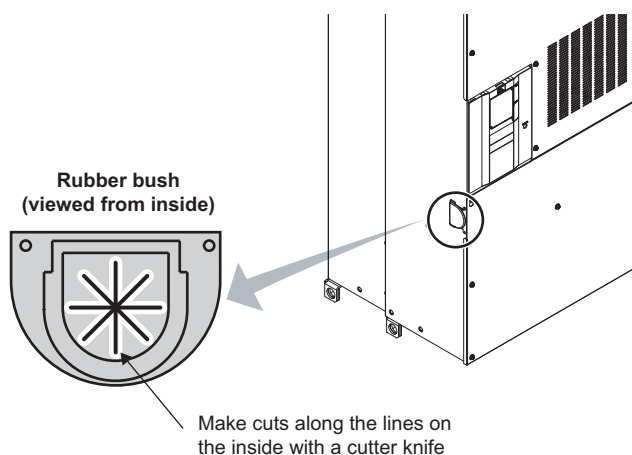
- It is recommended to use a cable of 0.75 mm² for connection to the control circuit terminals.
- The wiring length should be 30 m at the maximum.
- Use two or more parallel micro-signal contacts or twin contacts to prevent contact faults when using contact inputs since the control circuit input signals are micro-currents.
- To suppress EMI, use shielded or twisted cables for the control circuit terminals and run them away from the main and power circuits (including the 200 V relay sequence circuit). For the cables connected to the control circuit terminals, connect their shields to the common terminal of the connected control circuit terminal. When connecting an external power supply to the terminal PC, however, connect the shield of the power supply cable to the negative side of the external power supply. Do not directly earth (ground) the shield to the enclosure, etc.
- Always apply a voltage to the fault output terminals (A1, B1, C1) via a relay coil, lamp, etc.
- Separate the wiring of the control circuit away from the wiring of the main circuit.
Make cuts in rubber bush of the converter unit side and lead the wires through.



Micro signal contacts



Twin contacts



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

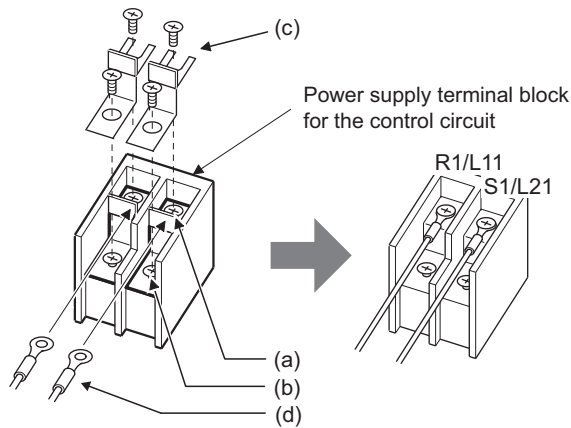
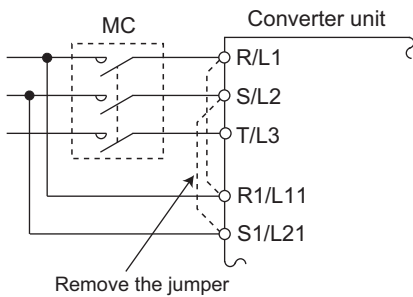
◆ Cable size for the control circuit power supply (terminals R1/L11 and S1/L21)

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

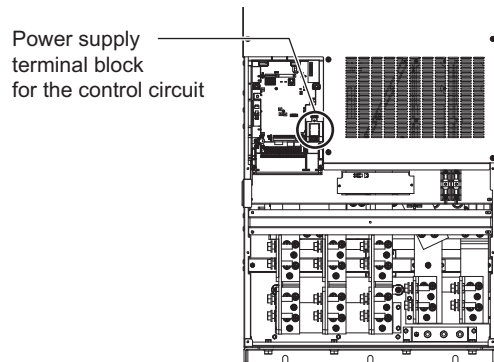
◆ Connected to

When a fault occurs, opening of the electromagnetic contactor (MC) on the converter unit power supply side results in power loss in the control circuit, disabling the fault output signal retention. Terminals R1/L11 and S1/L21 are provided to hold a fault signal. In this case, connect the power supply terminals R1/L11 and S1/L21 of the control circuit to the input side of the MC. Do not connect the power cable to incorrect terminals. Doing so may damage the converter unit.

<Connection diagram>



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



NOTE

- When using separate power supplies, always remove the jumpers from terminals R1/L11 and S1/L21. The converter unit may be damaged if the jumpers are not removed.
- The voltage should be the same as that of the main control circuit when the control circuit power is supplied from other than the input side of the MC.
- The power capacity necessary when separate power is supplied from R1/L11 and S1/L21 is 80 VA.
- If the main circuit power is switched OFF (for 0.1 s or more) then ON again, the converter unit is reset and a fault output will not be held.

2.6.6 When supplying 24 V external power to the control circuit

Connect a 24 V external power supply across terminals +24 and SD. Connecting a 24 V external power supply enables I/O terminal ON/OFF operation, operation panel displays, control functions, and communication during communication operation even during power-OFF of converter unit's main circuit power supply. When the main circuit power supply is turned ON, the power supply changes from the 24 V external power supply to the main circuit power supply.

◆ Specification of the applied 24 V external power supply

Item	Rate Specification
Input voltage	23 to 25.5 VDC
Input current	1.4 A or lower

Commercially available products (as of April 2023)

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

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

◆ Starting and stopping the 24 V external power supply operation

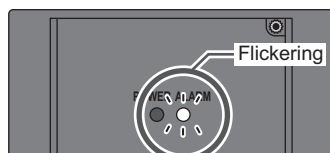
- Supplying 24 V external power across terminals +24 and SD while the main circuit power is OFF starts the 24 V external power supply operation. Likewise, turning OFF the main circuit power while supplying 24 V external power starts the 24 V external power supply operation.
- Turning ON the main circuit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

NOTE

- When the 24 V external power is supplied while the main circuit power supply is OFF, the converter unit operation is disabled.
- In the initial setting, when the main power supply is turned ON during the 24 V external power supply operation, a reset is performed in the converter unit, then the power supply changes to the main circuit power supply.

◆ Confirming the 24 V external power supply input

- During the 24 V external power supply operation, the alarm lamp flickers.



- During the 24 V external power supply operation, the 24 V external power supply operation signal (EV) is output. To use the EV signal, set "68 (positive logic) or 168 (negative logic)" in one of **Pr.190 to Pr.195 (output terminal function selection)** to assign function to an output terminal.

◆ Operation while the 24 V external power is supplied

- Faults history and parameters can be read and parameters can be written using the operation panel keys.
- During the 24 V external power supply operation, monitored items and signals related to inputs to main circuit power supply, such as input current, converter output voltage, and IPF signal, are invalid.
- The alarms, which have occurred when the main circuit power supply is ON, continue to be output after the power supply is changed to the 24 V external power supply. Perform the converter reset or turn OFF then ON the power to reset the faults.
- The retry function is invalid for all alarms during the 24 V external power supply.

NOTE

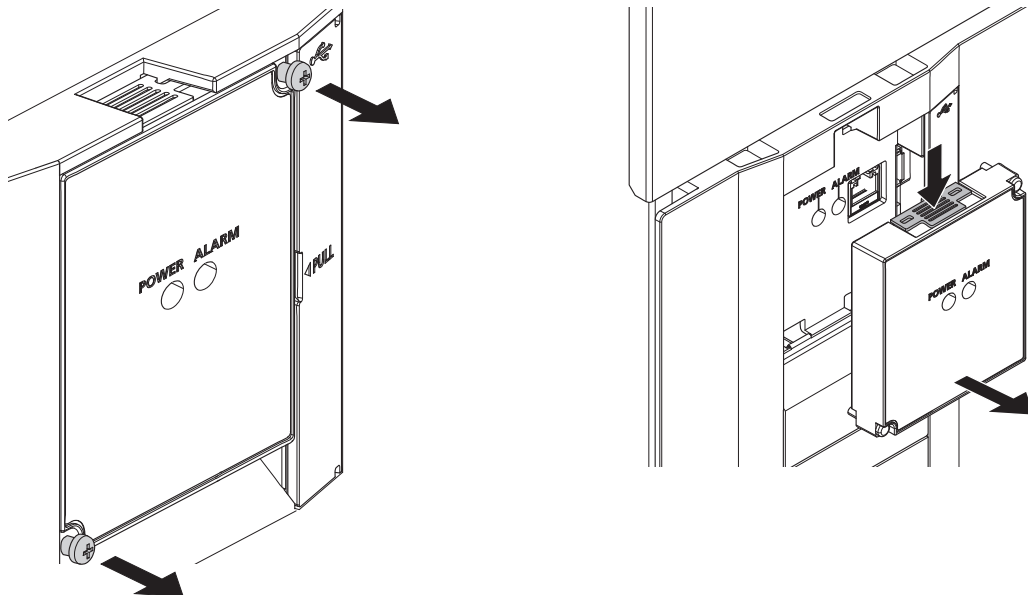
- Inrush current equal to or higher than the 24 V external power supply specification may flow at power-ON. Confirm that the power supply and other devices are not affected by the inrush current and the voltage drop caused by it. Depending on the power supply, the inrush current protection may be activated to disable the power supply. Select the power supply and capacity carefully.
- When the wiring length between the external power supply and the converter unit 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 converter units, the current increases when it flows through the converter unit wiring near the power supply. The increase of the current causes voltage to drop further. Use the converter units after confirming that the input voltage of each converter unit is within the rated input voltage range. Depending on the power supply, the inrush current protection may be activated to disable the power supply. Select the power supply and capacity carefully.
- "E.P24" may appear when the start-up time of the 24 V power supply is too long (less than 1.5 V/s) in the 24 V external power supply operation.
- "E.P24" may appear when the 24 V external power supply input voltage is low. Check the external power supply input.
- Do not touch the control circuit terminal block (circuit board) during the 24 V power supply operation (when conducted). Doing so may cause an electric shock or burn.

2.7 Communication connectors and terminals

2.7.1 PU connector

◆Removal and installation of the accessory cover

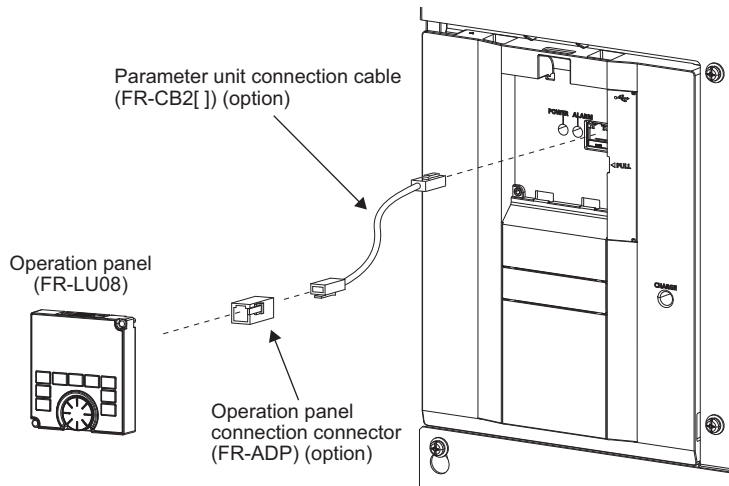
- Loosen the two fixing screws on the accessory cover. (These screws cannot be removed.)
- Push the upper edge of the accessory cover and pull the accessory cover to remove.



- To install the accessory cover, fit it securely and tighten the screws. (Tightening torque: 0.40 to 0.45 N•m)

◆Installing the operation panel on the enclosure surface

- The operation panel can be used for setting the converter unit parameters, monitoring various items, and checking fault indications.
- Having an operation panel on the enclosure surface is convenient. With a connection cable, you can install the operation panel to the enclosure surface, and connect it to the converter unit. Use the option FR-CB2[], or connectors and cables available on the market. (To install the operation panel, the optional connector (FR-ADP) is required.) Securely insert one end of the connection cable until the stoppers are fixed.



2

NOTE

- Refer to the following table when fabricating the cable on the user side. Keep the total cable length within 20 m.
- Commercially available products (as of February 2015)

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

- For the details of the FR-LU08, refer to the FR-LU08 Instruction Manual.

◆ Communication operation

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

Communication can be performed with the Mitsubishi inverter protocol (computer link operation).

For the details, refer to [page 92](#).

2.7.2 RS-485 terminal block

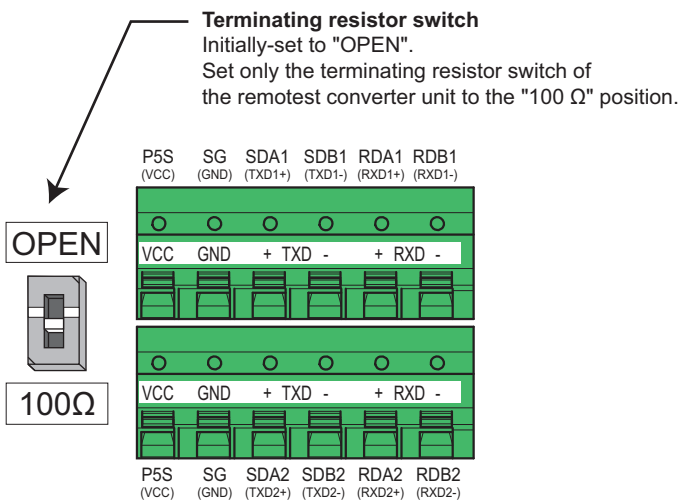
◆ Communication operation

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

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

Communication can be performed with the Mitsubishi inverter protocol (computer link operation) and MODBUS RTU protocol.

For the details, refer to [page 94](#).



NOTE

- To avoid malfunction, keep the RS-485 terminal wires away from the control circuit board.

3

PRECAUTIONS FOR USE OF THE CONVERTER UNIT

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

3.1	Electro-magnetic interference (EMI) and leakage currents ..	44
3.2	Power supply harmonics	48
3.3	Installation of a reactor	48
3.4	Power-OFF and magnetic contactor (MC)	49
3.5	Checklist before starting operation	51

3.1 Electro-magnetic interference (EMI) and leakage currents

3.1.1 Leakage currents and countermeasures

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

◆To-earth (ground) leakage currents

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

●Precautions

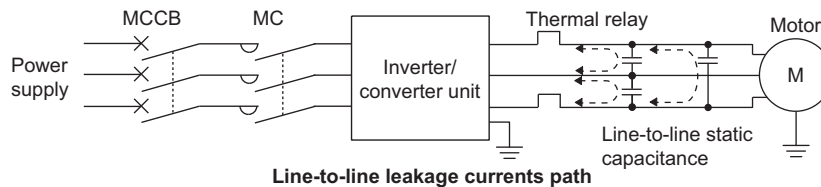
- If the carrier frequency setting is high, decrease the **Pr.72 PWM frequency selection** setting. Note that motor noise increases. Selecting **Pr.240 Soft-PWM operation selection** makes the sound inoffensive.
- By using earth leakage circuit breakers designed to suppress harmonics and surge voltage in the power system of the converter unit and other devices, 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.

◆Line-to-line leakage currents

Harmonics of leakage currents flowing in static capacitances between the output cables of the inverter or the converter unit may operate the external thermal relay unnecessarily.



●Precautions

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

●Installation and selection of the molded case circuit breaker

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

3.1.2 Countermeasures against EMI generated by the inverter or the converter unit

Some electromagnetic noises enter the inverter or the converter unit to cause the inverter or the converter unit malfunction, and others are radiated by the inverter or the converter unit to cause the peripheral devices to malfunction. Though the inverter or the converter unit 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 countermeasures should be taken to suppress noises. These techniques differ slightly depending on EMI paths.

- Basic techniques
 - Do not run the power cables (I/O cables) and signal cables of the inverter or the converter unit in parallel with each other and do not bundle them.
 - Use shielded twisted pair cables for the detector connecting and control signal cables and connect the sheathes of the shielded cables to terminal SD.
 - Ground (Earth) the inverter, converter unit, motor, etc. at one point.
- Techniques to reduce electromagnetic noises that enter and cause a malfunction of the inverter or the converter unit (EMI countermeasures)

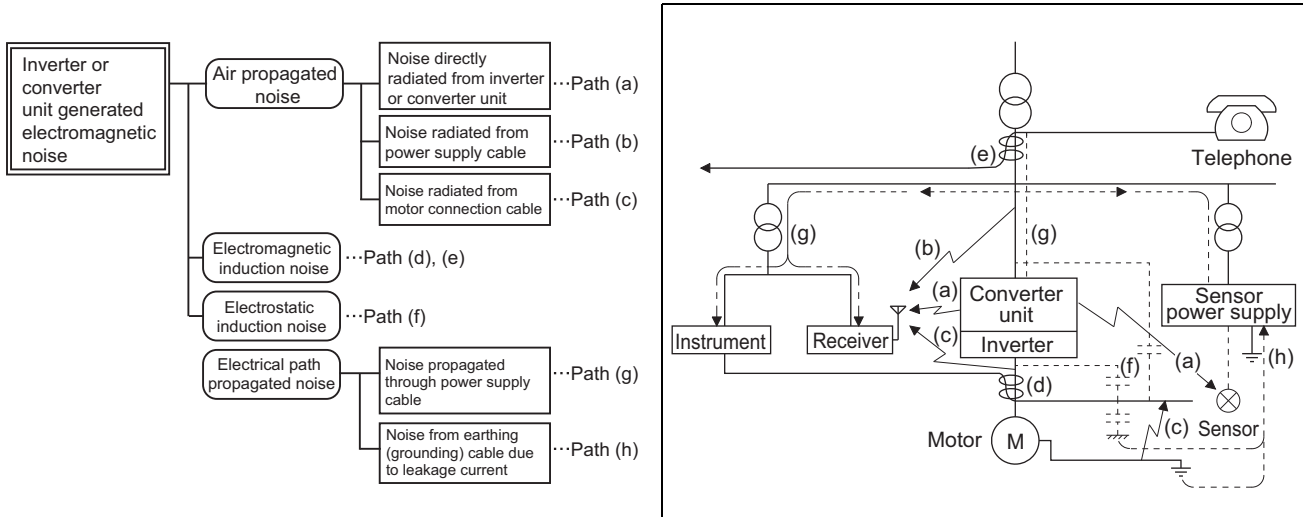
When devices that generate many electromagnetic noises (which use magnetic contactors, electromagnetic brakes, many relays, for example) are installed near the inverter or the converter unit, and the inverter or the converter unit may malfunction due to electromagnetic noises, the following countermeasures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

 - Provide surge suppressors for devices that generate many electromagnetic noises to suppress electromagnetic noises.
 - Install data line filters ([page 47](#)) to signal cables.
 - Ground (Earth) the shields of the detector connection and control signal cables with cable clamp metal.

Electro-magnetic interference (EMI) and leakage currents

- Techniques to reduce electromagnetic noises that are radiated by the inverter or the converter unit to cause the peripheral devices to malfunction (EMI countermeasures)

Noises generated from the inverter or the converter unit are largely classified into those radiated by the cables connected to the inverter or the converter unit and their main circuits (I/O), those electromagnetically and electrostatically induced to the signal cables of the peripheral devices close to the main circuit cables, and those transmitted through the power supply cables.



Noise propagation path	Countermeasure
(a) (b) (c)	<p>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 the converter unit, or when their signal cables are run near the inverter or the converter unit, the devices may malfunction due to by air-propagated electromagnetic noises. The following countermeasures must be taken:</p> <ul style="list-style-type: none"> Install easily affected devices as far away as possible from the inverter or the converter unit. Run easily affected signal cables as far away as possible from the inverter or the converter unit, and their I/O cables. Do not run the signal cables and power cables (I/O cables of the inverter or the converter unit) in parallel with each other and do not bundle them. Inserting a line noise filter into the output suppresses the radiated noise from the cables. Use shielded cables as signal cables and power cables and run them in individual metal conduits to produce further effects.
(d) (e) (f)	<p>When the signal cables are run in parallel with or bundled with the power cables, magnetic and static induction noises may be propagated to the signal cables to cause malfunction of the devices and the following countermeasures must be taken:</p> <ul style="list-style-type: none"> Install easily affected devices as far away as possible from the inverter or the converter unit. Run easily affected signal cables as far away as possible from the I/O cables of the inverter or the converter unit. Do not run the signal cables and power cables (I/O cables of the inverter or the converter unit) in parallel with each other and do not bundle them. Use shielded cables as signal cables and power cables and run them in individual metal conduits to produce further effects.
(g)	<p>When the peripheral devices use the power system of the inverter or the converter unit, noises generated from the inverter or the converter unit may flow back through the power supply cables to cause malfunction of the devices and the following countermeasures must be taken:</p> <ul style="list-style-type: none"> Install the line noise filter to the power cables (output cables) of the inverter.
(h)	<p>When a closed loop circuit is formed by connecting the peripheral device wiring to the inverter or the converter unit, leakage currents may flow through the earthing (grounding) cable of the inverter or the converter unit to cause the device to malfunction. In that case, disconnecting the earthing (grounding) cable from the device may stop the malfunction of the device.</p>

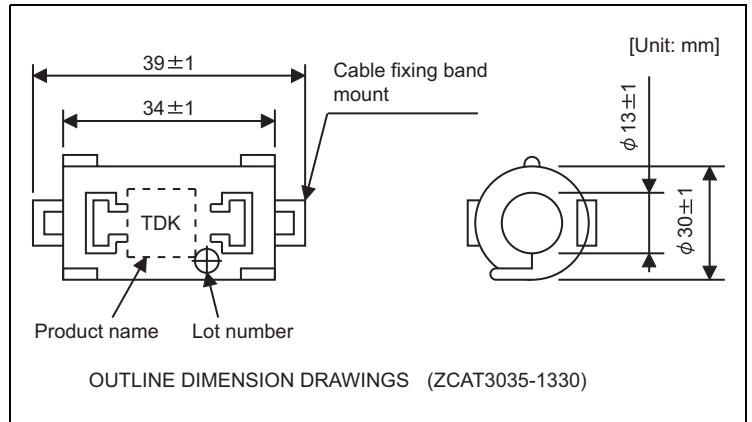
●Data line filter

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

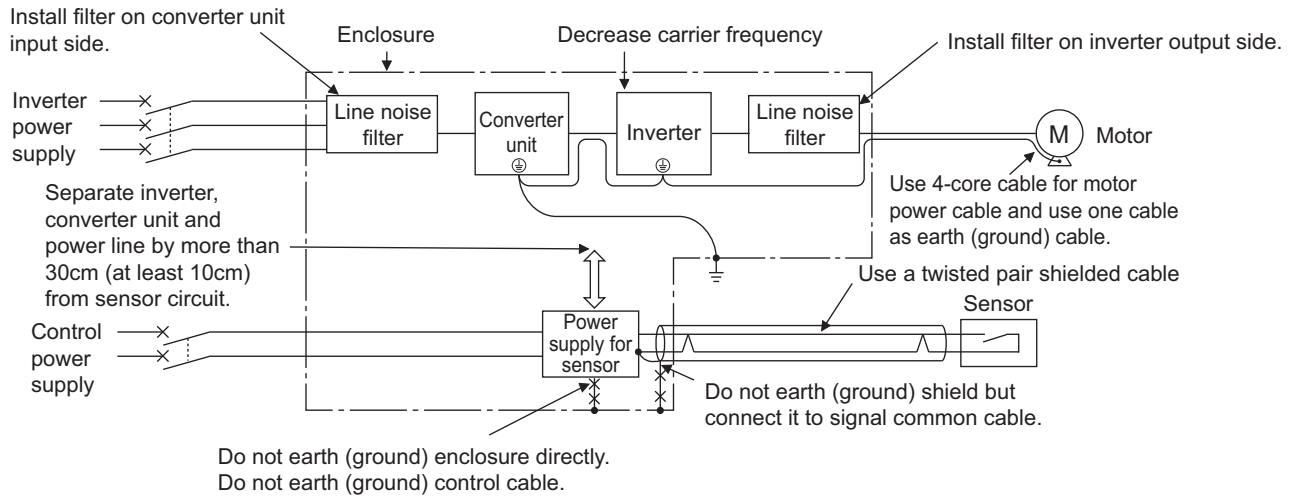
<Example> Data line filter : ZCAT3035-1330 (by TDK)
 : ESD-SR-250 (by NEC TOKIN)
 Impedance (ZCAT3035-1330)

Impedance (Ω)	
10 to 100 MHz	100 to 500 MHz
80	150

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



●EMI countermeasure example



3.2 Power supply harmonics

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

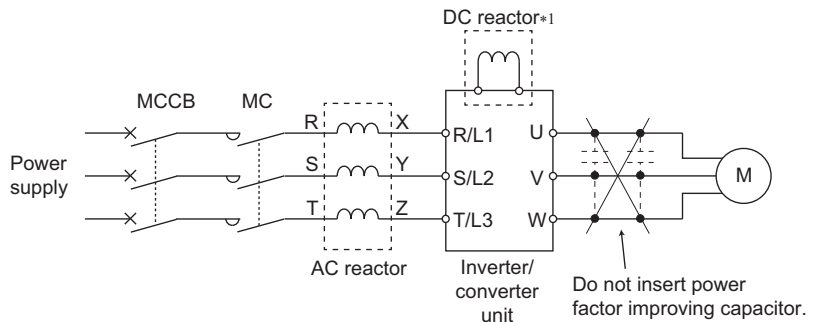
- The differences between harmonics and noises

Item	Harmonics	Noise
Frequency	Normally 40th to 50th degrees or less (3 kHz or less).	High frequency (several 10 kHz to 1 GHz order).
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 the load capacity.	Changes with the current variation ratio. (Gets larger as switching speed increases.)
Affected equipment immunity	Specified by standards per equipment.	Different depending on maker's equipment specifications.
Countermeasure	Provide a reactor.	Increase distance.

- Countermeasures

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

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



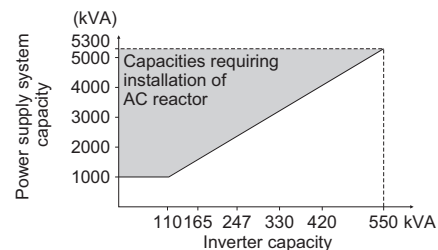
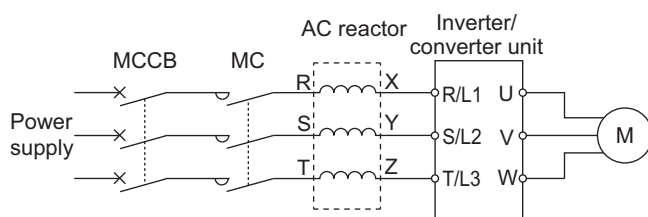
*1 The converter unit (FR-CC2) is equipped with the DC reactor.

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 input side of the inverter or the converter unit, or in the DC circuit.

3.3 Installation of a reactor

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



3.4 Power-OFF and magnetic contactor (MC)

◆ Converter unit input side magnetic contactor (MC)

On the converter unit input side, it is recommended to provide an MC for the following purposes:

(Refer to [page 14](#) for selection.)

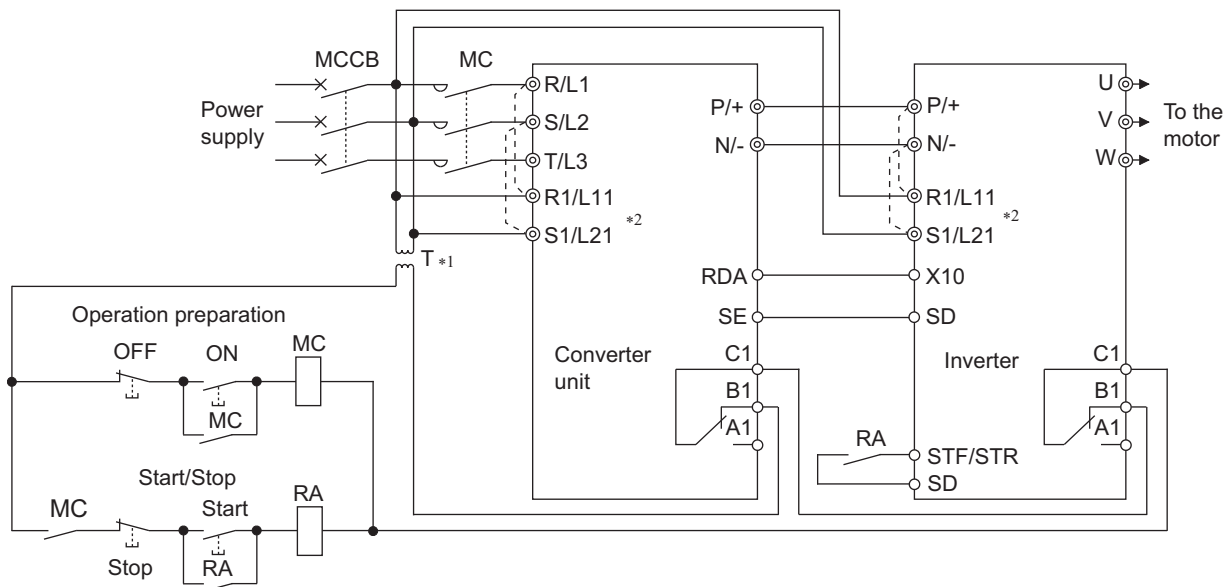
- To disconnect the inverter from the power supply at activation of a protective function or at malfunctioning of the driving system (emergency stop, etc.).
- To prevent any accident due to an automatic restart at power restoration after an inverter stop made by a power failure.
- To separate the inverter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

If using an MC for emergency stop during operation, select an MC regarding the converter unit input side current as JEM1038-AC-3 class rated current.

NOTE

- 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 the inverter start controlling terminals (STF, STR) to run/stop the inverter.
- Inverter start/stop circuit example

As shown on the left, always use the start signal (ON or OFF of STF(STR) signal) to make a start or stop.



*1 Install a stepdown transformer.

*2 Connect the power supply terminals R1/L11, S1/L21 of the control circuit to the input side of the MC to hold an alarm signal when the inverter's protective circuit is activated. At this time, remove jumpers across terminals R1/L11 and S1/L21. (Refer to [page 38](#) for removal of the jumper.)

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

Switch the magnetic contactor between the inverter and motor only when both the inverter and motor are at a stop. When the magnetic contactor is turned ON while the inverter is operating, overcurrent protection of the inverter and such will activate. When an MC is provided to switch to a commercial power supply, for example, it is recommended to use the electronic bypass function **Pr.135 to Pr.139**. (The commercial power supply operation is not available with vector control dedicated motors nor with PM motors.)

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

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

NOTE

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

3.5 Checklist before starting operation

The FR-CC2 converter unit is a highly reliable product, but incorrect peripheral circuit making or operation/handling method may shorten the product life or damage the product.

Before starting operation, always recheck the following points.

Checkpoint	Countermeasure	Refer to page	Check by user
Crimping terminals are insulated.	Use crimping terminals with insulation sleeves to wire the power supply and the inverter.	—	
No wire offcuts are left from the time of wiring.	Wire offcuts can cause an alarm, failure or malfunction. Always keep the converter unit clean. When drilling mounting holes in an enclosure etc., take caution not to allow chips and other foreign matter to enter the converter unit.	—	
The main circuit cable gauge is correctly selected.	Use an appropriate cable gauge to suppress the voltage drop to 2% or less.	29	
The total wiring length is within the specified length.	Keep the total wiring length within the specified length. In long distance wiring, charging currents due to stray capacitance in the wiring may cause the equipment on the converter unit's output side to malfunction. Pay attention to the total wiring length.	29	
Countermeasures are taken against EMI.	The input/output (main circuit) of the converter unit includes high frequency components, which may interfere with the communication devices (such as AM radios) used near the converter unit. In such a case, install a noise filter to minimize interference.	—	
When performing an inspection or rewiring on the product that has been energized, the operator has waited long enough after shutting off the power supply.	For a short time after the power-OFF, a high voltage remains in the smoothing capacitor, and it is dangerous. Before performing an inspection or rewiring, wait 10 minutes or longer after the power supply turns OFF, then confirm that the voltage across the main circuit terminals P/+ and N/- of the converter unit is low enough using a tester, etc.	—	
The voltage applied to the converter unit I/O signal circuits is within the specifications.	Application of a voltage higher than the permissible voltage to the converter unit I/O signal circuits or opposite polarity may damage the I/O devices. Check the wiring beforehand.	31	
A magnetic contactor (MC) is installed on the converter unit's input side.	On the converter unit's input side, connect an MC for the following purposes: • To disconnect the converter unit from the power supply at activation of a protective function or at malfunctioning of the driving system (emergency stop, etc.). • To prevent any accident due to an automatic restart at power restoration after an inverter stop made by a power failure. • To separate the converter unit from the power supply to ensure safe maintenance and inspection work. If using an MC for emergency stop during operation, select an MC regarding the converter unit input side current as JEM1038-AC-3 class rated current.	49	
The specifications and rating match the system requirements.	Make sure that the specifications and rating match the system requirements.	—	
The converter unit and the inverter are correctly connected.	• Make sure that the terminal P/+ of the converter unit and the terminal P/+ of the inverter, and the terminal N/- of the converter unit and the terminal N/- of the inverter are correctly connected. Connecting the opposite polarity of terminals N/- and P/+ will damage the inverter. Also, do not install an MCCB across the terminals P/+ and N/- (across terminals P and P/+ or across N and N/-). • Always connect the terminal RDA of the converter unit and the terminal MRS (X10) of the inverter, and the terminal SE of the converter unit and the terminal SD (terminal PC for source logic) of the inverter. Not connecting these terminals may damage the converter unit.	26	

MEMO

4 **PARAMETER**

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

4.1	Parameter list	54
4.2	(E) Environment setting parameters	59
4.3	(H) Protective function parameter	69
4.4	(M) Monitor display and monitor output signal.....	77
4.5	(T) Multi-function input terminal parameters	85
4.6	(A) Application parameters	87
4.7	(N) Operation via communication and its settings	92

4.1 Parameter list

4.1.1 Parameter list (by parameter number)

Set the necessary parameters to meet the load and operational specifications. Parameter setting, change and check can be performed from the operation panel.



- Refer to Appendix 1 (page 152) for instruction codes for communication and availability of parameter clear, all clear, and parameter copy of each parameter.

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value	Refer to page	Customer setting	
30	E300	Reset selection during power supply to main circuit	0, 100	1	0	87		
57	A702	Restart selection	0, 9999	1	9999	89		
65	H300	Retry selection	0 to 4	1	0	70		
67	H301	Number of retries at fault occurrence	0 to 10, 101 to 110	1	0	70		
68	H302	Retry waiting time	0.1 to 600 s	0.1 s	1 s	70		
69	H303	Retry count display erase	0	1	0	70		
75	-	Reset selection/disconnected PU detection/reset limit	14 to 17, 114 to 117	1	14	62		
	E100	Reset selection	0, 1		0			
	E101	Disconnected PU detection						
	E107	Reset limit						
77	E400	Parameter write selection	1, 2	1	2	63		
117	N020	PU communication station number	0 to 31	1	0	98		
118	N021	PU communication speed	48, 96, 192, 384, 576, 768, 1152	1	192	98		
119	-	PU communication stop bit length / data length	0, 10	1	1	98		
	N022	PU communication data length	0, 1		0			
	N023	PU communication stop bit length	0, 1		1			
120	N024	PU communication parity check	0 to 2	1	2	98		
121	N025	Number of PU communication retries	0 to 10, 9999	1	1	98		
122	N026	PU communication check time interval	0, 0.1 to 999.8 s, 9999	0.1 s	9999	98		
123	N027	PU communication waiting time setting	0 to 150 ms, 9999	1 ms	9999	98		
124	N028	PU communication CR/LF selection	0 to 2	1	1	98		
161	E200	Parameter for manufacturer setting. Do not set.						
168	E000	Parameter for manufacturer setting.						
	E080							
169	E001							
	E081							
170	M020	Watt-hour meter clear	0, 10, 9999	1	9999	77		
178	T700	RDI terminal function selection	7, 21, 62, 84, 9999	1	9999	85		
187	T709	OH terminal function selection		1	7	85		
189	T711	RES terminal function selection		1	62	85		
190	M400	RDB terminal function selection		1	111	81		
191	M401	RDA terminal function selection	2, 8, 11, 17, 25, 26, 64 to 66, 68, 90, 94, 95, 98, 99, 102, 108, 111, 125, 126, 164 to 166, 168, 190, 194, 195, 198, 199, 206, 207, 209, 210, 214, 252, 306, 307, 309, 310, 352, 9999	1	11	81		
192	M402	IPF terminal function selection		1	2	81		
193	M403	RSO terminal function selection		1	209	81		
194	M404	FAN terminal function selection		1	25	81		
195	M405	ABC1 terminal function selection		1	99	81		
244	H100	Cooling fan operation selection	0, 2	1	0			
248	A006	Self power management selection	0, 1, 2	1	0	87		
255	E700	Life alarm status display	(0 to 15)	1	0	66		
256	E701	Inrush current limit circuit life display	(0 to 100%)	1%	100%	66		

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value	Refer to page	Customer setting	
257	E702	Control circuit capacitor life display	(0 to 100%)	1%	100%	66		
261	A730	Power failure stop selection	0, 1, 2, 21, 22	1	0	90		
268	M022	Monitor decimal digits selection	0, 1, 9999	1	9999	77		
269	E023	Parameter for manufacturer setting. Do not set.						
290	M044	Monitor negative output selection	0, 2, 4, 6	1	0	77		
296	E410	Password lock level	0 to 3, 5, 6, 100 to 103, 105, 106, 9999	1	9999	64		
297	E411	Password lock/unlock	(0 to 5), 1000 to 9998, 9999	1	9999	64		
331	N030	RS-485 communication station number	0 to 31 (0 to 247)	1	0	98, 111		
332	N031	RS-485 communication speed	3, 6, 12, 24, 48, 96, 192, 384, 576, 768, 1152	1	96	98, 111		
333	-	RS-485 communication stop bit length / data length	0, 1, 10, 11	1	1	98		
	N032	RS-485 communication data length	0, 1	1	0			
	N033	RS-485 communication stop bit length	0, 1	1	1			
334	N034	RS-485 communication parity check selection	0 to 2	1	2	98, 111		
335	N035	RS-485 communication retry count	0 to 10, 9999	1	1	98		
336	N036	RS-485 communication check time interval	0 to 999.8 s, 9999	0.1 s	0 s	98		
337	N037	RS-485 communication waiting time setting	0 to 150 ms, 9999	1 ms	9999	98		
341	N038	RS-485 communication CR/LF selection	0 to 2	1	1	98		
342	N001	Communication EEPROM write selection	0, 1	1	0	97		
343	N080	Communication error count	-	1	0	111		
503	E710	Maintenance timer 1	0 (1 to 9998)	1	0	68		
504	E711	Maintenance timer 1 warning output set time	0 to 9998, 9999	1	9999	68		
514	H324	Emergency drive dedicated retry waiting time	0.1 to 600 s, 9999	0.1 s	9999	73		
515	H322	Emergency drive dedicated retry count	1 to 200, 9999	1	1	73		
523	H320	Emergency drive selection	100, 200, 9999	1	9999	73		
539	N002	MODBUS RTU communication check time interval	0 to 999.8 s, 9999	0.1 s	9999	111		
549	N000	Protocol selection	0, 1	1	0	97, 111		
563	M021	Energization time carrying-over times	(0 to 65535)	1	0	77		
663	M060	Control circuit temperature signal output level	0 to 100°C	1°C	0°C	84		
686	E712	Maintenance timer 2	0 (1 to 9998)	1	0	68		
687	E713	Maintenance timer 2 warning output set time	0 to 9998, 9999	1	9999	68		
688	E714	Maintenance timer 3	0 (1 to 9998)	1	0	68		
689	E715	Maintenance timer 3 warning output set time	0 to 9998, 9999	1	9999	68		
774	M101	Operation panel monitor selection 1	2, 8, 13, 20, 25, 43, 44, 55, 62, 68, 98, 9999	1	9999	77		
775	M102	Operation panel monitor selection 2		1	9999	77		
776	M103	Operation panel monitor selection 3		1	9999	77		
872	H201	Input phase loss protection selection	0, 1	1	0	69		
876	T723	OH input selection	0 to 2	1	0	86		
888	E420	Free parameter 1	0 to 9999	1	9999	66		
889	E421	Free parameter 2	0 to 9999	1	9999	66		
891	M023	Cumulative power monitor digit shifted times	0, 4, 9999	1	9999	77		
990	E104	PU buzzer control	0, 1	1	1	63		
992	M104	Parameter for manufacturer setting. Do not set.						
997	H103	Fault initiation	0 to 255, 9999	1	9999	69		

Pr. List

4

Parameter list

Parameter list (by parameter number)

Pr.	Pr. group	Name	Setting range	Minimum setting increments	Initial value	Refer to page	Customer setting
1006	E020	Clock (year)	2000 to 2099	1	2000	60	
1007	E021	Clock (month, day)	1/1 to 12/31	1	101	60	
1008	E022	Clock (hour, minute)	0:00 to 23:59	1	0	60	
1048	E106	Parameter for manufacturer setting. Do not set.					

4.1.2 Parameter list (by function group)

◆(E) Environment setting parameters

Parameters that set the converter unit operation characteristics.

Pr. group	Pr.	Name	Refer to page
E000	168	Parameter for manufacturer setting.	
E001	169	Parameter for manufacturer setting.	
E020	1006	Clock (year)	60
E021	1007	Clock (month, day)	60
E022	1008	Clock (hour, minute)	60
E023	269	Parameter for manufacturer setting. Do not set.	
E080	168	Parameter for manufacturer setting.	
E081	169	Parameter for manufacturer setting.	
E100	75	Reset selection	62
E101	75	Disconnected PU detection	62
E104	990	PU buzzer control	63
E106	1048	Parameter for manufacturer setting. Do not set.	
E107	75	Reset limit	62
E200	161	Parameter for manufacturer setting. Do not set.	
E300	30	Reset selection during power supply to main circuit	87
E400	77	Parameter write selection	63
E410	296	Password lock level	64
E411	297	Password lock/unlock	64
E420	888	Free parameter 1	66
E421	889	Free parameter 2	66
E700	255	Life alarm status display	66
E701	256	Inrush current limit circuit life display	66
E702	257	Control circuit capacitor life display	66
E710	503	Maintenance timer 1	68
E711	504	Maintenance timer 1 warning output set time	68
E712	686	Maintenance timer 2	68
E713	687	Maintenance timer 2 warning output set time	68
E714	688	Maintenance timer 3	68
E715	689	Maintenance timer 3 warning output set time	68

◆(H) Protective function parameters

Parameters to protect the converter unit.

Pr. group	Pr.	Name	Refer to page
H100	244	Cooling fan operation selection	72
H103	997	Fault initiation	69
H201	872	Input phase loss protection selection	69
H300	65	Retry selection	70
H301	67	Number of retries at fault occurrence	70
H302	68	Retry waiting time	70
H303	69	Retry count display erase	70
H320	523	Emergency drive selection	73
H322	515	Emergency drive dedicated retry count	73
H324	514	Emergency drive dedicated retry waiting time	73

◆(M) Monitor display and monitor output signal

Parameters regarding the converter unit's operating status. These parameters are used to set the monitors and output signals.

Pr. group	Pr.	Name	Refer to page
M020	170	Watt-hour meter clear	77
M021	563	Energization time carrying-over times	77
M022	268	Monitor decimal digits selection	77
M023	891	Cumulative power monitor digit shifted times	77
M044	290	Monitor negative output selection	77
M060	663	Control circuit temperature signal output level	84
M101	774	Operation panel monitor selection 1	77
M102	775	Operation panel monitor selection 2	77
M103	776	Operation panel monitor selection 3	77
M104	992	Parameter for manufacturer setting. Do not set.	
M400	190	RDB terminal function selection	81
M401	191	RDA terminal function selection	81
M402	192	IPF terminal function selection	81
M403	193	RSO terminal function selection	81
M404	194	FAN terminal function selection	81
M405	195	ABC1 terminal function selection	81

◆(T) Multi-function input terminal parameters

Parameters for the input terminals where converter unit commands are received through.

Pr. group	Pr.	Name	Refer to page
T700	178	RDI terminal function selection	85
T709	187	OH terminal function selection	85
T711	189	RES terminal function selection	85
T723	876	OH input selection	85

◆(A) Application parameters

Parameters to set a specific application.

Pr. group	Pr.	Name	Refer to page
A006	248	Self power management selection	87
A702	57	Restart selection	89
A730	261	Power failure stop selection	90

◆(N) Operation via communication and its settings

Parameters for communication operation. These parameters set the communication specifications and operation.

Pr. group	Pr.	Name	Refer to page
N000	549	Protocol selection	97, 111
N001	342	Communication EEPROM write selection	97
N002	539	MODBUS RTU communication check time interval	111
N020	117	PU communication station number	98
N021	118	PU communication speed	98
N022	119	PU communication data length	98
N023	119	PU communication stop bit length	98
N024	120	PU communication parity check	98
N025	121	Number of PU communication retries	98
N026	122	PU communication check time interval	98
N027	123	PU communication waiting time setting	98
N028	124	PU communication CR/LF selection	98
N030	331	RS-485 communication station number	98, 111
N031	332	RS-485 communication speed	98, 111
N032	333	RS-485 communication data length	98
N033	333	RS-485 communication stop bit length	98
N034	334	RS-485 communication parity check selection	98, 111
N035	335	RS-485 communication retry count	98
N036	336	RS-485 communication check time interval	98
N037	337	RS-485 communication waiting time setting	98
N038	341	RS-485 communication CR/LF selection	98
N080	343	Communication error count	97

4.2 (E) Environment setting parameters

Purpose	Parameter to set			Refer to page
To set the time	Real time clock function	P.E020 to P.E022	Pr.1006 to Pr.1008	60
To set a limit for the reset function. To shut off output if the operation panel disconnects.	Reset selection / disconnected PU detection / reset limit	P.E100, P.E101, P.E107	Pr.75	62
To control the buzzer of the operation panel	PU buzzer control	P.E104	Pr.990	63
To prevent parameter rewriting	Parameter write disable selection	P.E400	Pr.77	63
To restrict parameters with a password	Password function	P.E410, P.E411	Pr.296, Pr.297	64
To use parameters freely	Free parameter	P.E420, P.E421	Pr.888, Pr.889	66
To understand the maintenance time of converter unit parts and peripheral devices	Converter unit parts life display	P.E700 to P.E702	Pr.255 to Pr.257	66
	Maintenance output function	P.E710 to P.E715	Pr.503, Pr.504, Pr.686 to Pr.689	68

4.2.1 Real time clock function

The time can be set. The time can only be updated while the converter unit power is ON.
The real time clock function is enabled using an optional LCD operation panel (FR-LU08).

Pr.	Name	Initial value	Setting range	Description
1006 E020	Clock (year)	2000	2000 to 2099	Set the year.
1007 E021	Clock (month, day)	101 (January 1)	101 to 131, 201 to 228, (229), 301 to 331, 401 to 430, 501 to 531, 601 to 630, 701 to 731, 801 to 831, 901 to 930, 1001 to 1031, 1101 to 1130, 1201 to 1231	Set the month and day. 1000 and 100 digits: January to December 10 and 1 digits: 1 to the end of month (28, 29, 30 or 31) For December 31, set "1231".
1008 E022	Clock (hour, minute)	0 (00:00)	0 to 59, 100 to 159, 200 to 259, 300 to 359, 400 to 459, 500 to 559, 600 to 659, 700 to 759, 800 to 859, 900 to 959, 1000 to 1059, 1100 to 1159, 1200 to 1259, 1300 to 1359, 1400 to 1459, 1500 to 1559, 1600 to 1659, 1700 to 1759, 1800 to 1859, 1900 to 1959, 2000 to 2059, 2100 to 2159, 2200 to 2259, 2300 to 2359	Set the hour and minute using the 24-hour clock. 1000 and 100 digits: 0 to 23 hours 10 and 1 digits: 0 to 59 minutes For 23:59, set "2359".

◆ Simple clock function

- When the year, month, day, time and minute are set in the parameters, the converter unit counts the date and time. The date and time can be checked by reading the parameters.

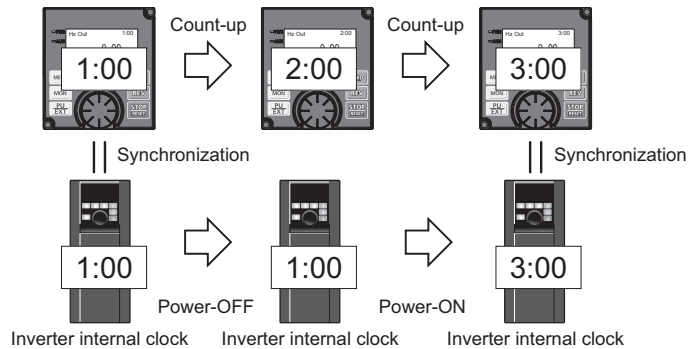
NOTE

- The clock's count-up data is saved in the inverter's EEPROM every 10 minutes.
- The clock does not count up while the control circuit power supply is OFF. The clock function must be reset after turning ON the power supply. Use a separate power supply, such as an external 24 V power supply, for the control circuit of the simple clock function, and supply power continuously to this control circuit.
- Converter reset is performed if supplying power to the main circuit power supply is started with power supplied only to the control circuit power supply. Thus, the clock information stored in the EEPROM is restored. Reset at the start of supplying power to the main circuit can be disabled by setting **Pr.30 Reset selection during power supply to main circuit**. (Refer to [page 87](#))
- The set clock is also used for functions such as faults history.

◆ Real time clock function

- When the FR-LU08 is connected to the inverter, the clock of FR-LU08 is synchronized with the internal clock of the inverter. (Real time clock function)

With a battery (CR1216), the FR-LU08 time count continues even if the main power of the inverter is turned OFF. (The time count of the inverter internal clock does not continue when the inverter power is turned OFF.)



- When the time is set using the inverter parameters, the time of FR-LU08 is set to the time of inverter internal clock.

NOTE

- Time adjustment between the inverter internal clock and the FR-LU08 is performed every one minute.
- If the time of the FR-LU08 progresses faster than the time of inverter internal clock, the FR-LU08 time setting is valid.
- When the FR-LU08 clock is initialized, the inverter internal clock is valid.

4.2.2 Reset selection / disconnected PU detection / reset limit

The reset input acceptance, the disconnected PU connector detection function, and the reset limit function can be selected.

Pr.	Name	Initial value	Setting range	Description
75	Reset selection/disconnected PU detection/reset limit	14	14 to 17, 114 to 117	For the initial setting, reset is always enabled, PU disconnection is not detected, and the reset limit function is disabled.
E100	Reset selection	0	0	Reset input is always enabled.
			1	Reset input is enabled only when the protective function is activated.
E101	Disconnected PU detection	0	0	Operation continues even when the PU is disconnected.
			1	The inverter output is shut off when the PU is disconnected.
E107	Reset limit	0	0	Reset limit is disabled.
			1	Reset limit is enabled.

The parameters above will not return to their initial values even if parameter (all) clear is executed.

Pr.75 Setting value	Reset selection	Disconnected PU detection	Reset limit function
14 (initial value)	Reset input always enabled.	Operation continues even when PU is disconnected.	Invalid
15	Reset input enabled only when the protective function activated.		
16	Reset input always enabled.		
17	Reset input enabled only when the protective function activated.	Inverter output shut off when PU is disconnected.	Enabled
114	Reset input always enabled.	Operation continues even when PU is disconnected.	
115	Reset input enabled only when the protective function activated.		
116	Reset input always enabled.	Inverter output shut off when PU is disconnected.	
117	Reset input enabled only when the protective function activated.		

◆ Reset selection (P.E100)

- When P.E100="1" or Pr.75="15, 17, 115, or 117", reset (reset command via RES signal or communication) input is enabled only when the protective function is activated.

NOTE

- When the reset signal (RES) is input during operation, the inverter is also reset. The motor coasts since the inverter being reset shuts off the output. Also, the cumulative value of electronic thermal O/L relay is cleared.
- The input of the PU reset key is only enabled when the protective function is activated, regardless of the P.E100 and Pr.75 settings.

◆ Disconnected PU detection (P.E101)

- If the PU is detected to be disconnected from the converter unit for 1 s or longer while P.E101="1" or Pr.75="16, 17, 116 or 117", PU disconnection (E.PUE) is displayed and the inverter output is shut off.

NOTE

- When the PU has been disconnected since before power-ON, the output is not shut off.
- To restart, confirm that the PU is connected and then reset.
- When RS-485 communication operation is performed through the PU connector, the reset selection is valid but the disconnected PU detection function is invalid. (The communication is checked according to Pr.122 PU communication check time interval.)

◆ Reset limit function (P.E107)

- Setting **P.E107="1"** or **Pr.75 = any of "114 to 117"** will make the inverter to refuse any reset operation (RES signal, etc.) for 3 minutes after the first activation of an electronic thermal function (E.THC).

NOTE

- Resetting the converter unit power (turning OFF the control power) will clear the accumulated thermal value.
- When the retry function is set enabled (**Pr.67 Number of retries at fault occurrence** ≠ "0"), the reset limit function is disabled.

⚠ Caution

- Do not perform a reset while an inverter start signal is being input. Doing so will cause a sudden start of the motor, which is dangerous.

◀ Parameters referred to ▶

Pr.67 Number of retries at fault occurrence  [page 70](#)

4.2.3 Buzzer control

The buzzer can be set to "beep" when the keys of the operation panel are operated.

Pr.	Name	Initial value	Setting range	Description
990 E104	PU buzzer control	1	0	Without buzzer
			1	With buzzer

NOTE

- When with buzzer is set, the buzzer sounds if a converter unit fault occurs.

4.2.4 Parameter write selection

Whether to enable the writing to various parameters or not can be selected. Use this function to prevent parameter values from being rewritten by misoperation.

Pr.	Name	Initial value	Setting range	Description
77 E400	Parameter write selection	2	1	Parameter writing is disabled.
			2	Parameter writing is enabled.

- Pr.77 can be set at any time. (Setting through communication is unavailable.)

◆ Disabling parameter write(Pr.77="1")

- Parameter write, parameter clear and all parameter clear are disabled. (Parameter read is enabled.)
- The following parameters can be written even if **Pr.77="1"**.

Pr.	Name
75	Reset selection/disconnected PU detection/ reset limit
77	Parameter write selection
296	Password lock level
297	Password lock/unlock
997	Fault initiation

◆ Writing parameters (Pr.77="2")

- These parameters can always be written.

4.2.5 Password function

Registering a 4-digit password can restrict parameter reading/writing.

Pr.	Name	Initial value	Setting range	Description
296 E410	Password lock level	9999	0 to 3, 5, 6, 100 to 103, 105, 106	Select restriction level of parameter reading/writing when a password is registered.
			9999	No password lock
297 E411	Password lock/unlock	9999	1000 to 9998	Register a 4-digit password.
			(0 to 5) *1	Displays password unlock error count. (Reading only) (Valid when Pr.296 = "100 to 103, 105 or 106")
			9999 *1	No password lock

*1 When Pr.297="0, 9999", writing is always enabled, but setting is disabled. (The display cannot be changed.)

◆Parameter reading/writing restriction level (Pr.296)

- The level of the reading/writing restriction using the operation panel or via RS-485 communication can be selected with Pr.296.

Pr.296 setting	Operation panel		RS-485 communication	
	Read	Write*1	Read	Write*1
9999	○	○	○	○
0, 100	×	×	×	×
1, 101	○	×	○	×
2, 102	○	×	○	○
3, 103	○	○	○	×
5, 105	×	×	○	○
6, 106	○	○	×	×

○: Enabled, ×: Disabled

*1 If the parameter writing is restricted by the Pr.77 Parameter write selection setting, those parameters are unavailable for writing even when "○" is indicated.

◆Registering a password (Pr.296, Pr.297)

- The following section describes how to register a password.
 - Set the parameter reading/writing restriction level. (Pr.296 ≠ "9999")

Pr.296 setting	Password unlock error restriction	Pr.297 display
0 to 3, 5, 6	No restriction	Always displays 0
100 to 103, 105, 106*1	Restricted at fifth error	Displays the error count (0 to 5)

*1 During Pr.296= any of "100 to 103, 105 or 106", if password unlock error has occurred five times, correct password will not unlock the restriction. All parameter clear can unlock the restriction. (In this case, the parameters are returned to their initial values.)

- Write a four-digit number (1000 to 9998) to Pr.297 as a password. Writing is disabled when Pr.296 = "9999".) When a password is registered, parameter reading/writing is restricted with the restriction level set in Pr.296 until unlocking.

NOTE

- After registering a password, the read value of Pr.297 is always one of "0" to "5".
- A password restricted parameter cannot be read/written.
- Even if a password is registered, the parameters, which the converter unit itself writes, such as converter unit parts life are overwritten as needed.

◆ Unlocking a password (Pr.296, Pr.297)

- There are two ways of unlocking the password.
- Enter the password in **Pr.297**. If the password matches, it unlocks. If the password does not match, an error occurs and the password does not unlock. During **Pr.296** = any of "100 to 103, 105 or 106", if password unlock error has occurred five times, correct password will not unlock the restriction. (Password lock in operation.)
- Perform all parameter clear.

NOTE

- If the password is forgotten, it can be unlocked with all parameter clear, but doing so will also clear the other parameters.
- All parameter clear cannot be performed during the operation.
- For the all parameter clear method, refer to the following.
(For the Mitsubishi inverter protocol of RS-485 communication, refer to [page 100](#), and for the MODBUS RTU communication protocol, refer to [page 111](#).)

◆ Parameter operations during password locking/unlocking

Operation	Password unlocked		Password locked	Password lock in operation
	Pr.296 = 9999 Pr.297 = 9999	Pr.296 ≠ 9999 Pr.297 = 9999	Pr.296 ≠ 9999 Pr.297 = 0 to 4 (read value)	Pr.296 = 100 to 103, 105, 106 Pr.297 = 5 (read value)
Pr.296	Read	○	○	○
	Write	○	○	×
Pr.297	Read	○	○	○
	Write	×	○	○*1
Parameter clear execution	○	○	×	×
All parameter clear execution	○	○	○	○
Parameter copy execution	○	○	×	×


○: Enabled, ×: Disabled

*1 Correct password will not unlock the restriction.

NOTE

- When the password is being locked, parameter copy using the operation panel is not enabled.

Parameters referred to

Pr.77 Parameter write selection  [page 63](#)

4.2.6 Free parameter

Any number within the setting range of 0 to 9999 can be input.

For example, these numbers can be used:

- As a unit number when multiple units are used.
- As a pattern number for each operation application when multiple units are used.
- As the year and month of introduction or inspection.

Pr.	Name	Initial value	Setting range	Description
888 E420	Free parameter 1	9999	0 to 9999	Any value can be input. The settings are retained even if the converter unit power is turned OFF.
889 E421	Free parameter 2	9999	0 to 9999	

NOTE

- Pr.888 and Pr.889 do not influence the operation of the converter unit.

4.2.7 Converter unit parts life display

The degree of deterioration of the control circuit capacitor, cooling fan, and inrush current limit circuit can be diagnosed on the monitor.

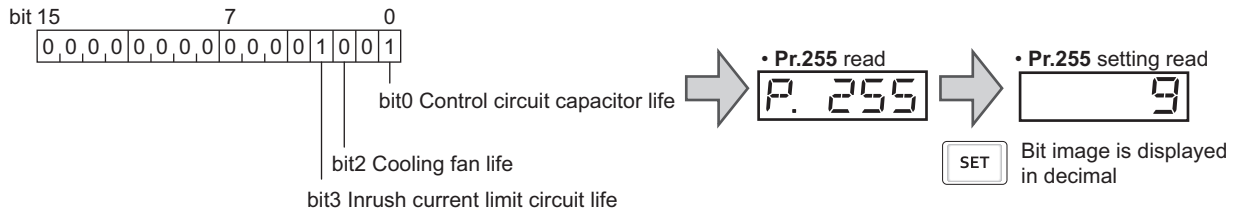
When a part approaches the end of its life, an alarm can be output by self diagnosis to prevent a fault.

(Note that the life diagnosis of this function should be used as a guideline only, because the life values are theoretical calculations.)

Pr.	Name	Initial value	Setting range	Description
255 E700	Life alarm status display	0	(0 to 15)	Displays whether or not the parts of the control circuit capacitor, cooling fan, and inrush current limit circuit have reached the life alarm output level. Read-only.
256 E701	Inrush current limit circuit life display	100%	(0 to 100%)	Displays the deterioration degree of the inrush current limit circuit. Read-only.
257 E702	Control circuit capacitor life display	100%	(0 to 100%)	Displays the deterioration degree of the control circuit capacitor. Read-only.

◆ Life alarm display and signal output (Y90 signal, Pr.255)

- Whether or not the parts of the control circuit capacitor, cooling fan, or inrush current limit circuit have reached the life alarm output level can be checked with **Pr.255 Life alarm status display** and the life alarm signal (Y90).



Pr.255		bit 3	bit 2	bit 0
Decimal	Binary			
13	1101	○	○	○
12	1100	○	○	×
9	1001	○	×	○
8	1000	○	×	×
5	0101	×	○	○
4	0100	×	○	×
1	0001	×	×	○
0	0000	×	×	×

○: With warnings, ×: Without warnings

- The life alarm signal (Y90) turns ON when any of the control circuit capacitor, cooling fan, or inrush current limit circuit reaches the life alarm output level.
- For the terminal used for the Y90 signal, set "90" (positive logic) or "190" (negative logic) in any of **Pr.190 to Pr.195 (output terminal function selection)**.

NOTE

- Changing the terminal assignment using **Pr.190 and Pr.195 (output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

◆ Life display of the inrush current limit circuit (Pr.256)

- The life of the inrush current limit circuit (relay, contactor and inrush resistor) is displayed in **Pr.256**.
- The number of contact (relay, contactor, thyristor) ON times is counted, and it is counted down from 100% (0 time) every 1%/10,000 times. As soon as 10% (900,000 times) is reached, **Pr.255** bit 3 is turned ON and also a warning is output to the Y90 signal.

◆ Life display of the control circuit capacitor (Pr.257)

- The deterioration degree of the control circuit capacitor is displayed in **Pr.257**.
- In the operating status, the control circuit capacitor life is calculated from the energization time and temperature, and is counted down from 100%. As soon as the control circuit capacitor life falls below 10%, **Pr.255** bit 0 is turned ON and also a warning is output to the Y90 signal

◆ Life display of the cooling fan

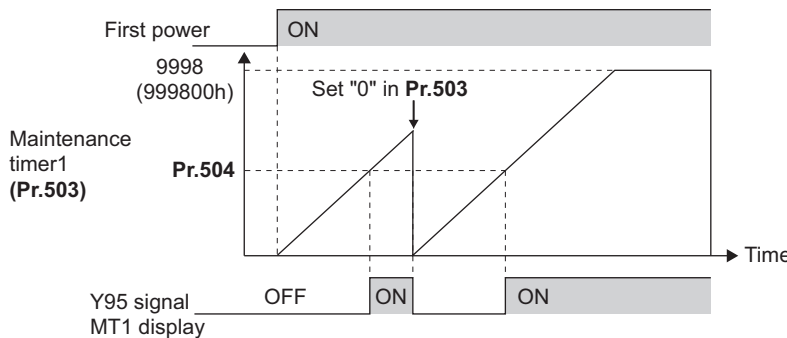
- If a cooling fan speed of less than about 1700 r/min is detected, Fan alarm (FN) is displayed on the operation panel. As an alert output, bit 2 of Pr.255 is turned ON (set to 1), and the Y90 signal, Alarm (LF) signal, and Fan fault output (FAN) signal are also output.
- For the terminal used for the LF signal, set "98" (positive logic) or "198" (negative logic) in any of **Pr.190 to Pr.195 (output terminal function selection)**.
- To use the FAN signal, assign the function by setting "25 (positive logic) or 125 (negative logic)" in any of Pr.190 to Pr.195 (Output terminal function selection).
 - When the converter unit is mounted with two or more cooling fans, "FN" is displayed with one or more fans with the speed below the warning level.
 - Changing the terminal assignment using **Pr.190 and Pr.195 (output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.
 - For replacement of each part, contact the nearest Mitsubishi FA center.

4.2.8 Maintenance timer alarm

The maintenance timer output signal (Y95) is output when the converter unit's cumulative energization time reaches the time period set with the parameter. MT1, MT2 or MT3 is displayed on the operation panel.

This can be used as a guideline for the maintenance time of peripheral devices.

Pr.	Name	Initial value	Setting range	Description
503 E710	Maintenance timer 1	0	0 (1 to 9998)	Displays the converter unit's cumulative energization time in increments of 100 h (read-only). Writing the setting of "0" clears the cumulative energization time while Pr.503 = "1 to 9998". (Writing is disabled when Pr.503 ="0".)
504 E711	Maintenance timer 1 warning output set time	9999	0 to 9998	Set the time until the maintenance timer signal (Y95) is output. MT1 is displayed on the operation panel.
			9999	No function
686 E712	Maintenance timer 2	0	0 (1 to 9998)	The same function as Pr.503 .
687 E713	Maintenance timer 2 warning output set time	9999	0 to 9998	The same function as Pr.504 .
			9999	MT2 is displayed on the operation panel.
688 E714	Maintenance timer 3	0	0 (1 to 9998)	The same function as Pr.503 .
689 E715	Maintenance timer 3 warning output set time	9999	0 to 9998	The same function as Pr.504 .
			9999	MT3 is displayed on the operation panel.



Operation example of the maintenance timer 1 (**Pr.503**, **Pr.504**) (with both MT2 and MT3 OFF)

- The cumulative energization time of the converter unit is stored in the EEPROM every hour and displayed in **Pr.503** (**Pr.686**, **Pr.688**) in 100 h increments. **Pr.503** (**Pr.686**, **Pr.688**) is clamped at 9998 (999800 h).
- When the value in **Pr.503** (**Pr.686**, **Pr.688**) reaches the time (100 h increments) set in **Pr.504** (**Pr.687**, **Pr.689**), Maintenance timer signal (Y95) is output, and also MT1, MT2, or MT3 is displayed on the operation panel.
- For the terminal used for Y95 signal output, assign the function by setting "95 (positive logic)" or "195 (negative logic)" in any of **Pr.190 to Pr.195** (**output terminal function selection**).

NOTE

- The Y95 signal turns ON when any of MT1, MT2 or MT3 is activated. It does not turn OFF unless all of MT1, MT2 and MT3 are cleared.
- If all of MT1, MT2 and MT3 are activated, they are displayed in the priority of "MT1 > MT2 > MT3".
- The cumulative energization time is counted every hour. Energization time of less than 1 h is not counted.
- Changing the terminal assignment using **Pr.190** and **Pr.195** (**output terminal function selection**) may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.190 to Pr.195 (output terminal function selection) page 81

4.3 (H) Protective function parameter

Purpose	Parameter to set			Refer to page
To initiate an inverter protective function	Fault initiation	P.H103	Pr.997	69
To disable the I/O phase loss protective function	Input phase loss protection selection	P.H201	Pr.872	69
To restart using the retry function when the protective function is activated	Retry operation	P.H300 to P.H303	Pr.65, Pr.67 to Pr.69	70
To operate without activating protective functions in case of emergency	Emergency drive	P.H301, P.H320, P.H322, P.H324	Pr.67, Pr.514 Pr.515, Pr.523	73

4.3.1 Initiating a protective function

A fault (protective function) is initiated by setting the parameter.

This function is useful to check how the system operates at activation of a protective function.

Pr.	Name	Initial value	Setting range	Description
997 H103	Fault initiation	9999	16 to 253	The setting range is same with the one for fault data codes of the converter unit (which can be read through communication). Written data is not stored in EEPROM.
			9999	The read value is always "9999". With this setting, the protective function is not activated.

- To initiate a fault (protective function), set the assigned number of the protective function you want to initiate in **Pr.997**.
- The value set in **Pr.997** is not stored in EEPROM.
- When a protective function is activated, the inverter trips, a fault is displayed, and a fault signal (ALM, ALM2) is output.
- The latest fault in the faults history is displayed while the fault initiation function is in operation. After a reset, the faults history goes back to the previous status. (The protective function generated by the fault is not saved in the faults history.)
- Perform converter reset to cancel the protective function.
- For the selectable parameter by **Pr.997** and the corresponding protective functions, refer to [page 127](#).

NOTE

- If a protective function is already operating, no protective function cannot be initiated by **Pr.997**.
- The retry function is disabled when a protective function has been initiated by fault initiation function.
- If a fault occurs after a protective function has been activated, the protective function indication does not change. The fault is not saved in the faults history either.

4.3.2 Input phase loss protection selection

The input phase loss protective function on the converter unit input side (R/L1, S/L2, T/L3) can be enabled.

Pr.	Name	Initial value	Setting range	Description
872 H201	Input phase loss protection selection	0	0	Without input phase loss protection
			1	With input phase loss protection

- When **Pr.872** = "1", the Input phase loss (E.ILF) protection will be activated if one of three phases is continuously lost for 1 second.
- While a phase loss is detected, the Input phase loss (IPL) signal is ON. To use the IPL signal, set "252" (positive logic) or "352" (negative logic) in any parameter from **Pr.190** to **Pr.195** (Output terminal function selection) to assign the function to a terminal.

(H) Protective function parameter

NOTE

- In the case of R/L1, S/L2 phase loss, the input phase loss protection will not operate, and the inverter will trip.
- If an input phase loss continues for a long time, the converter unit capacitor life will be shorter.

4.3.3 Retry function

If a protective function activates (fault display), the converter unit resets itself automatically to restart. The retry generating protective functions can be also selected.

When the automatic restart after instantaneous power failure function is selected (**Pr.57** ≠ "9999"), the restart operation is also performed after a retry operation as well as after an instantaneous power failure. (Refer to [page 89](#) for the restart operation.)

Pr.	Name	Initial value	Setting range	Description
65 H300	Retry selection	0	0 to 4	The fault that will cause a retry can be selected. (Refer to the table on the next page .)
67 H301	Number of retries at fault occurrence	0	0	No retry function
			1 to 10	Set the number of retries at a fault occurrence. A fault output is not provided during the retry operation.
			101 to 110	Set the number of retries at a fault occurrence. (The setting value minus 100 is the number of retries.) A fault output is provided during the retry operation.
68 H302	Retry waiting time	1 s	0.1 to 600 s	Set the waiting time from a fault occurrence to a retry.
69 H303	Retry count display erase	0	0	Clears the number of successful restarts made by retries.

◆ Setting the retry function (Pr.67, Pr.68)

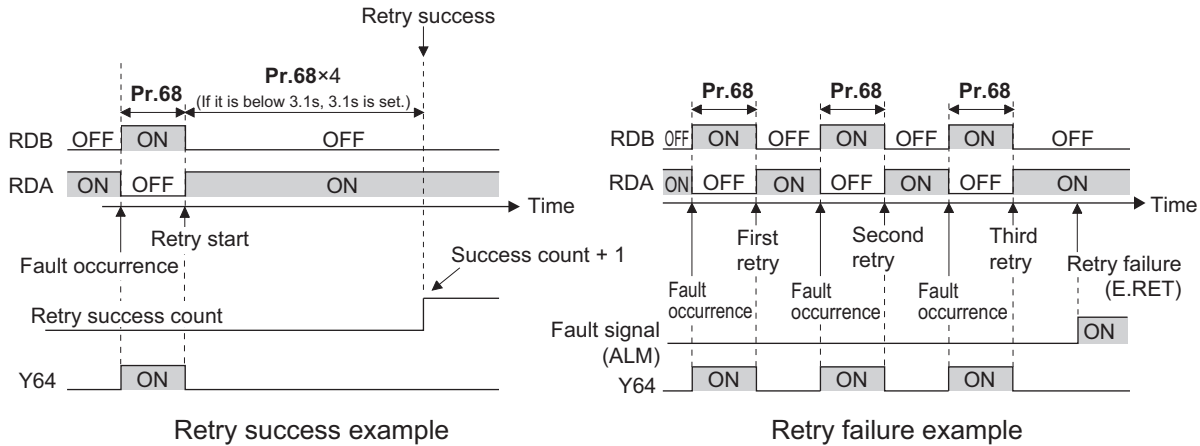
- When the converter unit protective function is operating (fault indication), the retry function automatically cancels (resets) the protective function after the time set in **Pr.68**.
- Retry operation is enabled when **Pr.67** ≠ "0". For **Pr.67**, set the number of retries at activation of the protective function.

Pr.67 setting	Fault output during retry operation	Retry count
0	—	No retry function
1 to 10	Not used	1 to 10 times
101 to 110	With	1 to 10 times

- When retries fail consecutively more than the number of times set in **Pr.67**, a Retry count excess (E.RET) occurs. (Refer to the retry failure example.)
- For **Pr.68**, set the waiting time from a protective function activation to a retry in the range of 0.1 to 600 s.
- During retry operation, the During retry (Y64) signal is ON. For the Y64 signal, assign the function by setting "64 (positive logic)" or "164 (negative logic)" in any of **Pr.190 to Pr.195 (output terminal function selection)**.

◆ Retry count check (Pr.69)

- By reading **Pr.69**, the number of successful restarts made by retries can be obtained. The cumulative count in **Pr.69** increases by 1 when a retry is successful. Retry is regarded as successful when normal operation continues without a fault for the **Pr.68** setting multiplied by four or longer (3.1 s at the shortest). (When retry is successful, the cumulative number of retry failures is cleared.)
- Writing "0" in **Pr.69** clears the cumulative count.



◆ Selecting retry generating faults (Pr.65)

- Using **Pr.65**, you can select the fault that will cause a retry. No retry will be made for the fault not indicated. (For the fault details, refer to [page 128](#).) ● indicates the faults selected for retry.

Retry-making fault	Pr.65 setting				
	0	1	2	3	4
E.OVT	●		●	●	●
E.THC	●				
E.IPF	●				●
E.UVT	●				●

Retry-making fault	Pr.65 setting				
	0	1	2	3	4
E.OHT	●				
E.PE	●				●
E.SER	●				●
E.ILF	●				●

NOTE

- Use the retry function only when the operation can be resumed after resetting a protective function activation. Making a retry against the protective function, which is activated by an unknown condition, will lead the converter unit to be faulty. Identify what condition the protective function was activated, and eliminate such condition before resuming the operation.
- Only the fault details for the first fault that occurred are stored in the faults history.
- The reset by the retry function does not clear the accumulated data of the electronic thermal O/L relay, etc. (This is different from power supply reset or reset by RES signal.)
- When the parameter storage device fault (E.PE) has occurred and reading of the retry-function-related parameters has failed, the retry operation cannot be performed.
- Changing the terminal assignment using **Pr.190 to Pr.195 (output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Caution

- When the retry function is set enabled, stay away from the motor and machine in the case of an inverter trip. The motor and machine will start suddenly (after the reset time has elapsed) after the inverter trip. If the retry function has been selected, apply the CAUTION stickers, which are supplied with the Inverter Manual, to easily visible places.

Parameters referred to

Pr.57 Restart selection [page 89](#)

4.3.4 Cooling fan ON/OFF control

Cooling fan operation can be stopped by signal input.

◆ Cooling fan operation selection (Pr.244)

- Cooling fan operation is selected by setting **Pr.244** Cooling fan operation selection. The same operation is applied regardless of the number of cooling fans.

Pr.	Name	Initial value	Setting range	Description
244 H100	Cooling fan operation selection	0	0	Cooling fan ON/OFF control is disabled. (The cooling fan is always ON at power ON) A cooling fan operates at power ON.
			2	Cooling fan ON/OFF control is enabled. While the Cooling fan operation input (X21) signal is OFF, the cooling fan is always ON. While the X21 signal is ON, the converter unit status is monitored and the fan switches ON/OFF according to the temperature.

- Cooling fan operation is selected by setting **Pr.244 Cooling fan operation selection**. When multiple cooling fans are used, the selected operation is applied to all the fans.
- When **Pr.244** = "0"
Turning ON the converter unit power starts cooling fan operation except during resetting.

Mode	Fan operation
Resetting	Cooling fan OFF
Except during resetting	Cooling fan ON

- When **Pr.244** = "2"
When the Cooling fan operation input (X21) signal is ON, the converter unit internal temperature is monitored and the fan switches ON/OFF according to the temperature. To assign the X21 signal, set "21" in any of **Pr.178, Pr.187, or Pr.189** (Input terminal function selection).

Resetting status while power is ON	Converter unit internal temperature	X21*1	Cooling fan operation
Except during resetting	Less than the specified value	ON	OFF
	Specified value or more	OFF	ON
Resetting	-	-	OFF

*1 Fan operation when the X21 signal is turned ON/OFF is as follows.

X21	Description
ON	When the converter unit internal temperature is less than the specified value, cooling fan operation is stopped.
OFF	Cooling fan operation starts.

NOTE

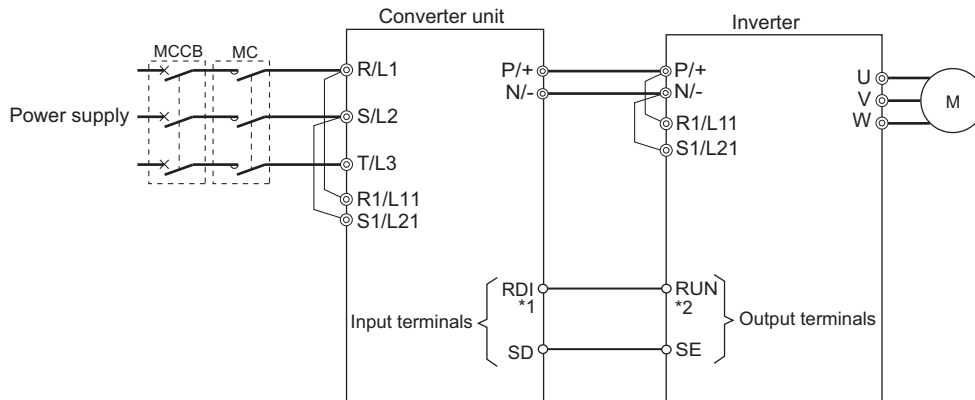
- When the terminal assignment is changed using **Pr.178, Pr.187, or Pr.189 (Input terminal function selection)**, wiring may be mistaken due to different terminal name and signal contents, or may affect other functions. Set parameters after confirming the function of each terminal.
- Cooling fan operation is OFF during resetting while power is ON regardless of the **Pr.244** setting.

• Application examples

Use the Cooling fan operation input (X21) signal in combination with a certain inverter output signal to control fan operation in conjunction with the inverter operation.

Example 1: When the Inverter running (RUN) signal of the inverter is used, the converter unit cooling fan can be operated only during inverter operation.

Example 2: When the Cooling fan operation command (Y206) signal of the inverter is used, the converter unit fan can be operated in conjunction with the inverter cooling fan. The following connection diagram shows the example using the RUN signal of the inverter



*1 To use the Cooling fan operation input (X21) signal, assign the function to an input terminal of the converter unit.

*2 To turn ON/OFF the Cooling fan operation input (X21) signal in conjunction with inverter operation, assign the Cooling fan operation command (Y206) signal or the Inverter running (RUN) signal in negative logic to an output terminal of the inverter.

4.3.5 Emergency drive

This function is used in case of emergency such as a fire to forcibly continue inverter operation to drive a motor without activating protective functions even if the inverter detects a fault. Using this function may cause damage of the motor or the inverter because driving the motor is given the highest priority. Use this function for emergency operation only. When the inverter is damaged by a fault, the motor operation can be continued by switching to the commercial power supply operation. To enable the emergency drive function, the function must be set in both the inverter and the converter unit.

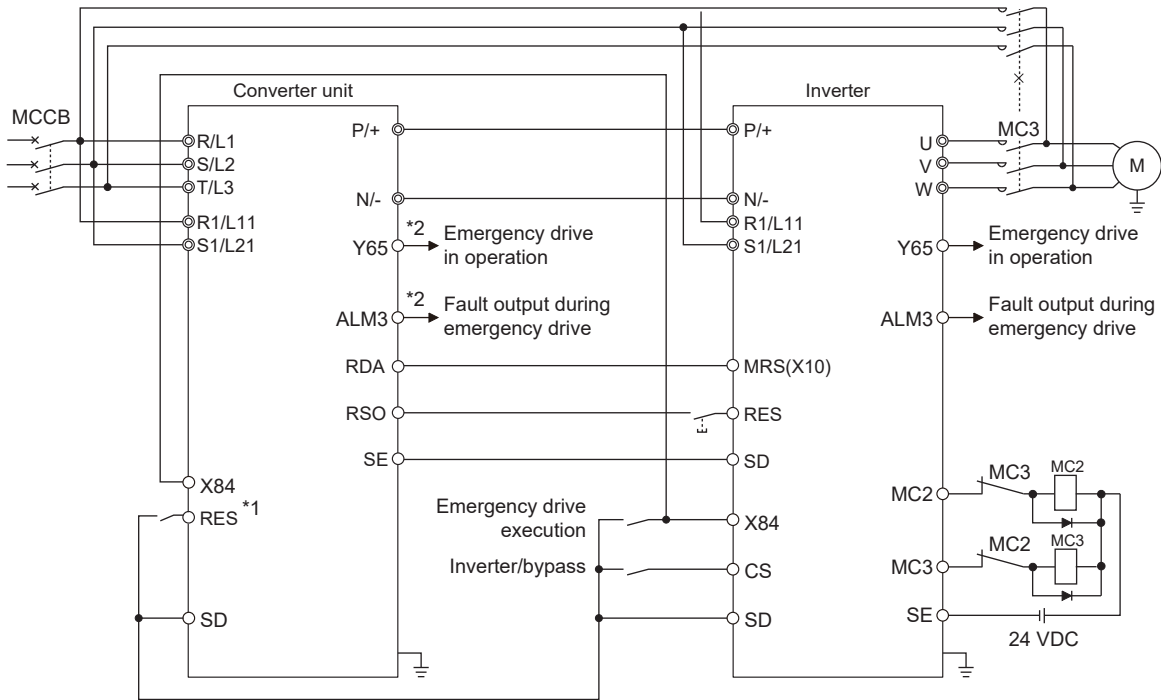
By setting the emergency drive function in the inverter, the operation can be switched to the commercial power supply operation at the occurrence of a fault which may cause damage of the converter unit or the inverter. The inverter does not detect faults in the converter unit. When faults occur frequently in the converter unit, modify the wiring to enable switchover to the commercial power supply operation using a programmable controller.

Pr.	Name	Initial value	Setting range	Description
67 H301	Input phase loss protection selection	0	0 to 10, 101 to 110	Select whether to output the Fault (ALM) signal during the retry operation while the emergency drive operation is performed. 0 to 10: The ALM signal is not output during retry. 101 to 110: The ALM signal is output during retry.
68 H302	Retry waiting time	1 s	0.1 to 600 s	Set the waiting time from a fault occurrence to a retry.
69 H303	Retry count display erase	0	0	Setting "0" clears the retry success counter ("retry success" means that the inverter successfully restarts).
523 H320	Emergency drive mode selection	9999	100, 200 9999	Select the operation mode of the emergency drive. Emergency drive disabled.
515 H322	Emergency drive dedicated retry count	1	1 to 200 9999	Set the retry count during emergency drive operation. Without retry count excess (no restriction on the number of retries)
514 H324	Emergency drive dedicated retry waiting time	9999	0.1 to 600 s 9999	Set the retry waiting time during emergency drive operation. Waiting time: According to Pr.68 setting
57 A702	Restart selection	9999	0 9999	Selected Not selected

(H) Protective function parameter

◆ Connection diagram

A connection diagram of the emergency drive is shown below.



*1 The applied terminals differ by the settings of **Pr.178**, **Pr.187**, and **Pr.189** (Input terminal function selection).

*2 The applied terminals differ by the settings of **Pr.190** to **Pr.195** (Output terminal function selection).

NOTE

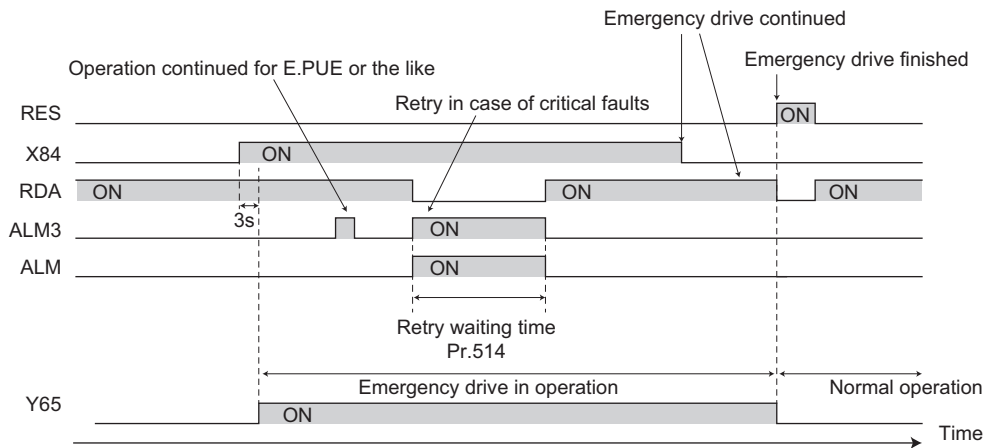
- Settings in the inverter is also required to enable the emergency drive function.

◆ Emergency drive execution sequence

NOTE

- When the X84 signal is ON for 3 seconds, the emergency drive is activated.
- The Y65 signal turns ON during emergency drive operation.
- "ED" appears on the operation panel during emergency drive operation.
- The ALM3 signal turns ON when a fault occurs during emergency drive operation.
- For protective functions (faults) valid during emergency drive operation, refer to [page 75](#).

- Operation of the emergency drive function (when the retry in case of critical faults is selected)



◆Emergency drive operation selection (Pr.523)

Use Pr.523 Emergency drive mode selection to select the emergency drive operation.

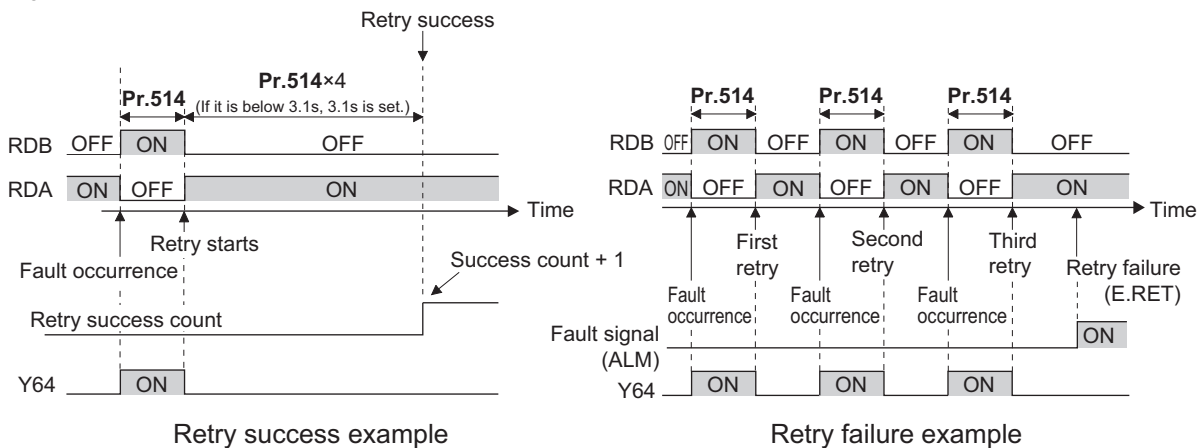
Pr.523 setting	Description
100	When a critical fault occurs, the RDA signal is turned OFF and the RDB signal is turned ON to disable inverter operation.
200	Retry operation when a critical fault occurs. When a critical fault for which retry is not permitted occurs or when the retry count is exceeded, the RDA signal is turned OFF and the RDB signal is turned ON to disable inverter operation.
9999	Emergency drive disabled.

◆Retry operation during emergency drive (Pr.515, Pr.514)

- Set the retry operation during emergency drive operation. Use Pr.515 Emergency drive dedicated retry count to set the retry count, and use Pr.514 Emergency drive dedicated retry waiting time to set the retry waiting time.
- The ALM signal output conditions depend on the Pr.67 Number of retries at fault occurrence setting.
- For the protective functions (critical faults) for which a retry is performed during emergency drive operation, refer to [page 75](#).

◆Retry count check (Pr.69)

- Reading the Pr.69 value provides the cumulative number of successful restart times made by retries. The cumulative count in Pr.69 increases by 1 when a retry is successful. Retry is regarded as successful when normal operation continues without a fault for the Pr.514 setting multiplied by four or longer (3.1 seconds at the shortest). (When retry is successful, the cumulative number of retry failures is cleared.)
- Writing "0" in Pr.69 clears the cumulative count.



◆Operation of protective functions during emergency drive

- Operation of protective functions during emergency drive is as follows.

Protective function	Operation during emergency drive
E.OVT	Retry
E.TH3	Retry
E.FIN	Retry
E.IPF	The function is disabled.
E.UVT	The function is disabled.
E.ILF	The function is disabled.
E.OHT	Retry
E.PE	Output shutoff

Protective function	Operation during emergency drive
E.PUE	The function is disabled.
E.RET	Output shutoff
E.PE2	Output shutoff
E.CPU	Retry
E.CTE	The function is disabled.
E.P24	The function is disabled.
E.IOH	Output shutoff
E.SER	The function is disabled.

Protective function	Operation during emergency drive
E.PBT	Retry
E1	Retry
E.5	Retry
E.6	Retry
E.7	Retry
E.13	Output shutoff

(H) Protective function parameter

- The fault output during emergency drive operation is as follows.

Signal	Pr.190 to Pr.196 setting		Description
	Positive logic	Negative logic	
Y65	65	165	Turns ON during emergency drive operation.
ALM	99	199	Turns ON at the occurrence of a fault that causes the above-mentioned "retry" or "output shutoff" during emergency drive operation. Use Pr.67 Number of retries at fault occurrence to select whether to output the Fault (ALM) signal during the retry operation. In the initial setting, "0" is set (the ALM signal is not output during retry).
ALM3	66	166	Output when a fault occurs during emergency drive operation. During emergency drive operation, if a fault that does not activate any protective function occurs, the signal turns ON for 3 seconds and then turns OFF.

◆ Input signal operation

- The following table shows status of input signals during emergency drive operation.

Input signal status	Description
Valid	OH, RES
Held	X84

◆ Emergency drive status monitor

- Set "68" in **Pr.774 to Pr.776, Pr.992** to monitor the status of the emergency drive on the operation panel.

Description of the status monitor

Operation panel indication	Description	
	Emergency drive setting	Emergency drive operating status
0	Emergency drive function setting is not available.	-
1	Emergency drive	During normal operation
2		Operating properly
3		A certain alarm is occurring.*1
4		Emergency drive in operation A critical fault is occurring. The operation is being continued by the retry.
5		A critical fault is occurring. The continuous operation is not allowed due to output shutoff.

*1 "A certain alarm" means a protective function disabled during emergency drive shown in the tables on [page 75](#).

NOTE

- When the "retry" (**Pr.523** = "200") is selected, it is recommended to use the automatic restart after instantaneous power failure function at the same time. (Refer to [page 89](#).)
- Parameter setting is not available during emergency drive operation.
- To return to the normal operation during emergency drive operation, reset the converter unit or the inverter, or turn OFF the power supply. (The operation will not be returned to normal only by turning OFF the X84 signal.)

CAUTION

When the emergency drive operation is performed, the operation is continued or the retry is repeated even when a fault occurs, which may damage or burn the inverter, converter unit and motor. Before restarting the normal operation after using this function, make sure that the inverter, converter unit and motor have no fault. Any damage of the inverter, converter unit or the motor caused by using the emergency drive function is not covered by the warranty even within the guarantee period.

4.4 (M) Monitor display and monitor output signal

Purpose	Parameter to set			Refer to page
To change the monitored item on the operation panel	Operation panel monitor selection Cumulative monitor clear	P.M020 to P.M023, P.M044, P.M100 to P.M103	Pr.170, Pr.268, Pr.290, Pr.563, Pr.774 to Pr.776, Pr.891	77
To assign functions to output terminals	Output terminal function assignment	P.M400 to P.M405	Pr.190 to Pr.195	81
To detect the control circuit temperature	Control circuit temperature monitor	P.M060	Pr.663	84

4.4.1 Monitor display selection using operation panel or via communication

The monitored item to be displayed on the operation panel can be selected.

Pr.	Name	Initial value	Setting range	Description
774 M101	Operation panel monitor selection 1	9999 (Converter output voltage)	2, 8, 13, 20, 25, 43, 44, 55, 62, 68, 98, 9999	The converter output voltage, input current and electronic thermal relay function load factor monitor that are displayed in monitor mode on the operation panel can be switched to a specified monitor.
775 M102	Operation panel monitor selection 2	9999 (Input current)		
776 M103	Operation panel monitor selection 3	9999 (Electric thermal relay function load factor)		
170 M020	Watt-hour meter clear	9999	0	Set "0" to clear the watt-hour monitor.
			10	Sets the maximum value for the monitoring from 0 to 9999 kWh.
			9999	Sets the maximum value for the monitoring from 0 to 65535 kWh.
563 M021	Energization time carrying-over times	0	(0 to 65535) (Read-only.)	Displays the numbers of times that the cumulative energization time monitor exceeded 65535 h. Read-only.
268 M022	Monitor decimal digits selection	9999	0	Displays as integral value.
			1	Displays in 0.1 increments.
			9999	No function
891 M023	Cumulative power monitor digit shifted times	9999	0 to 4	Set the number of times to shift the cumulative power monitor digit. The monitored value is clamped at the maximum value.
			9999	No shift. The monitored value is cleared when it exceeds the maximum value.
290 M044	Monitor negative output selection	0	0, 2, 4, 6	Set the availability of output with a minus sign for the operation panel display or monitoring via communication.

(M) Monitor display and monitor output signal

◆ Monitor description list (Pr.774 to Pr.776)

- Use **Pr.774 to Pr.776** to select a monitored item to be displayed on the operation panel. **Pr.774** sets the first monitor, **Pr.775** sets the second monitor, and **Pr.776** sets the third monitor to be displayed.
- Refer to the following table and set the monitor to be displayed. (The items with — are not available for monitoring.) The circle in the minus (—) display column denotes availability of the minus sign display.

Types of monitor	Unit	Pr.774 to Pr.776	RS-485 communication dedicated monitor (hexadecimal)	MODBUS RTU Real time monitor	Minus (-) display	Description
Input current*2*6	0.1 A	2	H02	40202		Displays the converter unit input current effective value.
Converter output voltage	0.1 V	8	H08	40208		Displays the DC bus voltage value.
Input power	0.1 kW	13	H0D	40213		Displays the power at the converter unit input side.
Cumulative energization time*1	1 h	20	H14	40220		Displays the cumulative energization time since the converter unit shipment. Check how many times the monitor value exceeded 65535 h with Pr.563 .
Cumulative power	0.1 kWh	25	H19	40225		Displays the cumulative energy based on the input power monitor. This can be cleared by Pr.170 . (Refer to page 79 .)
Station number (RS-485 terminals)	1	43	H2B	40243		Displays which station number (0 to 31) can currently be used for communication from the RS-485 terminal block.
Station number (PU)	1	44	H2C	40244		Displays which station number (0 to 31) can currently be used for communication from the PU connector.
Input terminal status	—	—*3	H0F*4	40215*4		Displays input terminal ON/OFF state of the converter unit.
Output terminal status	—	—*3	H10*5	40216*5		Displays output terminal ON/OFF state of the converter unit.
Electric thermal relay function load factor	0.1%	62	H3E	40262		Displays the accumulated heat value of the converter thermal O/L relay. The converter overload trip (electronic thermal relay function) (E.TH.C) occurs at 100%.
Emergency drive status	1	68	H44	40268		Displays the emergency drive status. (Refer to page 73 .)
32-bit cumulative power (lower 16 bits)	1 kWh	—	H4D	40277		Displays the 32-bit cumulative power value in multiplies of 16 bits. Monitoring can be performed via RS-485 communication.
32-bit cumulative power (upper 16 bits)	1 kWh	—	H4E	40278		
32-bit cumulative power (lower 16 bits)	0.1 kWh	—	H4F	40279		
32-bit cumulative power (upper 16 bits)	0.1 kWh	—	H50	40280		
Control circuit temperature	1°C	98	H62	40298	○	Displays the temperature of the control circuit board. Without minus sign: 0 to 100°C With minus sign: -20 to 100°C

*1 The cumulative energization time is accumulated from 0 to 65535 hours, then cleared, and accumulated again from 0.

*2 0 A appears during regenerative driving.

*3 Parameter setting is not available for setting the item as the main monitor data on the operation panel (FR-LU08). Use the monitor function of the FR-LU08 for setting.
When monitoring the input/output terminal status of the FR-LU08, replace the displayed input/output terminal name as the actual one according to the table below.
• Input terminal

Displayed terminal name	STF	STR	RL	RM	RH	RT	AU	JOG	CS	MRS	STP	RES
Actual terminal name	RDI	Unused								OH	Unused	RES

• Output terminal

Displayed terminal name	RUN	SU	IPF	OL	FU	A1B1C1	A2B2C2
Actual terminal name	RDB	RDA	IPF	RSO	FAN	A1B1C1	Unused

*4 Input terminal monitor details ("1" denotes terminal ON, "0" denotes terminal OFF, and "—" denotes undetermined value.)

b15	—	—	—	—	—	RES	—	OH	—	—	—	—	—	—	—	—	—	b0
																		RDI

*5 Output terminal monitor details ("1" denotes terminal ON, "0" denotes terminal OFF, and "—" denotes undetermined value.)

b15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	b0
																		RDB

*6 The monitored values are retained even if a converter unit fault occurs. Resetting will clear the retained values.

◆ Cumulative power monitor and clear (Pr.170, Pr.891)

- On the cumulative power monitor (Pr.774 to Pr.776 = "25"), the input power monitor value is added up and updated in 100 ms increments. (The values are saved in EEPROM every hour.)
- Display increments and display ranges of the operation panel and communication (RS-485 communication) are as indicated below.

Operation panel *1		Communication		
Range	Unit	Range		Unit
		Pr.170 = 10	Pr.170 = 9999	
1000.0 to 9999.9 kWh	0.1 kWh	0 to 9999 kWh	0 to 65535 kWh	1 kWh
10000 to 99999 kWh	1 kWh		(initial value)	

*1 Power is measured in the range of 0 to 99999.99 kWh, and displayed in five digits. When the monitor value exceeds "999.99", a carry occurs, for example "1000.0", so the value is displayed in 0.1 kWh increments.

- Digits in the cumulative power monitor can be shifted to the right for the numerical set in **Pr.891 Cumulative power monitor digit shifted times**.
For example, if the cumulative power value is 1278.56 kWh when **Pr.891** = "2", the operation panel display is 12.78 (display in 100 kWh increments) and the communication data is 12.
- If the maximum value is exceeded at **Pr.891** = "0 to 4", the monitor value is clamped at the maximum value, indicating that a digit shift is necessary. If the maximum value is exceeded at **Pr.891** = "9999", the monitor value returns to 0, and the counting starts again.
- Writing "0" in **Pr.170** clears the cumulative power monitor.

NOTE

- If "0" is written to **Pr.170**, and **Pr.170** is read again, "9999" or "10" is displayed.

◆ Cumulative energization time monitor (Pr.563)

- Cumulative energization time monitor (Pr.774 to Pr.776 = "20") accumulates energization time from shipment of the converter unit every one hour.
- If the number of monitor value exceeds 65535, it is added up from 0. Use **Pr.563** to check the numbers of times that the cumulative energization time monitor exceeded 65535 h.
- Writing "0" in **Pr.171** clears the actual operation time monitor. (The energization time monitor cannot be cleared.)

NOTE

- The cumulative energization time does not increase if the power is ON for less than an hour.

◆ Hiding the decimal places for the monitors (Pr.268)

- The numerical figures after a decimal point displayed on the operation panel may have small fluctuations during analog input, etc. The decimal places can be hidden by selecting the decimal digits with **Pr.268**.

Pr.268 setting	Description
9999 (initial value)	No function
0	For the first or second decimal places (0.1 increments or 0.01 increments) of the monitor, numbers in the first decimal place and smaller are rounded to display an integral value (1 increments). The monitor value equal to or smaller than 0.99 is displayed as 0.
1	When monitoring with the second decimal place (0.01 increments), the 0.01 decimal place is dropped and the monitor displays the first decimal place (0.1 increments). When the monitor display is incremented by one, the display will not change.

(M) Monitor display and monitor output signal

NOTE

- The number of display digits on the cumulative energization time (Pr.774 to Pr.776="20") and the cumulative power (Pr.774 to Pr.776="25") does not change.

◆ Minus sign display for the monitors (Pr.290)

- Values with minus signs can be displayed on the monitor indicator of the operation panel. For a list of monitored items that can be displayed with minus signs, refer to the monitor description list (on [page 78](#)).

Pr.290 setting	Minus-sign display on operation panel	Monitoring via communication
0 (initial value)	-	-
2	Displayed with minus sign.	-
4	-	Displayed with minus sign.
6	Displayed with minus sign.	Displayed with minus sign.

-: Output without minus sign (positive only)

4.4.2 Output terminal function selection

Use the following parameters to change the functions of the open collector output terminals and relay output terminals.

Pr.	Name		Initial value	Initial signal	Setting range
190 M400	RDB terminal function selection	Open collector output terminal	111	RDB (Inverter operation enable (NC contact))	2, 8, 11, 17, 25, 26, 64 to 66, 68, 90, 94, 95, 98, 99, 102, 108, 111, 125, 126, 164 to 166, 168, 190, 194, 195, 198, 199, 206, 207, 209, 210, 214, 252, 306, 307, 309, 310, 352, 9999
191 M401	RDA terminal function selection		11	RDA (Inverter operation enable (NO contact))	
192 M402	IPF terminal function selection		2	IPF (Instantaneous power failure/undervoltage)	
193 M403	RSO terminal function selection		209	RSO (Inverter reset)	
194 M404	FAN terminal function selection		25	FAN (Fan fault output)	
195 M405	ABC1 terminal function selection	Relay output terminal	99	ALM (Fault)	

◆ Output signal list

- The functions of the output terminals can be set.
- Refer to the following table and set the parameters. (0 to 99: Positive logic, 100 to 199: Negative logic)

Setting		Signal name	Function	Operation	Related parameter	Refer to page
Positive logic	Negative logic					
2	102	IPF	Instantaneous power failure/undervoltage	Output when an instantaneous power failure or undervoltage protection operation occurs.	Pr.57	89
8	108	THP	Electronic thermal O/L relay pre-alarm	Output when the cumulative electronic thermal O/L relay value reaches 85% of the trip level. (Electronic thermal O/L relay protection (E.THC) is activated when the value reaches 100%.)	—	82
11	—	RDA	Inverter operation enable (NO contact)	Output when the converter unit operation is ready.	—	83
—	111	RDB	Inverter operation enable (NC contact)	Output when a converter unit fault occurs or the converter is reset. (inverse to the logic of RDA)	—	
17	—	Y17	Control signal for main circuit power supply MC	Output while the self power management function is enabled. Turns OFF when a fault activating the self power management operation occurs.	Pr.248, Pr.30	87
25	125	FAN	Fan fault output	Output when a fan fault occurs.	—	82
26	126	FIN	Heatsink overheat pre-alarm	Output when the heatsink temperature reaches about 85% of the heatsink overheat protection operation temperature.	—	130
64	164	Y64	During retry	Output during retry processing.	Pr.65 to Pr.69	70
65	165	Y65	Emergency drive in operation	Output during emergency drive operation.	Pr.67, Pr.514, Pr.515, Pr.523	73
66	166	ALM3	Fault output during emergency drive	Output when a fault occurs during emergency drive operation.		
68	168	EV	24 V external power supply operation	Output while operating with a 24 V power supply input from an external source.	—	39
90	190	Y90	Life alarm	Output when any of the control circuit capacitor, the inrush current limit circuit, or the cooling fan approaches the end of its life.	Pr.255 to Pr.257	66
94	194	ALM2	Fault output 2	Output when the converter unit's protective function is activated to stop the output (at fault occurrence). The signal output continues even during a converter reset, and the signal output stops after the reset release. *1	—	83
95	195	Y95	Maintenance timer signal	Output when Pr.503 reaches the Pr.504 setting or higher.	Pr.503, Pr.504	68
98	198	LF	Alarm	Output when an alarm (fan fault or communication error warning) occurs.	Pr.121	82, 105, 122

(M) Monitor display and monitor output signal

Setting		Signal name	Function	Operation	Related parameter	Refer to page
Positive logic	Negative logic					
99	199	ALM	Fault	Output when the converter unit's protective function is activated to stop the output (at fault occurrence). The signal output is stopped after a reset.	—	83
206	306	Y206	Cooling fan operation command signal	Output when the cooling fan operation is commanded.	—	83
207	307	Y207	Control circuit temperature signal	Output when the temperature of the control circuit board reaches the detection level or higher.	Pr.663	84
209	309	RSO	Inverter reset	Output at the converter reset.	—	83
210	310	PWF	Power failure stop signal	Output during instantaneous power failure, undervoltage, or input phase loss.	Pr.261	90
214	—	Y214	Converter unit fault (E.OHT, E.CPU)	The signal turns ON when the converter unit is in the normal state. The signal turns OFF when the converter unit's protective function (E.CPU, E.OHT) is activated (at fault occurrence).	—	—
252	352	IPL	Input phase loss	Output when the power input phase loss is detected.	Pr.872	69
9999	—	—	No function	—	—	—

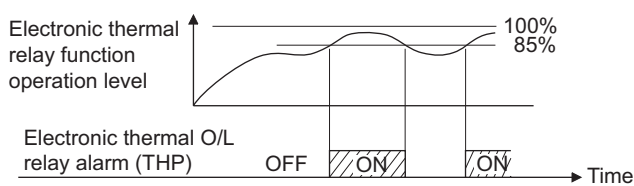
*1 When the power is reset, the fault output 2 signal (ALM2) turns OFF at the same time as the power turns OFF.

NOTE

- The same function may be set to more than one terminal
- The terminal conducts during function operation when the setting is "0 to 99, 200 to 299", and does not conduct when the setting is "100 to 199, 300 to 399".
- Changing the terminal assignment using **Pr.190 to Pr.195 (output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.
- Do not assign signals which frequently repeat switching between ON and OFF to terminals A1B1C1. Otherwise the life of the relay contacts decreases.

◆ Electronic thermal O/L relay pre-alarm (TH) and warning signal (THP)

- If the accumulated electronic thermal value reaches 85%, Electronic thermal relay function pre-alarm (TH) is displayed and the Electronic thermal O/L relay pre-alarm (THP) signal is output. If the value reaches 100% of the setting, the electronic thermal O/L relay protection (E.THC) is activated to shut off the inverter output. The inverter output is not shut off with the TH display.
- For the terminal used for THP signal output, set "8 (positive logic)" or "108 (negative logic)" in any of **Pr.190 to Pr.195 (output terminal function selection)** to assign the function.



- 100%: Electronic thermal O/L relay activation value

NOTE

- Changing the terminal assignment using **Pr.190 to Pr.195 (output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

◆ Fan fault output signal (FAN)

- A cooling fan operates at power ON of the converter unit. If the fan stops at this time, fan operation is regarded as faulty, Fan alarm (FN) is displayed on the operation panel, and the Fan fault output (FAN) and Alarm (LF) signals are output.
- To assign the FAN signal to the terminal, set "25 (positive logic) or 125 (negative logic)" in one of **Pr.190 to Pr.195 (output terminal function selection)**. To assign the LF signal, set "98 (positive logic) or 198 (negative logic)".

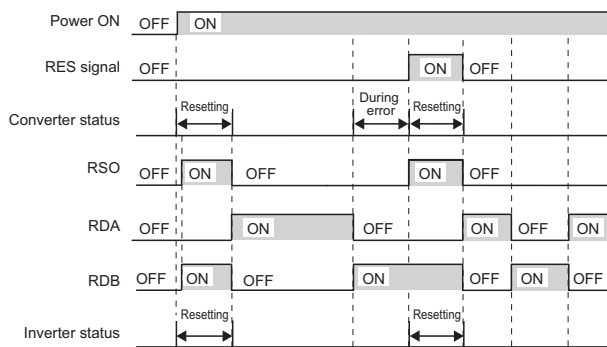
◆ Cooling fan operation command signal (Y206)

- The cooling fan operation command signal (Y206 signal) can be output when the converter unit cooling fan meets the conditions for running. The function can be used when the fan installed on the enclosure is synchronized with the converter unit cooling fan.
- Y206 signal indicates the operating command condition of the converter unit cooling fan depending on the power supply ON/OFF. The signal does not indicate the actual operation of the cooling fan. (The signal is output even if the cooling fan is stopped due to a fault.)
- To use the Y206 signal, set "206 (positive logic) or 306 (negative logic)" in any of **Pr.190 to Pr.195 (output terminal function selection)** to assign the function to the output terminal.

NOTE

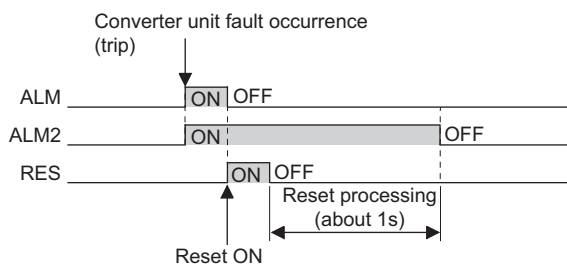
- Changing the terminal assignment using **Pr.190 to Pr.195 (output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

◆ Inverter operation enable signals (RDA and RDB) and inverter reset signal (RSO)



- The inverter operation enable (NO contact) (RDA) signal turns ON when the converter unit operation is ready, and turns OFF when a converter unit fault occurs or the converter is reset.
- A logic inverse to that of RDA is applied to the inverter operation enable (NC contact) (RDB) signal. (However, the RDB signal is in the OFF status while the converter unit power supply is turned OFF.)
- The RDA and RDB signals are initially assigned to the terminals RDA and RDB respectively. By setting "11" for the RDA signal or "111" for the RDB signal in either **Pr.190 to Pr.195 (output terminal function selection)**, the signals can be assigned to other terminals.
- When the converter reset (RES) signal is input to the converter unit, the inverter reset (RSO) signal is output to the inverter.
- The RSO signal is assigned to the terminal RSO in the initial status. The RSO signal can also be assigned to other terminals by setting "209 (positive logic) or 309 (negative logic)" in any of **Pr.190 to Pr.195 (output terminal function selection)**.

◆ Fault output signals (ALM, ALM2)



- The Fault (ALM, ALM2) signals are output when the converter unit protective function is activated.
- The ALM2 signal stays ON during the reset period after the fault occurs.
- To use the ALM2 signal, set "94 (positive logic) or 194 (negative logic)" in any of **Pr.190 to Pr.195 (output terminal function selection)** to assign the function to the output terminal.
- The ALM signal is assigned to the A1B1C1 contacts in the initial status.

NOTE

- For the details of converter unit faults, refer to [page 128](#).

4.4.3 Detection of control circuit temperature

The temperature of the control circuit board of the converter unit can be monitored, and a signal can be output according to the predetermined temperature setting.

Pr.	Name	Initial value	Setting range	Description
663 M060	Control circuit temperature signal output level	0°C	0 to 100°C	Set the temperature where the Y207 signal turns ON.

◆ Control circuit temperature monitor

- The operation panel can be used to monitor the temperature of the control circuit board within the range of 0 to 100°C.
- The range becomes -20 to 100°C by setting the display with a minus sign in **Pr.290 Monitor negative output selection**.

◆ Control circuit temperature detection (Pr.663, Y207 signal)

- The Y207 signal can be output when the control circuit temperature reaches the **Pr.663** setting or higher.
- For the Y207 signal, set "207 (positive logic) or 307 (negative logic)" in one of **Pr.190 to Pr.195 (output terminal function selection)** to assign the function to the output terminal.

NOTE

- The Y207 signal is turned OFF when the control circuit temperature becomes 5°C or more lower than the **Pr.663** setting.
- Changing the terminal assignment using **Pr.190 to Pr.195 (output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.190 to Pr.195 (output terminal function selection)  [page 81](#)

Pr.290 Monitor negative output selection  [page 77](#)

4.5 (T) Multi-function input terminal parameters

Purpose	Parameter to set			Refer to page
To assign functions to input terminals	Input terminal function selection	P.T700, P.T709, P.T711	Pr.178, Pr.187, Pr.189	85
To change operation when the OH signal is input	OH input selection	P.T723	Pr.876	86

4.5.1 Input terminal function selection

Use the following parameters to select or change the input terminal functions.

Pr.	Name	Initial value	Initial signal	Setting range
178 T700	RDI terminal function selection	9999	No function	7, 21, 62, 84, 9999
187 T709	OH terminal function selection	7	OH (External thermal relay input)	
189 T711	RES terminal function selection	62	RES (Converter reset)	

◆ Input terminal function assignment

- Using Pr.178, Pr.187, and Pr.189, set the functions of the input terminals.
- Refer to the following table and set the parameters.

Setting value	Signal name	Function	Related parameter	Refer to page
7	OH	External thermal relay input *1	Pr.876	86
21	X21	Cooling fan ON/OFF control	Pr.244	72
62	RES	Converter reset	—	62
84	X84	Emergency drive execution command	Pr.67, Pr.514, Pr.515, Pr.523	73
9999	—	No function	—	—

*1 OH signal will operate with the relay contact "open".

NOTE

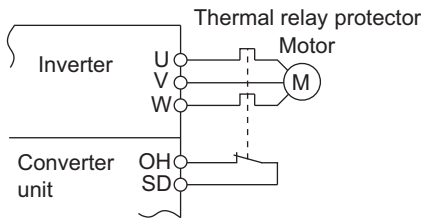
- Same function can be assigned to two or more terminals. In this case, the logic of terminal input is OR.
- When the terminal assignment is changed using Pr.178, Pr.187, and Pr.189 (input terminal function selection), the terminal name will be different, which may result in an error of wiring, or affect other functions. Set parameters after confirming the function of each terminal.

4.5.2 Operation selection for the external thermal relay input (Pr.876)

The operation when the external thermal relay input (OH) signal is input can be changed by the **Pr.876** setting.

Pr.	Name	Initial value	Setting range	Description
876 T723	OH input selection	0	0	No function
			1	Turning the OH signal OFF trips the converter unit. (NC contact)
			2	Turning the OH signal ON trips the converter unit. (NO contact)

◆ External thermal relay (OH signal, E.OHT)



External thermal relay input connection diagram

- The External thermal relay input (OH) signal is used when using the external thermal relay or the thermal protector built into the motor to protect the motor from overheating.
- When the thermal relay is activated, the inverter trips by the External thermal relay operation (E.OHT).
- The OH signal is assigned to the terminal OH in the initial status. Set "7" in any of **Pr.178**, **Pr.187**, or **Pr.189 (input terminal function selection)** to assign the OH signal to another terminal.

NOTE

- Changing the terminal assignment using **Pr.178**, **Pr.187**, or **Pr.189 (input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

◆ Operation selection for the OH signal (Pr.876)

- The following table shows the OH signal input status and the converter unit operation determined by the setting of **Pr.876**.

OH signal input status (external terminal)	Converter unit operation		
	Pr.876 = "0"	Pr.876 = "1" (NC contact)	Pr.876 = "2" (NO contact)
ON	No function	Continuous operation	Inverter trip (E.OHT)
OFF	No function	Inverter trip (E.OHT)	Continuous operation

4.6 (A) Application parameters

Purpose	Parameter to set			Refer to page
To reduce the standby power	Self power management	P.A006, P.E300	Pr.30, Pr.248	87
To restart after instantaneous power failure	Automatic restart operation after instantaneous power failure	P.A702	Pr.57	89
To decelerate the motor to a stop at instantaneous power failure	Power failure time deceleration-to-stop function	P.A730	Pr.261	90

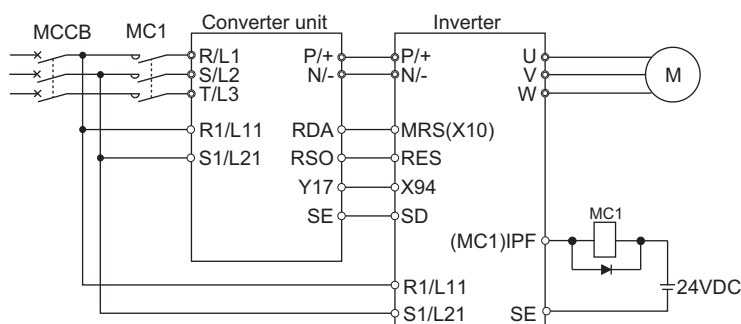
4.6.1 Self power management

By turning ON the magnetic contactor (MC) on the input side before the motor is started and turning OFF the MC after the motor is stopped, power is not supplied to the main circuit, reducing the standby power.

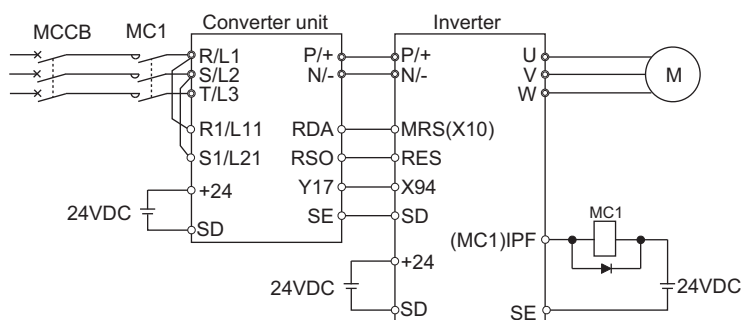
Pr.	Name	Initial value	Setting range	Description
248 A006	Self power management selection	0	0	Self power management function disabled
			1	Self power management function enabled (main circuit OFF at protective function activation)
			2	Self power management function enabled (main circuit OFF at protective function activation due to a circuit failure)
30 E300	Reset selection during power supply to main circuit	0	0	When power is supplied only to the control circuit, and then switched to be supplied to both the control and main circuits, converter reset is performed.
			100	When power is supplied only to the control circuit, and then switched to be supplied to both the control and main circuits, converter reset is not performed.

◆ Connection diagram

- Input using terminals R1 and S1



- 24 V external power supply input



(A) Application parameters

◆ Operation of the self power management function

- This is a function to control the input side magnetic contactor (MC) with an output relay to reduce standby power. Use separate power supplies for the main circuit and the control circuit by using terminals R1/L11 or S1/L21 (refer to [page 38](#)) and 24 V external power supply input (refer to [page 39](#)). Control the main circuit power supply MC by the electronic bypass MC1 signal of the inverter.
- Set **Pr.248 Self power management selection** = "1 or 2", and **Pr.190 to Pr.195 (output terminal function selection)** = "17 (positive logic)" to assign the control signal for main circuit power supply MC (Y17 signal) to an output terminal. (Set **Pr.248** in accordance with the **Pr.248** setting of the inverter.)
- Y17 signal turns ON while the self power management function is enabled.
- When the protective function of the converter unit is activated, Y17 signal immediately turns OFF according to the **Pr.248** setting.

When **Pr.248** = "1", Y17 signal turns OFF whenever a protective function is activated.

When **Pr.248** = "2", Y17 signal turns OFF only when a protective function is activated by a fault originating in the converter unit circuit or a connection fault (refer to the table below). (For the fault details, refer to [page 128](#).)

Fault record
Inrush current limit circuit fault (E.IOH)
CPU fault (E.CPU)
CPU fault (E.6)
CPU fault (E.7)
Parameter storage device fault (E.PE)
Parameter storage device fault (E.PE2)
24 VDC power fault (E.P24)
Operation panel power supply short circuit/RS-485 terminals power supply short circuit (E.CTE)
Internal circuit fault (E.13/E.PBT)

- To enable the self power management function for the separated converter type, enable the self power management function also on the converter unit side. To activate the self power management function when a converter unit fault occurs, connect the terminal to which Y17 signal of the converter unit is assigned and the terminal to which X94 signal of the inverter is assigned.

Y17 output signal (converter unit side)	MC1 output signal (inverter side)	MC1 output signal actual operation	Main circuit power supply
OFF	OFF	OFF	Stop
OFF	ON	OFF	Stop
ON	OFF	OFF	Stop
ON	ON	ON	Supplied

NOTE

- When the retry function is used for resetting during self power management operation, Y17 signal retains the value before the reset.
- Repeated operation of the magnetic contactor due to frequent start and stop or activation of the protective function may shorten the inverter and the converter unit life.
- Changing the terminal assignment using **Pr.190 to Pr.195 (output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.


◆ Selection between resetting or not resetting during power supply to main circuit (Pr.30 = "100")

- Converter reset is not performed if **Pr.30 Reset selection during power supply to main circuit** = "100", and supplying power to the main circuit (R/L1, S/L2, T/L3 input) is started when power is supplied only to the control circuit (R1/L11, S1/L12 input, or 24 V external power supply input).

NOTE

- When supplying power to the main circuit is started when power is supplied only to the control circuit, there is a slight waiting time before starting.
- When supplying power to the main circuit is started while the protective function of the converter unit is activated, converter reset is performed even when "not resetting after power-ON" is selected.

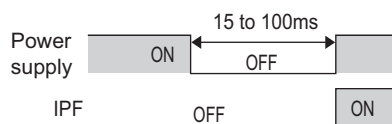
« Parameters referred to »

Pr.190 to Pr.195 (output terminal function selection)  page 81

4.6.2 Automatic restart after instantaneous power failure selection

The converter unit can be restarted after power restoration from instantaneous power failure.

Pr.	Name	Initial value	Setting range	Description
57 A702	Restart selection	9999	0	Restarts the motor after power restoration from instantaneous power failure
			9999	Does not restart the motor.



- When the automatic restart after instantaneous power failure is selected on the inverter side, set **Pr.57 Restart selection** = "0" on the converter unit side.
- When the automatic restart after instantaneous power failure function is set, the motor is restarted after power restoration from instantaneous power failure or undervoltage condition. (E.IPF and E.UVT are not activated.)
- When **Pr.57** = "9999" (initial value), the inverter output is shut off at the activation of the instantaneous power failure protection (E.IPF or E.UVT) of the converter unit, even when the automatic restart after instantaneous power failure is selected on the inverter side. (Refer to [page 128](#) for E.IPF or E.UVT.)
- When E.IPF or E.UVT is activated, the Instantaneous power failure/undervoltage (IPF) signal is output.
- The IPF signal is assigned to the terminal IPF in the initial status. The IPF signal can also be assigned to other terminals by setting "2 (positive logic) or 102 (negative logic)" in any of **Pr.190 to Pr.195 (output terminal function selection)**.

Caution

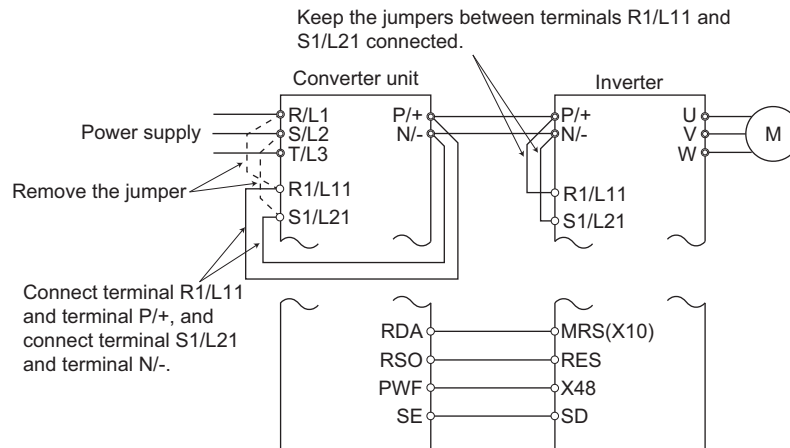
- If the automatic restart after instantaneous power failure function has been selected, motor suddenly restarts at the power restoration after an instantaneous power failure (after the reset time has elapsed).
Stay away from the motor and machine.
If the automatic restart after instantaneous power failure function has been selected, apply the CAUTION stickers, which are supplied with the Inverter Manual, to easily visible places.

4.6.3 Power failure time deceleration-to-stop function

This is a function to decelerate the motor to a stop when an instantaneous power failure or undervoltage occurs.

Pr.	Name	Initial value	Setting range	Description
261 A730	Power failure stop selection	0	0	Power failure time deceleration-to-stop function disabled
			1, 2, 21, 22	Power failure time deceleration-to-stop function enabled

◆ Connection and parameter setting



- Remove the jumpers between terminals R/L1 and R1/L11 and terminals S/L2 and S1/L21 of the converter unit, and connect terminals R1/L11 and P/+ and terminals S1/L21 and N/-. Do not remove the jumpers of terminal R1/L11 and terminal S1/L21 of the inverter. (In the initial status of the separated converter type, terminals P/+ and R1/L11 and terminals N/- and S1/L21 are connected.)
- Connect the terminal to which PWF signal of the converter unit is assigned and the terminal to which X48 signal of the inverter is assigned. Set **Pr.261** of the converter unit as shown in the table below in accordance with the **Pr.261** setting of the inverter.

Pr.261 setting		Description	Power failure time deceleration-to-stop function when the automatic restart after instantaneous power failure is enabled (Pr.57 ≠ "9999")
Inverter	Converter unit		
0	0	Power failure time deceleration-to-stop function disabled	—
1, 11	1	Power failure time deceleration-to-stop function enabled	Disabled
2, 12	2		Enabled
21	21		Disabled
22	22		Enabled

◆ Power failure stop signal (PWF signal)


- Power failure stop signal (PWF) turns ON during instantaneous power failure, undervoltage, or input phase loss.
- For the PWF signal, assign the function by setting "210 (positive logic)" or "310 (negative logic)" in any of **Pr.190 to Pr.195 (output terminal function selection)**.

When the input specification of the power failure stop external signal (X48 signal) is the NC contact, set the negative logic for the PWF signal of the converter unit. When the input specification of the power failure stop external signal (X48 signal) is the NO contact, set the positive logic for the PWF signal of the converter unit. (For the X48 signal, the initial setting is the NC contact input specification. For changing the input logic, refer to the Instruction Manual of the inverter.)

NOTE

- When the power failure time deceleration-to-stop function is selected, undervoltage protection (E.UVT), instantaneous power failure protection (E.IPF) and input phase loss protection (E.ILF) are not invalid.
- Changing the terminal assignment using **Pr.190 to Pr.195 (output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

« Parameters referred to »»

Pr.190 to Pr.195 (output terminal function selection)  [page 81](#)

Pr.872 Input phase loss protection selection  [page 69](#)

4.7 (N) Operation via communication and its settings

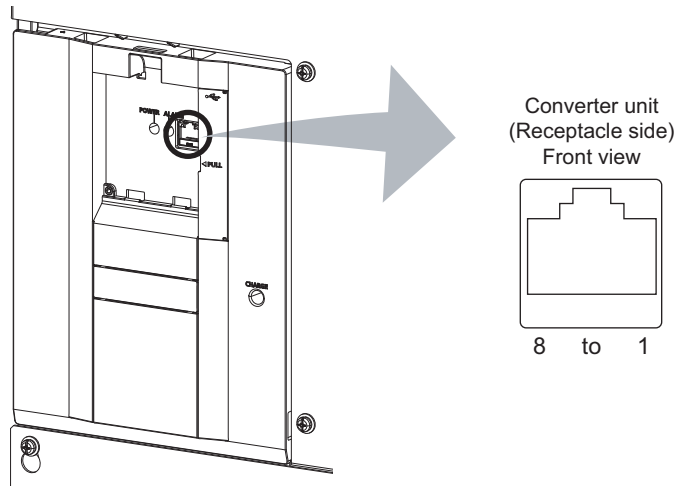
Purpose	Parameter to set			Refer to page
To start operation via communication	Initial setting of operation via communication	P.N000, P.N001	Pr.549, Pr.342	97
To operate via communication from PU connector	Initial setting of computer link communication (PU connector)	P.N020 to P.N028	Pr.117 to Pr.124	98
To operate via communication from RS-485 terminals	Initial setting of computer link communication (RS-485 terminals)	P.N030 to P.N038	Pr.331 to Pr.337, Pr.341	
	MODBUS RTU communication specification	P.N002, P.N030, P.N031, P.N034, P.N080,	Pr.539, Pr.331, Pr.332, Pr.334, Pr.343,	111

4.7.1 Wiring and configuration of PU connector

Using the PU connector enables communication operation from a personal computer, etc.

When the PU connector is connected with a personal, FA or other computer by a communication cable, a user program can run to monitor the converter unit or read and write parameters.

◆PU connector pin-outs



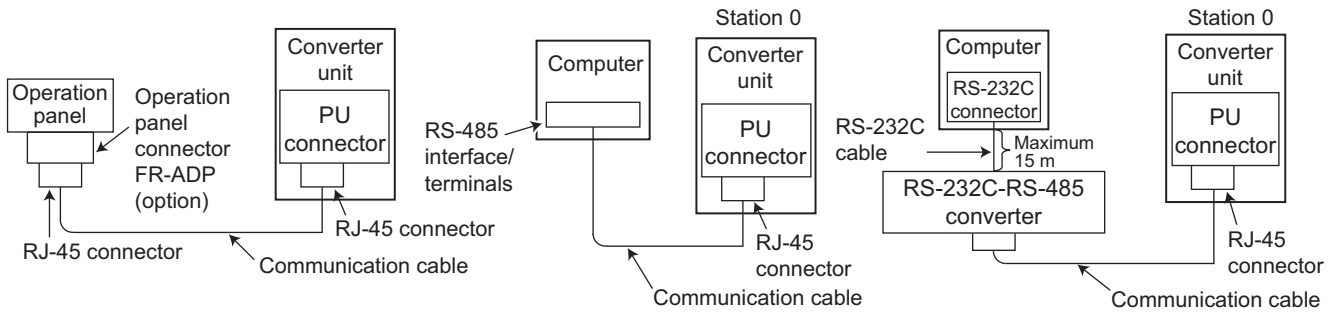
Pin number	Name	Description
1	SG	Earthing (grounding)
2	-	Operation panel power supply
3	RDA	Converter unit receive+
4	SDB	Converter unit send-
5	SDA	Converter unit send+
6	RDB	Converter unit receive-
7	SG	Earthing (grounding)
8	-	Operation panel power supply

NOTE

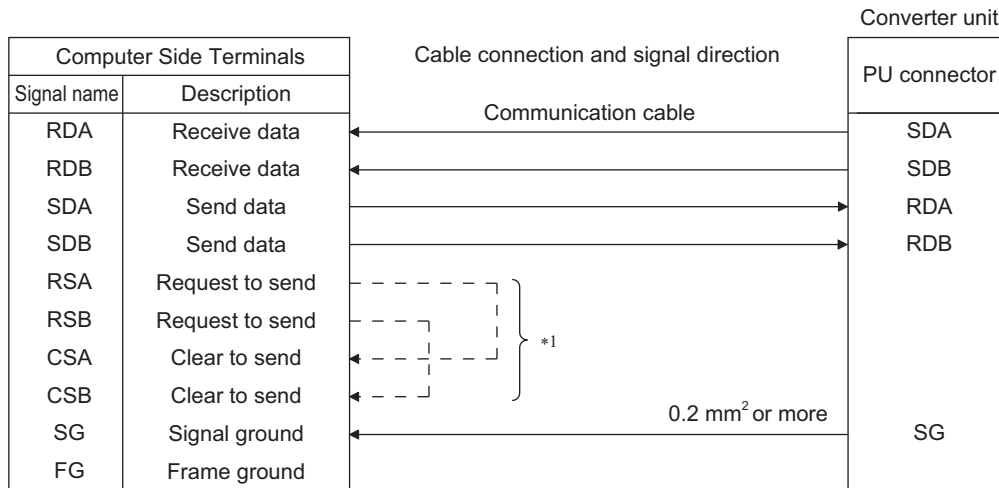
- Pins No. 2 and 8 provide power to the operation panel. Do not use these pins during RS-485 communication.
- Do not connect the cable to a computer's LAN board, to a fax modem socket, or to a telephone connector. Doing so may damage the product due to the differences in the electric specifications.

◆ Configuration and wiring of PU connector communication system

• System configuration



• Wiring of computer by RS-485



*1 Make connection in accordance with the Instruction Manual of the computer to be used with. Fully check the terminal numbers of the computer since they vary with the model.

NOTE

- When performing RS-485 communication with multiple converter units, use the RS-485 terminals. (Refer to [page 95](#).)
- Computer-converter unit connection cable

Refer to the following for the connection cable (RS-232C ⇔ RS-485 converter) between the computer with an RS-232C interface and a converter unit. Commercially available products (as of February 2015)

Model	Manufacturer
Interface embedded cable DAFXIH-CAB (D-SUB25P for personal computer side) DAFXIH-CABV (D-SUB9P for personal computer side) +	Diatrend Corp.
Connector conversion cable DINV-485CAB (for converter unit side) *2	
Interface embedded cable dedicated for converter unit DINV-CABV *2	

*2 The conversion cable cannot connect multiple converter units. (The computer and the converter unit are connected in a 1:1 pair.) This product is a RS-232C ⇔ RS-485 conversion cable that has a built-in converter. No additional cable or connector is required. For the product details, contact the cable manufacturer.

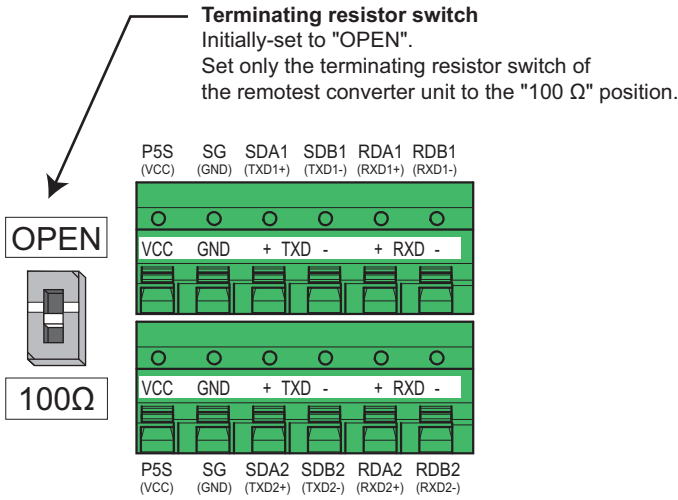
- Refer to the following table when fabricating the cable on the user side. Commercially available products (as of February 2015)

Name	Model	Manufacturer
Communication cable	SGLPEV-T (Cat5e/300 m) 24AWG × 4P*3	Mitsubishi Cable Industries, Ltd.
RJ-45 connector	5-554720-3	Tyco Electronics

*3 Do not use pins No. 2 and 8 of the communication cable.

4.7.2 Wiring and configuration of RS-485 terminals

◆RS-485 terminal layout



Name	Description
RDA1 (RXD1+)	Converter unit receive+
RDB1 (RXD1-)	Converter unit receive-
RDA2 (RXD2+)	Converter unit receive+ (for branch)
RDB2 (RXD2-)	Converter unit receive- (for branch)
SDA1 (TXD1+)	Converter unit send+
SDB1 (TXD1-)	Converter unit send-
SDA2 (TXD2+)	Converter unit send+ (for branch)
SDB2 (TXD2-)	Converter unit send- (for branch)
P5S (VCC)	5V Permissible load current 100 mA
SG (GND)	Earthing (grounding) (connected to terminal SD)

◆Wiring the RS-485 terminals

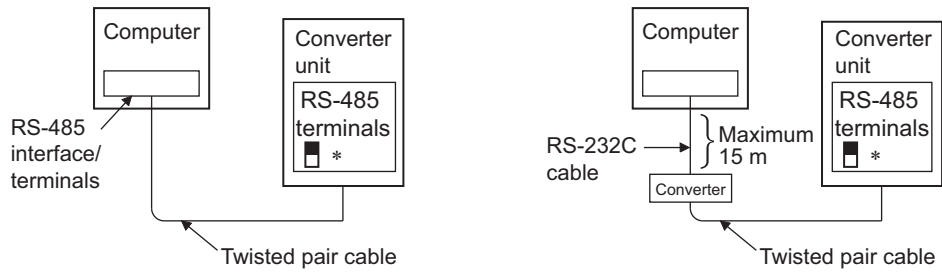
- The size of RS-485 terminal block is the same as the control circuit terminal block. Refer to [page 35](#) for the wiring method.

NOTE

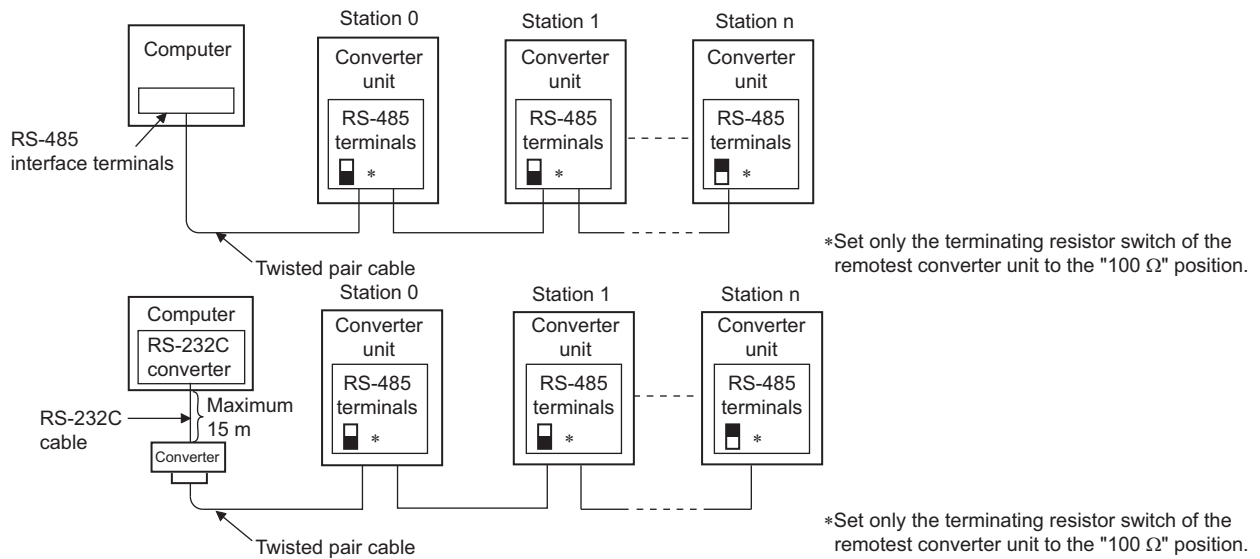
- To avoid malfunction, keep the RS-485 terminal wires away from the control circuit board.

◆ System configuration of RS-485 terminals

- Computer and converter unit connection (1:1)

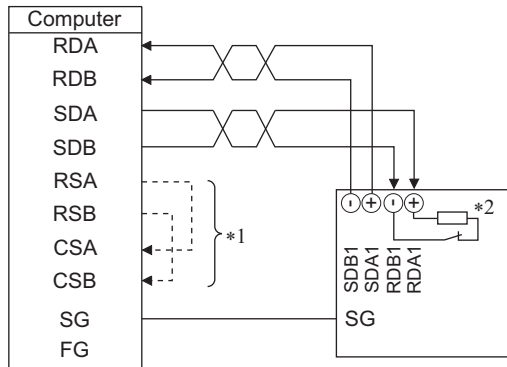


- Combination of computer and multiple converter units (1:n)

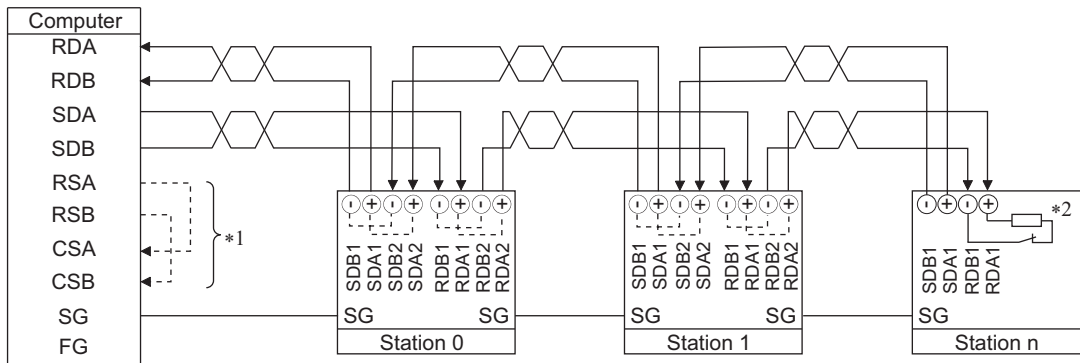


◆ How to wire RS-485 terminals

- Wiring of one converter unit and one computer with RS-485 terminals



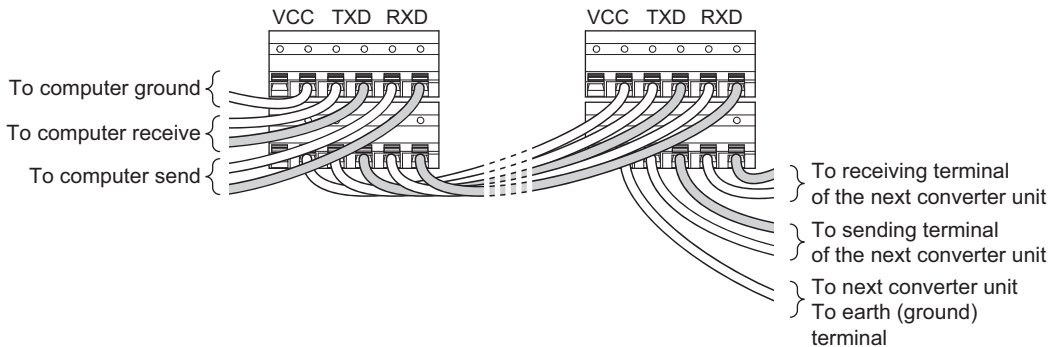
- Wiring of n converter units (multiple units) and one computer with RS-485 terminals



- *1 Make connection in accordance with the Instruction Manual of the computer to be used with. Fully check the terminal numbers of the computer since they vary with the model.
- *2 For the converter unit farthest from the computer, set the terminating resistor switch to ON (100 Ω side).

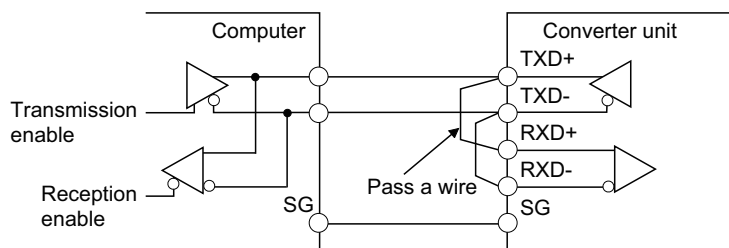
NOTE

- For branching, connect the wires as shown below.



◆ Two-wire type connection

- If the computer is 2-wire type, a connection from the converter unit can be changed to 2-wire type by passing wires across reception terminals and transmission terminals of the RS-485 terminals.



NOTE

- A program should be created so that transmission is disabled (receiving state) when the computer is not sending and reception is disabled (sending state) during sending to prevent the computer from receiving its own data.

4.7.3 Initial setting of operation via communication

Set the action when the converter unit is performing operation via communication.

- Set the communication protocol. (Mitsubishi inverter protocol/MODBUS RTU protocol)
- Set the action at fault occurrence or at writing of parameters.

Pr.	Name	Initial value	Setting range	Description
549 N000	Protocol selection	0	0	Mitsubishi inverter (computer link) protocol
			1	MODBUS RTU protocol
342 N001	Communication EEPROM write selection	0	0	Parameter values written by communication are written to the EEPROM and RAM.
			1	Parameter values written by communication are written to the RAM.

◆ Setting the communication protocol (Pr.549)

- Select the communication protocol.
- The MODBUS RTU protocol can be used by communication from the RS-485 terminals.

Pr.549 setting	Communication protocol
0 (initial value)	Mitsubishi inverter (computer link) protocol
1	MODBUS RTU protocol

◆ Communication EEPROM write selection (Pr.342)

- Storage device of the parameter setting can be changed to RAM only from EEPROM+RAM for the parameter writing from the RS-485 communication via the converter unit PU connector or the RS-485 terminals. Use this function if parameter settings are changed frequently.
- When changing the parameter values frequently, set "1" in **Pr.342 Communication EEPROM write selection** to write them to the RAM only. The life of the EEPROM will be shorter if parameter write is performed frequently with the setting unchanged from "0 (initial value)" (EEPROM write).

NOTE

- Turning OFF the converter unit's power supply clears the modified parameter settings when **Pr.342** = "1 (write only to RAM)". Therefore, parameter settings at next power-ON will be the ones that are last stored to EEPROM.
- The parameter setting written in RAM cannot be checked on the operation panel. (The values displayed on the operation panel are the ones stored in EEPROM.)

4.7.4 Initial settings and specifications of RS-485 communication

Use the following parameters to perform required settings for the RS-485 communication between the converter unit and a personal computer.

- There are two types of communication, communication using the converter unit's PU connector and communication using the RS-485 terminals.
- Parameter setting, monitoring, etc. can be performed using the Mitsubishi inverter protocol or the MODBUS RTU communication protocol.
- To make communication between the personal computer and the converter unit, initial setting of the communication specifications must be made to the converter unit in advance.

Data communication cannot be made if the initial settings are not made or if there is any setting error.

[Parameters related to PU connector communication]

Pr.	Name	Initial value	Setting range	Description	
117 N020	PU communication station number	0	0 to 31	Specify the converter unit station number. Set the converter unit station numbers when two or more converter units are connected to one personal computer.	
118 N021	PU communication speed	192	48, 96, 192, 384, 576, 768, 1152	Set the communication speed. The setting value × 100 equals the communication speed. For example, if 192 is set, the communication speed is 19200 bps.	
N022	PU communication data length	0	0 1	Data length 8 bits Data length 7 bits	
N023	PU communication stop bit length	1	0 1	Stop bit length 1 bit Stop bit length 2 bits	
119	PU communication stop bit length / data length	1	0	Stop bit length 1 bit	Data length 8 bits
			1	Stop bit length 2 bits	
			10	Stop bit length 1 bit	Data length 7 bits
			11	Stop bit length 2 bits	
120 N024	PU communication parity check	2	0 1 2	Without parity check With odd parity With even parity	
121 N025	Number of PU communication retries	1	0 to 10	Set the permissible number of retries for unsuccessful data reception. If it is still unsuccessful after the permissible number of retries, the inverter will trip.	
			9999	The inverter will not trip even when the communication is unsuccessful.	
122 N026	PU communication check time interval	9999	0	PU connector communication is disabled.	
			0.1 to 999.8 s	Set the interval of the communication check (signal loss detection) time. If a no-communication state persists for longer than the permissible time, the inverter will trip.	
			9999	No communication check (signal loss detection)	
123 N027	PU communication waiting time setting	9999	0 to 150 ms	Set the waiting time between data transmission to the converter unit and the response.	
			9999	Set with communication data. Waiting time: Communication data×10ms	
124 N028	PU communication CR/LF selection	1	0	Without CR/LF	
			1	With CR	
			2	With CR/LF	

[Parameters related to communication with the RS-485 terminals]

Pr.	Name	Initial value	Setting range	Description
331 N030	RS-485 communication station number	0	0 to 31 (0 to 247) *1*2	Set the converter unit station number. (Same specifications as Pr.117)
332 N031	RS-485 communication speed	96	3, 6, 12, 24, 48, 96, 192, 384, 576, 768, 1152	Select the communication speed. (Same specifications as Pr.118)
N032	RS-485 communication data length	0	0, 1	Select the data length. (the same specifications as P.E022)*3
N033	RS-485 communication stop bit length	1	0, 1	Select the stop bit length. (the same specifications as P.E023)*4
333	RS-485 communication stop bit length / data length	1	0, 1, 10, 11	Select the stop bit length and the data length. (the same specifications as Pr.119)*3*4
334 N034	RS-485 communication parity check selection	2	0, 1, 2	Select the parity check specifications. (Same specifications as Pr.120)
335 N035*5	RS-485 communication retry count	1	0 to 10, 9999	Set the permissible number of retries for unsuccessful data reception. (Same specifications as Pr.121)
336 N036*5	RS-485 communication check time interval	0 s	0	The RS-485 communication is available, but a communication error occurs.
			0.1 to 999.8 s	Set the interval of the communication check (signal loss detection) time. (Same specifications as Pr.122)
			9999	No communication check (signal loss detection)
337 N037*5	RS-485 communication waiting time setting	9999	0 to 150 ms, 9999	Set the waiting time between data transmission to the converter unit and the response. (Same specifications as Pr.123)
341 N038*5	RS-485 communication CR/LF selection	1	0, 1, 2	Select the presence/absence of CR/LF. (Same specifications as Pr.124)

*1 When Pr.549 = "1" (MODBUS RTU protocol), the setting range within parentheses is applied.

*2 When a value outside the setting range is set, the converter unit operates at the initial value.

*3 In the MODBUS RTU protocol, the data length is fixed at 8 bits.

*4 In the MODBUS RTU protocol, Pr.334 setting is applied as the stop bit length. (Refer page 111.)

*5 In the MODBUS RTU protocol, this is invalid.

NOTE

- The monitored items and parameter settings can be read during communication with the **Pr.336 RS-485 communication check time interval** = "0 (initial value)" setting, but a converter unit communication error (E.SER) occurs.
To perform operation or parameter writing via communication, set "9999" or a large setting value in **Pr.336**. (The setting value is determined by the computer program.) (Refer page 105.)
- Always reset the converter after making the initial settings of the parameters. After changing the communication-related parameters, communication cannot be made until the converter is reset.

4.7.5 Mitsubishi inverter protocol (computer link communication)

Parameter settings and monitoring are possible by using the Mitsubishi inverter protocol (computer link communication) via inverter PU connector and the RS-485 terminals.

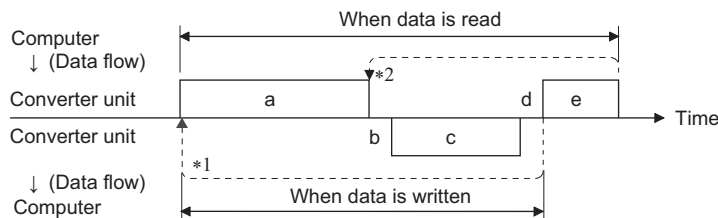
◆ Communication specifications

- The communication specifications are given below.

Item	Description	Related parameter
Communication protocol	Mitsubishi protocol (computer link)	Pr.551
Conforming standard	EIA-485 (RS-485)	—
Connectable units	1:N (maximum 32 units), setting is 0 to 31 stations	Pr.117 Pr.331
Communication speed	PU connector	Selected among 4800/9600/19200/38400 bps
	RS-485 terminals	Selected among 300/600/1200/2400/4800/9600/19200/38400/57600/76800/115200 bps
Control procedure	Start-stop synchronization method	—
Communication method	Half-duplex system	—
Communication specifications	Character system	ASCII (7 bits or 8 bits can be selected.)
	Start bit	1 bit
	Stop bit length	1 bit or 2 bits can be selected.
	Parity check	Check (even or odd) or no check can be selected.
	Error check	Sum code check
	Terminator	CR/LF (presence/absence selectable)
Waiting time setting	Selectable between presence and absence	Pr.123 Pr.337

◆ Communication procedure

- Data communication between the computer and the converter unit is made in the following procedure.
 - Request data is sent from the computer to the converter unit. (The converter unit will not send data unless requested.)
 - After waiting for the waiting time,
 - The converter unit sends reply data to the computer in response to the computer request.
 - After waiting for the converter unit data processing time,
 - An answer from the computer in response to reply data (c) of the converter unit is transmitted. (Even if (e) is not sent, subsequent communication is made properly.)



*1 If a data error is detected and a retry must be made, perform retry operation with the user program. The converter unit trips when the number of consecutive retries exceeds the parameter setting.

*2 On receipt of a data error occurrence, the converter unit returns reply data (c) to the computer again. The converter unit trips when the number of consecutive data errors exceeds the parameter setting.

◆ Communication operation presence/absence and data format types

- Data communication between the computer and the converter unit is made in ASCII code (hexadecimal code).
- Communication operation presence/absence and data format types are as follows.

Symbol	Operation	Special monitor write	Pr. write	Converter reset	Monitor	Pr. read	
a	Communication request is sent to the converter unit in accordance with the user program in the computer.	A1	A	A	B	B	
b	Converter unit data processing time	With	With	Without	With	With	
c	Reply data from the computer unit (Data a) is checked for an error)	No error *1 (Request accepted)	C	C	C*2	E, E1, E2, E3	E
		With error (Request rejected)	D	D	D*2	D	D
d	Computer processing delay time	10 ms or more					
e	Answer from computer in response to reply data c (Data c is checked for error)	No error *1 (No converter unit processing)	Without	Without	Without	Without (C)	Without (C)
		With error (Converter unit output c again.)	Without	Without	Without	F	F

*1 In the communication request data from the computer to the converter unit, 10 ms or more is also required after "no data error (ACK)". (Refer [page 104.](#))

*2 Reply from the converter unit to the converter reset request can be selected. (Refer to [page 108.](#))

- Data writing format

a. Communication request data from the computer to the converter unit

Format	Number of characters												
	1	2	3	4	5	6	7	8	9	10	11	12	13
A	ENQ *1	Converter unit station No.*2	Instruction code		*3	Data					Sum check	*4	
A1	ENQ *1	Converter unit station No.*2	Instruction code		*3	Data	Sum check				*4		

c. Reply data from the converter unit to the computer (No data error detected)

Format	Number of characters			
	1	2	3	4
C	ACK *1	Converter unit station No.*2		*4

c. Reply data from the converter unit to the computer (Data error detected)

Format	Number of characters				
	1	2	3	4	5
D	NAK *1	Converter unit station No.*2	Error code		*4

*1 Indicates a control code.

*2 Specifies the converter unit station numbers in the range of H00 to H1F (stations 0 to 31) in hexadecimal.

*3 Set the waiting time. When **Pr.123 and Pr.337 (Waiting time setting)** ≠ 9999, create a communication request data without "waiting time" in the data format. (The number of characters decreases by 1.)

*4 CR, LF code: When data is transmitted from the computer to the converter unit, codes CR (carriage return) and LF (line feed) are automatically set at the end of a data group on some computers. In this case, setting must be also made on the converter unit according to the computer. Whether the CR and LF codes will be present or absent can be selected using **Pr.124 and Pr.341 (CR/LF selection)**.

(N) Operation via communication and its settings

- Data reading format
 - a. Communication request data from the computer to the converter unit

Format	Number of characters								
	1	2	3	4	5	6	7	8	9
B	ENQ *1	Converter unit station No. *2		Instruction code		*3	Sum check		*4

- c. Reply data from the converter unit to the computer (No data error detected)

Format	Number of characters												
	1	2	3	4	5	6	7	8	9	10	11	12	13
E	STX *1	Converter unit station No. *2		Read data				ETX *1	Sum check		*4		
E1	STX *1	Converter unit station No. *2		Read data		ETX *1	Sum check		*4				
E2	STX *1	Converter unit station No. *2		Read data (model information, capacity)					ETX *1	Sum check		*4	

Format	Number of characters													
	1	2	3	4 to 23						24	25	26	27	
E3	STX *1	Converter unit station No. *2		Read data (model information, model name)						ETX *1	Sum check		*4	

- c. Reply data from the converter unit to the computer (Data error detected)

Format	Number of characters				
	1	2	3	4	5
D	NAK *1	Converter unit station No. *2		Error code	*4

- e. Transmission data from the computer to the converter unit

Format	Number of characters			
	1	2	3	4
C (No data error detected)	ACK *1	Converter unit station No. *2		*4
F (Data error detected)	NAK *1	Converter unit station No. *2		*4

- *1 Indicates a control code.
- *2 Specifies the converter unit station numbers in the range of H00 to H1F (stations 0 to 31) in hexadecimal.
- *3 Set the waiting time. When **Pr.123 and Pr.337 (Waiting time setting)** ≠ 9999, create a communication request data without "waiting time" in the data format. (The number of characters decreases by 1.)
- *4 CR, LF code: When data is transmitted from the computer to the converter unit, codes CR (carriage return) and LF (line feed) are automatically set at the end of a data group on some computers. In this case, setting must be also made on the converter unit according to the computer. Whether the CR and LF codes will be present or absent can be selected using **Pr.124 and Pr.341 (CR/LF selection)**.

◆ Data definitions

- Control code

Signal name	ASCII code	Description
STX	H02	Start Of Text (Start of data)
ETX	H03	End Of Text (End of data)
ENQ	H05	Enquiry (Communication request)
ACK	H06	Acknowledge (No data error detected)
LF	H0A	Line Feed
CR	H0D	Carriage Return
NAK	H15	Negative Acknowledge (Data error detected)

- Converter unit station No.

Specify the station number of the converter unit which communicates with the computer.

- Instruction code

Specify the processing request, for example, monitoring, given by the computer to the converter unit. Therefore, the converter unit can be run and monitored in various ways by specifying the instruction code appropriately. (Refer [page 108](#).)

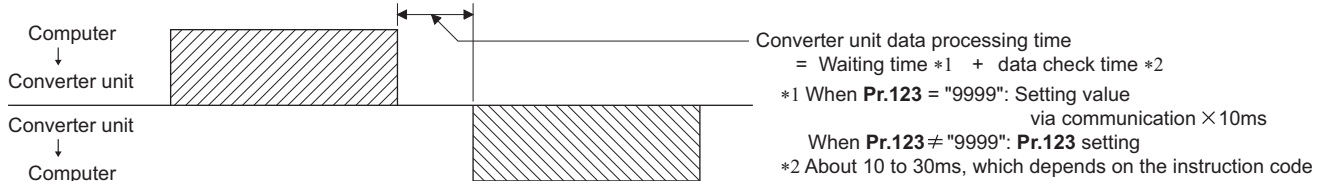
- Data

Indicates the data such as frequency and parameters transferred to and from the converter unit. The definitions and ranges of set data are determined in accordance with the instruction codes. (Refer [page 108](#).)

- Waiting time

Specify the waiting time between the receipt of data at the converter unit from the computer and the transmission of reply data. Set the waiting time in accordance with the response time of the computer in the range of 0 to 150 ms in 10 ms increments. (Example; 1: 10 ms, 2: 20 ms)

When **Pr.123 (waiting time setting)** ≠ "9999", the **Pr.123** setting is applied to waiting time. Create a communication request data without "waiting time" in the data format. (The number of characters decreases by 1.)

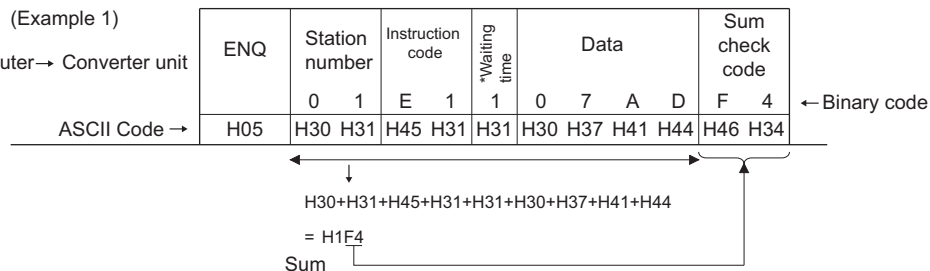


NOTE

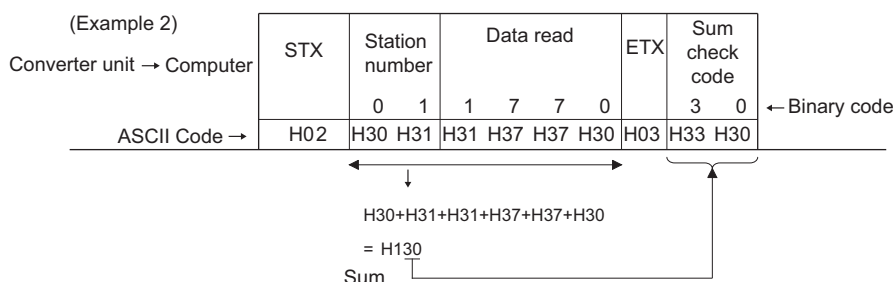
- The data check time varies depending on the instruction code. (Refer [page 104](#).)

- Sum check code

The sum check code is 2-digit ASCII (hexadecimal) representing the lower 1 byte (8 bits) of the sum of the target data converted in ASCII character code.



* When the **Pr. 123 Waiting time setting** ≠ "9999", create the communication request data without "waiting time" in the data format. (The number of characters decreases by 1.)



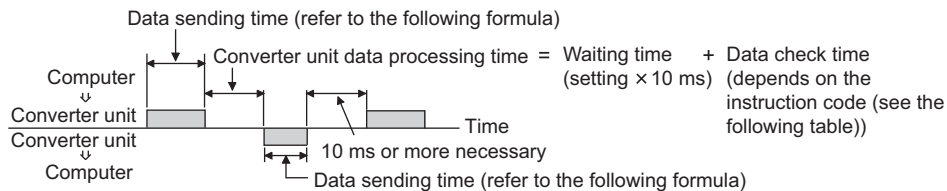
(N) Operation via communication and its settings

- Error code

If any error is found in the data received by the converter unit, its error definition is sent back to the computer together with the NAK code.

Error code	Error item	Fault definition	Converter unit operation
H0	Computer NAK error	The transmission request data from the computer was containing errors for the permissible number of retries or more.	Trips (E.PUE/E.SER) if error occurs continuously more than the permissible number of retries.
H1	Parity error	The parity check result does not match the specified parity.	
H2	Sum check error	The sum check code in the computer does not match that of the data received by the converter unit.	
H3	Protocol error	The data received by the converter unit has a grammatical mistake. Or, data receive is not completed within the predetermined time. CR or LF is not as set in the parameter.	
H4	Framing error	The stop bit length differs from the initial value.	
H5	Overrun	New data has been sent by the computer before the converter unit completes receiving the preceding data.	
H6	—	—	—
H7	Character error	The character received is invalid (other than 0 to 9, A to F, control code).	Does not accept the received data. The converter unit does not trip.
H8	—	—	—
H9	—	—	—
HA	Mode error	Parameter write was attempted in other than the computer link operation mode, when operation command source is not selected or during converter unit operation.	Does not accept the received data. The fault does not occur.
HB	Instruction code error	The specified instruction code does not exist.	
HC	Data range error	Invalid data has been specified for parameter writing, etc.	
HD	—	—	—
HE	—	—	—
HF	Normal (no error)	—	—

◆ Response time



[Formula for data transmission time]

$$\frac{1}{\text{Communication speed (bps)}} \times \text{Number of data characters (Refer to page 101.)} \times \text{Communication specifications (Total number of bits) = data transmission time (s)}$$

Refer to the following section.

- Communication specifications

Name	Number of bits
Stop bit length	1 bit 2 bits
Data length	7 bits 8 bits
Parity check	With 1 bit
	Without 0

- Data check time

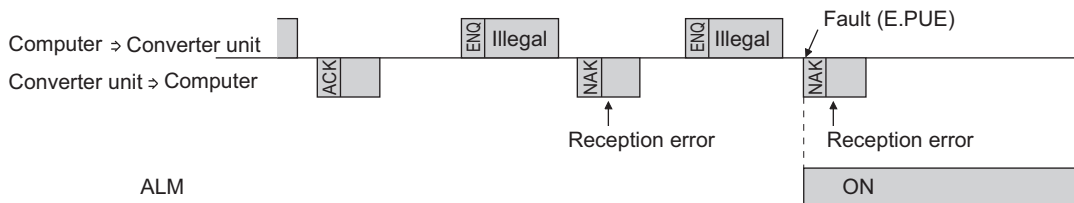
Item	Check time
Converter status monitor, reading monitor values	<20 ms
Reading/writing parameters (RAM)	<Approximately 20 ms
Reading/writing parameters (EEPROM)	<Approximately 50 ms

In addition to the above, 1 start bit is necessary.
 Minimum number of total bits 9 bits
 Maximum number of total bits 12 bits

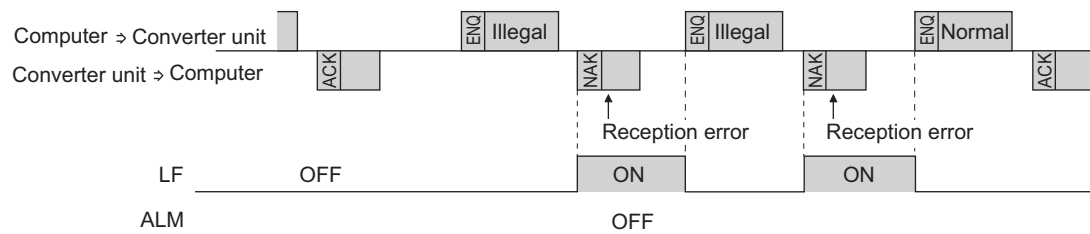
◆ Retry count setting (Pr.121, Pr.335)

- Set the permissible number of retries for data receive error occurrence. (Refer to [page 104](#) for data receive error for retry.)
- When the data receive errors occur consecutively and the number of retries exceeds the permissible number setting, a communication fault (PU connector communication: E.PUE, RS-485 terminal communication: E.SER) occurs and the inverter trips.
- When a data transmission error occurs while "9999" is set, the inverter does not trip but outputs the Alarm (LF) signal. To use the LF signal, set "98 (positive logic) or 198 (negative logic)" in any of **Pr.190 to Pr.195 (output terminal function selection)** to assign the function to an output terminal.

Example: PU connector communication, Pr. 121 = "1" (initial value)



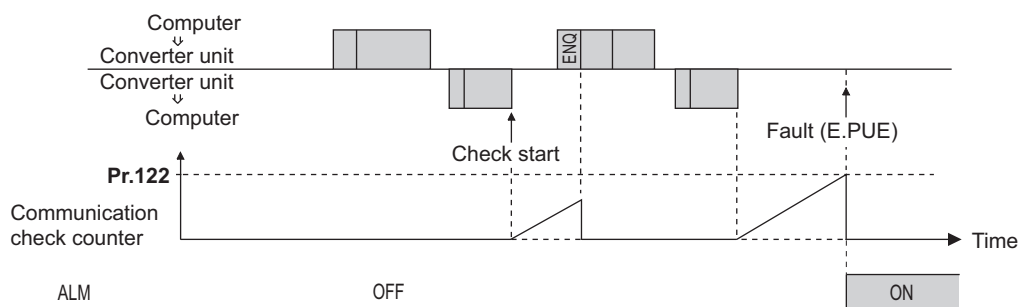
Example: PU connector communication, Pr. 121 = "9999"



◆ Signal loss detection (Pr.122, Pr.336)

- If signal loss is detected between the converter unit and the computer, the communication fault (PU connector communication: E.PUE, RS-485 terminal communication: E.SER) occurs and the inverter trips.
- When the setting is "9999", communication check (signal loss detection) is not made.
- When the setting is "0", communication from the PU connector is not possible. The monitored items and parameter settings can be read during communication via RS-485 terminals, but a communication error (E.SER) occurs.
- Setting any value from 0.1 s to 999.8 s will enable signal loss detection. To detect signal loss, data must be sent from the computer within the communication check time interval (for further information on control codes, refer to [page 103](#)). (The converter unit makes a communication check (clearing of communication check counter) regardless of the station number setting of the data sent from the master.)

Example: PU connector communication, Pr. 122 = "0.1 to 999.8 s"



◆ Instructions for the program

- When data from the computer has any error, the converter unit does not accept that data. Hence, in the user program, always insert a retry program for data error.
- All data communication, for example, monitoring, are started when the computer gives a communication request. The converter unit does not return any data without the computer's request. Hence, design the program so that the computer gives a data read request for monitoring, etc. as required.
- Program example) Writing "0" in **Pr.57**

Microsoft® Visual C++® (Ver. 6.0) programming example

```
#include <stdio.h>
#include <windows.h>

void main(void){
    HANDLE      hCom;          // Communication handle
    DCB          hDcb;        // Structure for setting communication settings
    COMMTIMEOUTS hTim;       // Structure for setting timeouts

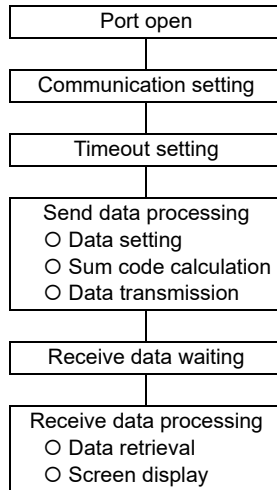
    char        szTx[0x10];   // Send buffer
    char        szRx[0x10];   // Receive buffer
    char        szCommand[0x10]; // Command
    int         nTx,nRx;      // For storing buffer size
    int         nSum;         // For calculating sum code
    BOOL        bRet;
    int         nRet;
    int         i;

    /***** Open COM1 port ****
    hCom = CreateFile("COM1", (GENERIC_READ | GENERIC_WRITE), 0, NULL, OPEN_EXISTING, FILE_ATTRIBUTE_NORMAL, NULL);
    if(hCom != NULL) {
        /***** Set COM1 port communication ****
        GetCommState(hCom,&hDcb); // Get current communication information
        hDcb.DCBLength = sizeof(DCB); // Structure size setting
        hDcb.BaudRate = 19200; // Communication speed = 19200 bps
        hDcb.ByteSize = 8; // Data length = 8 bits
        hDcb.Parity = 2; // Even parity
        hDcb.StopBits = 2; // Stop bit = 2 bits
        bRet = SetCommState(hCom,&hDcb); // Setting of changed communication information
        if(bRet == TRUE) {
            /***** Set COM1 port timeout ****
            GetCommTimeouts(hCom,&hTim); // Get current timeout values
            hTim.WriteTotalTimeoutConstant = 1000; // Write timeout 1 second
            hTim.ReadTotalTimeoutConstant = 1000; // Read timeout 1 second
            SetCommTimeouts(hCom,&hTim); // Setting of changed timeout values
            /***** Setting a command to write "0" in Pr.57 of the station number 1 converter unit ****
            sprintf(szCommand,"01B910000"); // Send data (Parameter write)
            nTx = strlen(szCommand); // Send data size
            /***** Generate sum code ****
            nSum = 0; // Initialize sum data
            for(i = 0;i < nTx;i++) {
                nSum += szCommand[i]; // Calculate sum code
                nSum &= (0xff); // Mask data
            }

            /***** Generate send data ****
            memset(szTx,0,sizeof(szTx)); // Initialize send buffer
            memset(szRx,0,sizeof(szRx)); // Initialize receive buffer
            sprintf(szTx,"%5s%02X",szCommand,nSum); // ENQ code + send data + sum code
            nTx = 1 + nTx + 2; // Number of ENQ codes + number of send data + number of sum codes

            nRet = WriteFile(hCom,szTx,nTx,&nTx,NULL);
            /***** Send ****
            if(nRet != 0) {
                nRet = ReadFile(hCom,szRx,sizeof(szRx),&nRx,NULL);
            /***** Receive ****
            if(nRet != 0) {
                /***** Display receive data ****
                for(i = 0;i < nRx;i++) {
                    printf("%02X ",(BYTE)szRx[i]); // Output received data to console
                    // Display ASCII code in Hexadecimal' In case of 0, "30" is displayed.
                }
                printf("\n\r");
            }
            }
        }
        CloseHandle(hCom); // Close communication port
    }
}
```

General flowchart



⚠ Caution

- Always set the communication check time interval before starting operation to prevent hazardous conditions.
- Data communication is not started automatically but is made only once when the computer provides a communication request. If communication is disabled during operation due to signal cable breakage etc., the inverter cannot be stopped. When the communication check time interval has elapsed, the inverter will trip (E.PUE, E.SER).
The inverter can be coasted to a stop by switching ON the RES signals or by switching the power OFF.
- If communication is broken due to signal cable breakage, computer fault etc., the converter unit does not detect such a fault. This should be fully noted.

(N) Operation via communication and its settings

◆ Setting items and set data

- After completion of parameter settings, set the instruction codes and data as shown in the following table, then start communication from the computer to allow reading/writing of parameters and monitoring.

Item	Read/write	Instruction code	Data description	Number of data digits (Format)*1																																																	
Monitor	Converter output voltage	Read	H6F	H0000 to HFFFF: Converter output voltage (hexadecimal) in 0.1 V increments	4 digits (B.E/D)																																																
	Input current	Read	H70	H0000 to HFFFF: Input current (hexadecimal) in 0.1 A increments	4 digits (B.E/D)																																																
	Electric thermal relay function load factor	Read	H71	H0000 to HFFFF: Electronic thermal relay function load factor (hexadecimal) in 0.1% increments	4 digits (B.E/D)																																																
	Special monitor	Read	H72	H0000 to HFFFF: Monitor data selected in the instruction code HF3	4 digits (B.E/D)																																																
	Special monitor selection No.	Read	H73	Monitor selection data (Refer to page 77 on selection No.)	2 digits (B.E1/D)																																																
		Write	HF3		2 digits (A1, C/D)																																																
	Fault record	Read	H74 to H77	<p>H0000 to HFFFF: Two latest fault records</p> <table border="1" style="margin-left: 40px;"> <tr> <td style="text-align: center;">b15</td> <td style="text-align: center;">b8 b7</td> <td style="text-align: center;">b0</td> </tr> <tr> <td>H74</td> <td>Second fault in past</td> <td>Latest fault</td> </tr> <tr> <td>H75</td> <td>Fourth fault in past</td> <td>Third fault in past</td> </tr> <tr> <td>H76</td> <td>Sixth fault in past</td> <td>Fifth fault in past</td> </tr> <tr> <td>H77</td> <td>Eighth fault in past</td> <td>Seventh fault in past</td> </tr> </table> <p>Fault record display example (instruction code H74)</p> <p>With the read data H3040 (Last fault : E.THG) (Present fault : E.FIN)</p> <table border="1" style="margin-left: 40px;"> <tr> <td style="text-align: center;">b15</td> <td style="text-align: center;">b8 b7</td> <td style="text-align: center;">b0</td> </tr> <tr> <td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td> </tr> <tr> <td colspan="8" style="text-align: center;">Last fault (H30)</td> <td colspan="7" style="text-align: center;">Present fault (H40)</td> </tr> </table> <p>(Refer to page 127 for details on fault record read data.)</p>	b15	b8 b7	b0	H74	Second fault in past	Latest fault	H75	Fourth fault in past	Third fault in past	H76	Sixth fault in past	Fifth fault in past	H77	Eighth fault in past	Seventh fault in past	b15	b8 b7	b0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	Last fault (H30)								Present fault (H40)							4 digits (B.E/D)
	b15	b8 b7	b0																																																		
	H74	Second fault in past	Latest fault																																																		
	H75	Fourth fault in past	Third fault in past																																																		
H76	Sixth fault in past	Fifth fault in past																																																			
H77	Eighth fault in past	Seventh fault in past																																																			
b15	b8 b7	b0																																																			
0	0	1	1	0	0	0	0	0	1	0	0	0	0	0																																							
Last fault (H30)								Present fault (H40)																																													
Converter status monitor (extended)	Read	H79	Status of the output signals can be monitored. (For the details, refer to page 110 .)	4 digits (B.E/D)																																																	
Converter status monitor	Read	H7A		2 digits (B.E1/D)																																																	
Converter reset	Write	HFD	H9696: Converter unit reset • As the converter unit is reset at the start of communication by the computer, the converter unit cannot send reply data back to the computer.	4 digits (A, C/D)																																																	
			H9966: Converter unit reset • When data is sent normally, ACK is returned to the computer, and then the converter is reset.	4 digits (A, D)																																																	
Faults history batch clear	Write	HF4	H9696: Faults history batch clear	4 digits (A, C/D)																																																	

Item	Read/write	Instruction code	Data description	Number of data digits (Format)*1
Parameter clear All clear	Write	HFC	All parameters return to initial values. Whether to clear communication parameters or not can be selected according to the data. • Parameter clear H9696: Communication parameters are cleared. H5A5A: Communication parameters are not cleared.*2 • All parameter clear H9966: Communication parameters are cleared. H55AA: Communication parameters are not cleared.*2 For the details of whether or not to clear parameters, refer to page 152 . When a clear is performed with H9696 or H9966, communication related parameter settings also return to the initial values. When resuming the operation, set the parameters again. Performing a clear will clear the instruction code HEC, HF3, and HFF settings. Only H9966 and H55AA (all parameter clear) are valid during the password lock (refer to page 64).	4 digits (A, C/D)
Parameter	Read	H00 to H63	Refer to the instruction code (page 152) and write and/or read parameter values as required.	4 digits (B,E/D)
	Write	H80 to HE3	When setting Pr.100 and later, the link parameter extended setting must be set.	4 digits (A, C/D)
Link parameter extended setting	Read	H7F	Parameter settings are switched according to the H00 to H0D settings.	2 digits (B,E1/D)
	Write	HFF	For details of the settings, refer to the instruction code (page 152).	2 digits (A1, C/D)
Model information monitor	Model	Read H7C	Reading the model in ASCII code. "H20" (blank code) is set for blank area. Example) For "FR-CC2-C-60" H46, H52, H2D, H43, H43, H32, H2D, H43, H2D, H36, H30, H20, H20 ... H20	20 digits (B, E3/D)
	Capacity	Read H7D	Reading the converter capacity in ASCII code. Data is read in increments of 0.1 kW. "H20" (blank code) is set for blank area. Example) 355K....." 3550" (H20, H20, H33, H35, H35, H30)	6 digits (B, E2/D)

*1 Refer to [page 101](#) for data formats (A, A1, B, C, C1, D, E, E1, E2, E3, F).

*2 Turning OFF the power supply while clearing parameters with H5A5A or H55AA sets back the communication parameter settings to the initial settings.

NOTE

- Set 65520 (HFFF0) as a parameter value "8888" and 65535 (HFFFF) as "9999".
- For the instruction codes HFF, HEC and HF3, their values are held once written but cleared to zero when a converter reset or all clear is performed.
- When a 32-bit parameter setting or monitored value is read and the read value exceeds HFFFF, the reply data will be HFFFF.

◆ Converter status monitor

Item	Instruction code	Bit length	Description*1	Example
Converter status monitor	H7A	8 bits	b0: RDB (inverter operation enable signal (NC contact)) b1: Fixed to 0 b2: Fixed to 0 b3: RDA (inverter operation enable signal (NO contact)) b4: RSO (inverter reset signal) b5: IPF (instantaneous power failure/undervoltage) b6: FAN (fan fault signal) b7: ABC1 (Fault)	[Example 1] H01...Inverter operation enable signal (NC contact) ON b7 b0 0 0 0 0 0 0 0 1 [Example 2] H80...Fault occurrence b7 b0 1 0 0 0 0 0 0 0
Converter status monitor (extended)	H79	16 bits	b0: RDB (inverter operation enable signal (NC contact)) b1: Fixed to 0 b2: Fixed to 0 b3: RDA (inverter operation enable signal (NO contact)) b4: RSO (inverter reset signal) b5: IPF (instantaneous power failure/undervoltage) b6: FAN (fan fault signal) b7: ABC1 (Fault) b8 to b14: — b15: Fault occurrence	[Example 1] H0001...Inverter operation enable signal (NC contact) ON b15 b0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 [Example 2] H8080...Fault occurrence b15 b0 1 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0

*1 The signal within parentheses () is the initial status. The description changes depending on the setting of Pr.190 to Pr.195 (output terminal function selection).

4.7.6 MODBUS RTU communication specification

Operation by MODBUS RTU communication or parameter setting is possible by using the MODBUS RTU communication protocol from the RS-485 terminals of the converter unit.

Pr.	Name	Initial value	Setting range	Description
331 N030	RS-485 communication station number	0	0	Broadcast communication
			1 to 247	Specify the converter unit station number. Set the converter unit station numbers when two or more converter units are connected to one personal computer.
332 N031	RS-485 communication speed	96	3, 6, 12, 24, 48, 96, 192, 384, 576, 768, 1152	Set the communication speed. The setting value × 100 equals the communication speed. For example, if 96 is set, the communication speed is 9600 bps.
334 N034	RS-485 communication parity check selection	2	0	Without parity check Stop bit length 2 bits
			1	With odd parity Stop bit length 1 bit
			2	With even parity Stop bit length 1 bit
343 N080	Communication error count	0	—	Displays the communication error count during MODBUS RTU communication. Read-only.
539 N002	MODBUS RTU communication check time interval	9999	0	The MODBUS RTU communication is available, but a communication error occurs.
			0.1 to 999.8 s	Set the interval of the communication check (signal loss detection) time. (Same specifications as Pr.122)
			9999	No communication check (signal loss detection)
549 N000	Protocol selection	0	0	Mitsubishi inverter (computer link) protocol
			1	MODBUS RTU protocol

NOTE

- To use the MODBUS RTU protocol, set "1" to **Pr.549 Protocol selection**.
- If MODBUS RTU communication is performed from the master to the address 0 (station number 0), broadcast communication is performed, and the converter unit does not send any reply to the master. To obtain replies from the converter unit, set **Pr.331 RS-485 communication station number** ≠ "0 (initial value)".
Some functions are disabled in broadcast communication. (Refer [page 113](#).)

◆ Communication specifications

- The communication specifications are given below.

Item	Description	Related parameter	
Communication protocol	MODBUS RTU protocol	Pr.549	
Conforming standard	EIA-485 (RS-485)	—	
Connectable units	1:N (maximum 32 units), setting is 0 to 247 stations	Pr.331	
Communication speed	Selected among 300/600/1200/2400/4800/9600/19200/38400/57600/76800/115200 bps	Pr.332	
Control procedure	Start-stop synchronization method	—	
Communication method	Half-duplex system	—	
Communication specifications	Character system	Binary (fixed at 8 bits)	
	Start bit	1 bit	
	Stop bit length	Select from the following three types: No parity check, stop bit length 2 bits Odd parity check, stop bit length 1 bit Even parity check, stop bit length 1 bit	Pr.334
	Parity check		
	Error check	CRC code check	
Terminator	Not used	—	
Waiting time setting	Not used	—	

(N) Operation via communication and its settings

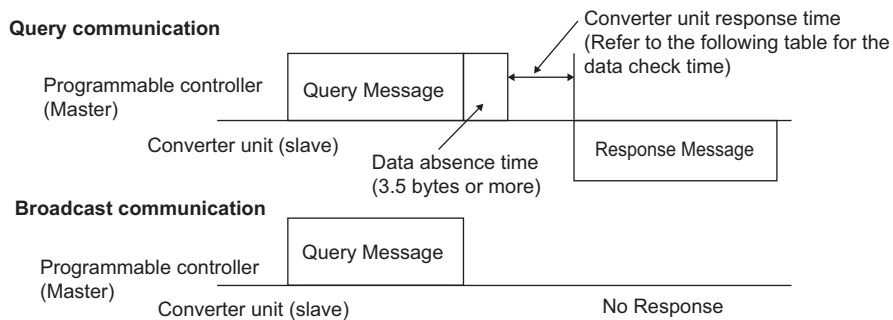
◆ Overview

- The MODBUS communication protocol was developed by Modicon for programmable controllers.
- The MODBUS protocol uses exclusive message frames to perform serial communication between a master and slaves. These exclusive message frames are provided with a feature called "functions" that allows data to be read or written. These functions can be used to read or write parameters from the converter unit, or check the converter unit's operating status, for example. This product classifies the data of each converter unit into holding register area (register address 40001 to 49999). The master can communicate with converter units (slaves) by accessing preassigned holding register addresses.

NOTE

- There are two serial transmission modes, the ASCII (American Standard Code for Information Interchange) mode and the RTU (Remote Terminal Unit) mode. However, this product supports only the RTU mode, which transfers 1 byte data (8 bits) as it is. Also, only communication protocol is defined by the MODBUS protocol. Physical layers are not stipulated.

◆ Message format



- Data check time

Item	Check time
Various monitored values	<20 ms
Parameter read/write	<Approximately 50 ms
Parameter clear / all clear	<5 s
Reset command	No answer

- Query

A message is sent to the slave (for instance, the converter unit) having the address specified by the master.

- Normal Response

After the query from the master is received, the slave executes the requested function, and returns the corresponding normal response to the master.

- Error Response

When an invalid function code, address or data is received by the slave, the error response is returned to the master. This response is appended with an error code that indicates the reason why the request from the master could not be executed.

This response cannot be returned for errors detected by the hardware, frame error, and CRC check error.

- Broadcast

The master can broadcast messages to all slaves by specifying address 0. All slaves that receive a message from the master execute the requested function. With this type of communication, slaves do not return a response to the master.

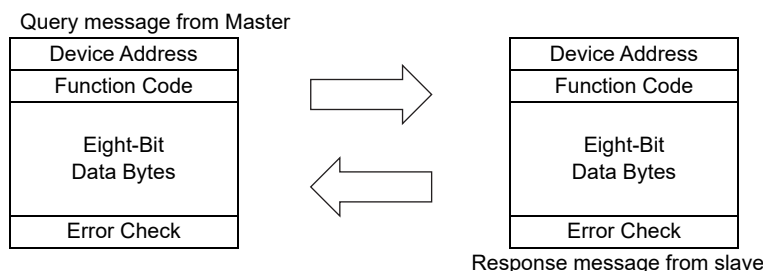
NOTE

- During broadcast communication, functions are executed regardless of the converter unit station number (**Pr.331**) setting.

◆ Message frame (protocol)

- Communication method

Basically, the master sends a Query message (question), and slaves return the Response message (response). At normal communication, the Device Address and Function Code are copied as they are, and at erroneous communication (illegal function code or data code), bit 7 (= H80) of the Function Code is turned ON, and the error code is set at Data Bytes.



Message frames comprise of the four message fields shown in the figures above.

A slave recognizes message data as a message by the message data being prefixed and appended with a no data time of 3.5 characters (T1: start/end).

- Details of protocol

The following table explains the four message fields.

Start	ADDRESS	FUNCTION	DATA	CRC CHECK		End
T1	8 bits	8 bits	n × 8 bits	L 8 bits	H 8 bits	T1

Message field	Description
ADDRESS field	For the address, 0 to 247 can be set in single byte lengths (8 bits). Set "0" when sending broadcast messages (instructions to all addresses), and "1 to 247" to send messages to individual slaves. The address set by the master is also returned when the response is sent from the slave. The value set to Pr.331 RS-485 communication station number is the slave address.
FUNCTION field	For the function code, 1 to 255 can be set in single byte lengths (8 bits). The master sets the function to be sent to the slave as the request, and the slave performs the requested operation. For the supported function codes, refer to the "Function code list" on page 114 . An error response is generated when a function code other than one in the "Function code list" is set. At a response from the slave, the function code set by the master is returned in the case of a normal response. At an error response, H80 + the function code is returned.
DATA field	The format changes according to the function code. (Refer to page 115 .) The data, for example, includes the byte count, number of bytes, and accessing content of holding registers.
CRC CHECK field	Errors in the received message frame are detected. Errors are detected in the CRC check, and the message is appended with data 2 bytes long. When the message is appended with the CRC, the lower bytes are appended first, followed by the upper bytes. The CRC value is calculated by the sender that appends the message with the CRC. The receiver recalculates the CRC while the message is being received, and compares the calculation result against the actual value that was received in the error check field. If the two values do not match, the result is treated as an error.

◆ Function code list

Function name	Read/write	Code	Overview	Broadcast communication	Message format reference page
Read Holding Register	Read	H03	The data of the holding registers is read. The various data of the converter unit can be read from MODBUS registers. System environmental variable (Refer to page 121.) Real time monitor (Refer to page 78.) Faults history (Refer to page 121.) Model information monitor (Refer to page 122.) Converter unit parameters (Refer to page 121.)	Not available	page 115
Preset Single Register	Write	H06	Data is written to holding registers. Data can be written to MODBUS registers to set parameters in the converter unit. System environmental variable (Refer to page 121.) Converter unit parameters (Refer to page 121.)	Available	page 116
Diagnostics	Read	H08	Functions are diagnosed. (communication check only) A communication check can be made since the query message is sent and returned as it is as the return message (subfunction code H00 function). Subfunction code H00 (Return Query Data)	Not available	page 117
Preset Multiple Registers	Read	H10	Data is written to consecutive multiple holding registers. Data can be written to consecutive multiple MODBUS registers to set parameters in the converter unit. System environmental variable (Refer to page 121.) Converter unit parameters (Refer to page 121.)	Available	page 118
Read Holding Register Access Log	Read	H46	The number of registers that were successfully accessed by the previous communication is read. Queries by function codes H03 and H10 are supported. The number and start address of holding registers successfully accessed by the previous communication are returned. "0" is returned for both the number and start address for queries other than the function codes H03 and H10.	Not available	page 119

◆ Read Holding Register (reading of data of holding registers) (H03 or 03)

- Query message

a. Slave Address	b. Function	c. Starting Address		d. No. of Points		CRC Check	
(8 bits)	H03 (8 bits)	H (8 bits)	L (8 bits)	H (8 bits)	L (8 bits)	L (8 bits)	H (8 bits)

- Normal response (Response message)

a. Slave Address	b. Function	e. Byte Count	f. Data			CRC Check	
(8 bits)	H03 (8 bits)	(8 bits)	H (8 bits)	L (8 bits)	... (n × 16 bits)	L (8 bits)	H (8 bits)

- Query message setting

Message		Description
a	Slave Address	Set the address to send messages to. Broadcast communication is not available. (Invalid when "0" is set.)
b	Function	Set H03.
c	Starting Address	Set the holding register address from which to start reading the data. Start address = start register address (decimal) - 40001 For example, when start register address 0001 is set, the data of holding register address 40002 is read.
d	No. of Points	Set the number of holding registers to read. Data can be read from up to 125 registers.

- Content of normal response

Message		Description
e	Byte Count	The setting range is H02 to HFA (2 to 250). Twice the number of reads specified by d is set.
f	Data	The amount of data specified by d is set. Read data is output Hi bytes first followed by Lo bytes, and is arranged as follows: data of start address, data of start address+1, data of start address+2, and so forth.

Example) Read the register values of 41067 (**Pr.67**) to 41069 (**Pr.69**) from slave address 17 (H11).

Query message

Slave Address	Function	Starting Address		No. of Points		CRC Check	
H11 (8 bits)	H03 (8 bits)	H04 (8 bits)	H2B (8 bits)	H00 (8 bits)	H03 (8 bits)	— (8 bits)	— (8 bits)

Normal response (Response message)

Slave Address	Function	Byte Count	Data						CRC Check	
H11 (8 bits)	H03 (8 bits)	H06 (8 bits)	H00 (8 bits)	H00 (8 bits)	H00 (8 bits)	H0A (8 bits)	H00 (8 bits)	H00 (8 bits)	— (8 bits)	— (8 bits)

Read value

Register 41067 (**Pr.67**): H0000 (0)

Register 41068 (**Pr.68**): H000A (1.0 s)

Register 41069 (**Pr.69**): H0000 (0)

(N) Operation via communication and its settings

◆ Preset Single Register (writing of data to holding registers) (H06 or 06)

- The content of the "system environmental variables" and "inverter parameters" assigned to the holding register area (refer to the register list (page 121)) can be written.
- Query message

a. Slave Address	b. Function	c. Register Address		d. Preset Data		CRC Check	
(8 bits)	H06 (8 bits)	H (8 bits)	L (8 bits)	H (8 bits)	L (8 bits)	L (8 bits)	H (8 bits)

- Normal response (Response message)

a. Slave Address	b. Function	c. Register Address		d. Preset Data		CRC Check	
(8 bits)	H06 (8 bits)	H (8 bits)	L (8 bits)	H (8 bits)	L (8 bits)	L (8 bits)	H (8 bits)

- Query message setting

Message		Description
a	Slave Address	Set the address to send messages to. Setting "0" enables broadcast communication.
b	Function	Set H06.
c	Register Address	Set the holding register address to write data to. Register address = holding register address (decimal) - 40001 For example, when the register address 0001 is set, data is written to the holding register address 40002.
d	Preset Data	Set the data to write to the holding register. Write data is fixed at 2 bytes.

- Content of normal response
With a normal response, the contents in the response (a to d, including the CRC check) are the same as those in the query messages.
In the case of broadcast communication, no response is returned.

Example) Write 114 (H0072) to 41075 (Pr.75) of slave address 5 (H05).

Query message

Slave Address	Function	Register Address		Preset Data		CRC Check	
H05 (8 bits)	H06 (8 bits)	H04 (8 bits)	H32 (8 bits)	H00 (8 bits)	H72 (8 bits)	— (8 bits)	— (8 bits)

Normal response (Response message)
Same data as query message

NOTE

- With broadcast communication, no response is generated even if a query is executed. When the next query is made, it must be made after waiting for the inverter data processing time after the previous query is executed.

◆Diagnostics (diagnosis of functions) (H08 or 08)

- A communication check can be made since the query message is sent and returned as it is as the return message (subfunction code H00 function).

Subfunction code H00 (Return Query Data)

- Query message

a. Slave Address	b. Function	c. Subfunction		d. Data		CRC Check	
(8 bits)	H08 (8 bits)	H00 (8 bits)	H00 (8 bits)	H (8 bits)	L (8 bits)	L (8 bits)	H (8 bits)

- Normal response (Response message)

a. Slave Address	b. Function	c. Subfunction		d. Data		CRC Check	
(8 bits)	H08 (8 bits)	H00 (8 bits)	H00 (8 bits)	H (8 bits)	L (8 bits)	L (8 bits)	H (8 bits)

- Query message setting

Message		Description
a	Slave Address	Set the address to send messages to. Broadcast communication is not available. (Invalid when "0" is set.)
b	Function	Set H08.
c	Subfunction	Set H0000.
d	Data	Any data 2 bytes long can be set. The setting range is H0000 to HFFFF.

- Content of normal response

With a normal response, the contents in the response (**a to d**, including the CRC check) are the same as those in the query messages.

NOTE

- With broadcast communication, no response is generated even if a query is executed. When the next query is made, it must be made after waiting for the inverter data processing time after the previous query is executed.

(N) Operation via communication and its settings

◆ Preset Multiple Registers (writing of data to multiple holding registers) (H10 or 16)

- Data can be written to multiple holding registers.
- Query message

a. Slave Address	b. Function	c. Starting Address		d. No. of Registers		e. ByteCount	f. Data				CRC Check	
(8 bits)	H10 (8 bits)	H (8 bits)	L (8 bits)	H (8 bits)	L (8 bits)	(8 bits)	H (8 bits)	L (8 bits)	... (n × 2 × 8 bits)		L (8 bits)	H (8 bits)

- Normal response (Response message)

a. Slave Address	b. Function	c. Starting Address		d. No. of Registers		CRC Check	
(8 bits)	H10 (8 bits)	H (8 bits)	L (8 bits)	H (8 bits)	L (8 bits)	L (8 bits)	H (8 bits)

- Query message setting

Message		Description
a	Slave Address	Set the address to send messages to. Setting "0" enables broadcast communication.
b	Function	Set H10.
c	Starting Address	Set the holding register address from which to start writing the data. Start address = start register address (decimal) - 40001 For example, when start register address 0001 is set, the data of holding register address 40002 is write.
d	No. of Points	Set the number of holding registers to write to. Data can be written to up to 125 registers.
e	Byte Count	The setting range is H02 to HFA (2 to 250). Set twice the value specified by d.
f	Data	Set the amount of data specified by d. Write data is set Hi bytes first followed by Lo bytes, and is arranged as follows: data of start address, data of start address+1, data of start address+2, and so forth.

- Content of normal response

With a normal response, the contents in the response (a to d, including the CRC check) are the same as those in the query messages.

Example) Write 2 (H02) to 41190 (**Pr.190**) and 8 (H08) to 41191 (**Pr.191**) of slave address 25 (H19).

Query message

Slave Address	Function	Starting Address		No. of Points		Byte Count	Data				CRC Check	
H19 (8 bits)	H10 (8 bits)	H04 (8 bits)	HA5 (8 bits)	H00 (8 bits)	H02 (8 bits)	H04 (8 bits)	H00 (8 bits)	H02 (8 bits)	H00 (8 bits)	H08 (8 bits)	— (8 bits)	— (8 bits)

Normal response (Response message)

Slave Address	Function	Starting Address		No. of Points		CRC Check	
H19 (8 bits)	H10 (8 bits)	H04 (8 bits)	HA5 (8 bits)	H00 (8 bits)	H02 (8 bits)	— (8 bits)	— (8 bits)

◆ Read Holding Register Access Log (H46 or 70)

- Queries by function codes H03 and H10 are supported.

The number and start address of holding registers successfully accessed by the previous communication are returned.

"0" is returned for both the number and start address for queries other than the above function codes.

- Query message

a. Slave Address	b. Function	CRC Check	
(8 bits)	H46 (8 bits)	L (8 bits)	H (8 bits)

- Normal response (Response message)

a. Slave Address	b. Function	c. Starting Address		d. No. of Points		CRC Check	
(8 bits)	H46 (8 bits)	H (8 bits)	L (8 bits)	H (8 bits)	L (8 bits)	L (8 bits)	H (8 bits)

- Query message setting

Message		Description
a	Slave Address	Set the address to send messages to. Broadcast communication is not available. (Invalid when "0" is set.)
b	Function	Set H46.

- Content of normal response

Message		Description
c	Starting Address	The start address of the holding register that was successfully accessed is returned. Start address = start register address (decimal) - 40001 For example, when start address 0001 is returned, the holding register address that was successfully accessed is 40002.
d	No. of Points	The number of holding registers that were successfully accessed is returned.

Example) Read the successful register start address and number of successful accesses from slave address 25 (H19).

Query message

Slave Address	Function	CRC Check	
H19 (8 bits)	H46 (8 bits)	— (8 bits)	— (8 bits)

Normal response (Response message)

Slave Address	Function	Starting Address		No. of Points		CRC Check	
H19 (8 bits)	H46 (8 bits)	H04 (8 bits)	H32 (8 bits)	H00 (8 bits)	H02 (8 bits)	— (8 bits)	— (8 bits)

Two successful reads with the start address 41075 (**Pr.75**) are returned.

(N) Operation via communication and its settings

◆ Error response

- An error response is returned if the query message received from the master contains an illegal function, address or data. No response is returned for parity, CRC, overrun, framing, and busy errors.

NOTE

- No response is returned also in the case of broadcast communication.
- Error response (Response message)

a. Slave Address	b. Function	c. Exception Code	CRC Check	
(8 bits)	H80 + Function (8 bits)	(8 bits)	L (8 bits)	H (8 bits)

	Message	Description
a	Slave Address	The address received from the master is set.
b	Function	The function code requested by the master + H80 is set.
c	Exception Code	The codes in the following table are set.

- Error code list

Code	Error item	Fault definition
01	ILLEGAL FUNCTION	The query message from the master is set with a function code that cannot be handled by the slave.
02	ILLEGAL DATA ADDRESS *1	The query message from the master is set with a register address that cannot be handled by the converter unit. (No parameter, parameter cannot be read, parameter cannot be written)
03	ILLEGAL DATA VALUE	The query message from the master is set with data that cannot be handled by the converter unit. (Out of parameter write range, a mode is specified, other error)

*1 An error does not occur in the following cases:

- Function code H03 (read data of holding register)
When there are 1 or more number of reads (No. of Points) and there is 1 or more holding register from where data can be read.
- Function code H10 (write data to multiple holding registers)
When there are 1 or more number of writes (No. of Points) and there is 1 or more holding registers to which data can be written.

In other words, when function code H03 or H10 is used and multiple holding registers are accessed, an error will not occur even if a non-existent holding register or a holding register that cannot be read or written is accessed.

NOTE

- An error will occur if all accessed holding registers do not exist. The data read value of non-existent holding registers is 0, and data is invalid when written to non-existent holding registers.
- Error detection of message data

The following errors are detected in message data from the master. Tripping does not occur even if an error is detected.

Error check items

Error item	Fault definition	Converter unit operation
Parity error	The data received by the converter unit has different parity from the specified one (Pr.334 setting).	When this error occurs, Pr.343 is incremented by one. When this error occurs, the LF signal is output.
Framing error	The data received by the converter unit has a different stop bit length from the specified one (Pr.334 setting).	
Overrun error	The next data has been sent by the master before the converter unit completes receiving the preceding data.	
Message frame error	The data length of the message frame is checked, and an error is generated if the received data length is less than 4 bytes.	
CRC check error	An error is generated if the data in the message frame does not match the calculation result.	

NOTE

- The LF signal can be assigned to an output terminal by setting Pr.190 to Pr.195 (output terminal function selection). Changing the terminal assignment may affect other functions. Set parameters after confirming the function of each terminal.

◆ MODBUS register

- System environmental variable

Register	Definition	Read/write	Remarks
40002	Converter reset	Write	Any value can be written.
40003	Parameter clear	Write	Set H965A for the write value.
40004	All parameter clear	Write	Set H99AA for the write value.
40006	Parameter clear *1	Write	Set H5A96 for the write value.
40007	All parameter clear *1	Write	Set HAA99 for the write value.
40009	Converter unit status	Read	Refer to the following section.

*1 Communication parameter settings are not cleared.

<Converter unit status>

Bit	Description
0	RDB (inverter operation enable (NC contact))*2
1	0
2	0
3	RDA (inverter operation enable (NO contact))*2
4	RSO (inverter reset)*2
5	IPF (instantaneous power failure/under voltage)*2
6	FAN (fan fault)*2
7	ABC1 (fault)*2
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	Fault occurrence

*2 The signal within parentheses () is the initial status. The description changes depending on the setting of Pr.190 to Pr.195 (output terminal function selection) (page 81).

- Real time monitor

Refer to page 77 for the register numbers and monitored items of the real time monitor.

- Parameter

Pr.	Register	Name	Read/write	Remarks
0 to 999	41000 to 41999	For parameter names, refer to the parameter list (page 54).	Read/write	The parameter number + 41000 is the register number.
1000 to 1999	45000 to 45359	For parameter names, refer to the parameter list (page 54).	Read/write	The parameter number + 44000 is the register number.

- Faults history

Register	Definition	Read/write	Remarks
40501	Faults history 1	Read/write	Data is 2 bytes and so is stored in "H0000". The lowest 1 byte can be referred to for the error code. (For the error codes, refer to page 127.) The faults history is batch-cleared by writing to the register 40501. Set any value for the data.
40502	Faults history 2	Read	
40503	Faults history 3	Read	
40504	Faults history 4	Read	
40505	Faults history 5	Read	
40506	Faults history 6	Read	
40507	Faults history 7	Read	
40508	Faults history 8	Read	

(N) Operation via communication and its settings

- Model information monitor

Register	Definition	Read/write	Remarks
44001	Model (First and second characters)	Read	Reading the model in ASCII code. "H20" (blank code) is set for blank area. Example) For "FR-CC2-C-60" H46, H52, H2D, H43, H43, H32, H2D, H43, H2D, H36, H30, H20H20
44002	Model (Third and fourth characters)	Read	
44003	Model (Fifth and sixth characters)	Read	
44004	Model (Seventh and eighth characters)	Read	
44005	Model (Ninth and tenth characters)	Read	
44006	Model (Eleventh and twelfth characters)	Read	
44007	Model (Thirteenth and fourteenth characters)	Read	
44008	Model (Fifteenth and sixteenth characters)	Read	
44009	Model (Seventeenth and eighteenth characters)	Read	
44010	Model (Nineteenth and twentieth characters)	Read	
44011	Capacity (First and second characters)	Read	Reading the converter unit capacity in ASCII code. Data is read in increments of 0.1 kW. "H20" (blank code) is set for blank area. Example) 355K " 3550" (H20, H20, H33, H35, H35, H30)
44012	Capacity (Third and fourth characters)	Read	
44013	Capacity (Fifth and sixth characters)	Read	

NOTE

- When a 32-bit parameter setting or monitored value is read and the read value exceeds HFFFF, the reply data will be HFFFF.

◆ Pr.343 Communication error count

- The cumulative count of communication error occurrences can be checked.

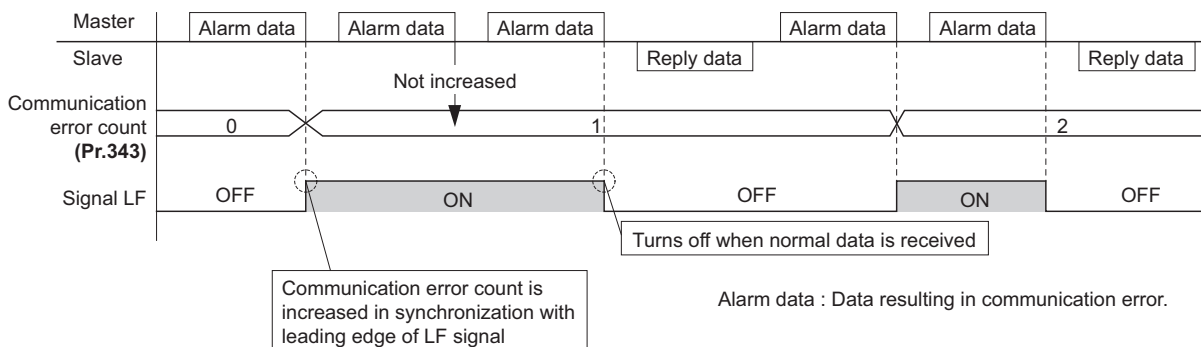
Parameter	Setting range	Minimum setting range	Initial value
343	(Read-only)	1	0

NOTE

- The communication error count is temporarily stored in the RAM memory. The value is not stored in EEPROM, and so is cleared to 0 when power is reset and the converter is reset.

◆ Output signal LF "alarm output (communication error warning)"

- During a communication error, the alarm signal (LF signal) is output by open collector output. Assign the terminal to be used using any of **Pr.190 to Pr.195 (output terminal function selection)**.



NOTE

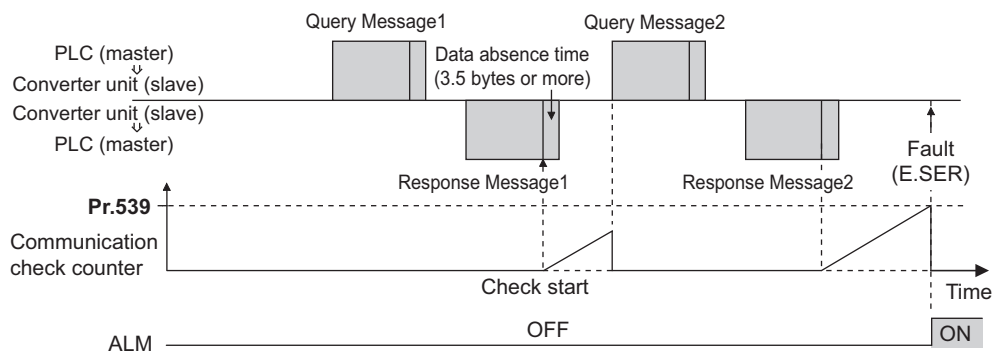
- The LF signal can be assigned to an output terminal by setting **Pr.190 to Pr.195**. Changing the terminal assignment may affect other functions. Set parameters after confirming the function of each terminal.

◆ Signal loss detection (Pr.539 MODBUS RTU communication check time interval)

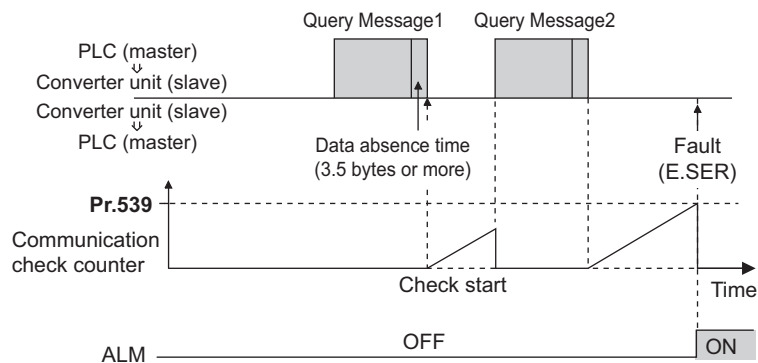
- If signal loss is detected between the converter unit and the master, the Communication fault (inverter) "E.SER" will occur and the inverter trips.
 - When the setting is "9999", communication check (signal loss detection) is not made.
 - The monitored items and parameter settings can be read when "0" is set, but E.SER occurs.
 - Setting any value from 0.1 s to 999.8 s will enable signal loss detection. To detect signal loss, data must be sent from the master within the communication check time interval. (The inverter makes a communication check (clearing of communication check counter) regardless of the station number setting of the data sent from the master.)
 - The communication check time by query communication includes a no data time (3.5 bytes).
- This no data time differs according to the communication speed, so take this no data time into consideration when setting the communication check time.

Example: RS-485 terminal communication, Pr. 539 = "0.1 to 999.8s"

Query communication



Broadcast communication



MEMO

5 PROTECTIVE FUNCTIONS

This chapter explains the "PROTECTIVE FUNCTION" that operates in this product.

Always read the instructions before using the equipment.

5.1	Converter unit fault and alarm indications.....	126
5.2	Reset method for the protective functions.....	126
5.3	Faults history and the list of fault displays	127
5.4	Causes and corrective actions	128
5.5	Check first when you have trouble	134

5.1 Converter unit fault and alarm indications

- When the converter unit detects a fault, depending on the nature of the fault, the operation panel displays an error message or warning, or a protective function activates to trip the inverter.
- When a protective function is activated, take an appropriate corrective action, then reset the converter unit (inverter), and resume the operation. Restarting the operation without a reset may break or damage the converter unit (inverter).
- When a protective function is activated, note the following points.

Item	Description
Fault output signal	Opening the magnetic contactor (MC) provided on the input side of the converter unit at a fault occurrence shuts off the control power to the converter unit, therefore, the fault output will not be retained.
Fault or alarm indication	When a protective function is activated, the operation panel displays a fault indication.
Operation restart method	While a protective function is activated, the inverter output is kept shutdown. Reset the converter unit (inverter) to restart the operation.

- Converter unit fault or alarm indications are categorized as below.

Displayed item	Description
Error message	A message regarding an operational fault and setting fault by the operation panel is displayed. The inverter does not trip.
Warning	The inverter does not trip even when a warning is displayed. However, failure to take appropriate measures will lead to a fault.
Alarm	The inverter does not trip. An Alarm (LF) signal can also be output with a parameter setting.
Fault	A protective function is activated to trip the inverter and output a Fault (ALM) signal.


NOTE

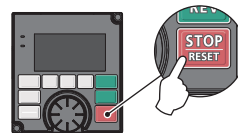
- The past eight faults can be displayed on the operation panel. (Faults history) (For the operation, refer to the FR-LU08 Instruction Manual.)

5.2 Reset method for the protective functions

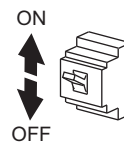
Reset the converter unit by performing any of the following operations. Note that the accumulated heat value of the electronic thermal relay function and the number of retries are cleared (erased) by resetting the converter unit.

The converter unit recovers about 1s after the reset is released.

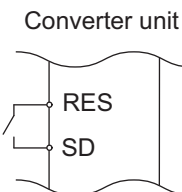
- On the operation panel, press  to reset the converter unit. (This may only be performed when a fault occurs. (Refer to [page 130](#) of the Instruction Manual for faults.))



- Switch power OFF once, then switch it ON again.



- Turn ON the reset signal (RES) for 0.1s or more. (If the RES signal is kept ON, "Err" appears (flickers) to indicate that the converter unit is in a reset status.)



NOTE

- Resetting a converter unit fault with the inverter start signal ON restarts the inverter suddenly. OFF status of the inverter start signal must be confirmed before resetting.

5.3 Faults history and the list of fault displays

If the displayed message does not correspond to any of the following or if you have any other problem, please contact your sales representative.

◆ Error message

- A message regarding an operational fault and setting fault by the operation panel is displayed. The inverter does not trip.

Abbreviation	Name	Refer to page
LOCD	Password locked	128
Er1	Parameter write error	128
rE1 to rE4	Copy operation error	128 128
Err.	Error	129

◆ Warning

- The inverter does not trip even when a warning is displayed. However, failure to take appropriate measures will lead to a fault.

Abbreviation	Name	Refer to page
TH	Electronic thermal relay function pre-alarm	129
MT1 to MT3	Maintenance timer 1 to 3	129
EV	24 V external power supply operation	129
ED	Emergency drive in operation	129

◆ Alarm

- The inverter does not trip. An Alarm (LF) signal can be output with a parameter setting.

Abbreviation	Name	Refer to page
FN	Fan alarm	129

◆ Fault

- A protective function is activated to trip the inverter and output a fault (ALM) signal.
- The data codes are used to check the fault record via communication or used for **Pr.997 Fault initiation**.

Abbreviation	Name	Data code	Refer to page
E.OVT	Overvoltage trip	32 (H20)	130
E.THC	Converter overload trip (electronic thermal relay function)	48 (H30)	130
E.FIN	Heatsink overheat	64 (H40)	130
E.IPF	Instantaneous power failure	80 (H50)	130
E.UVT	Undervoltage	81 (H51)	130
E.ILF	Input phase loss	82 (H52)	131
E.OHT	External thermal relay operation	144 (H90)	131
E.PE	Parameter storage device fault	176 (HB0)	131
E.PUE	PU disconnection	177 (HB1)	131
E.RET	Retry count excess	178 (HB2)	131
E.PE2	Parameter storage device fault	179 (HB3)	131
E.CPU	CPU fault	192 (HC0)	132
E. 5		245 (HF5)	
E. 6		246 (HF6)	
E. 7		247 (HF7)	
E.CTE	Operation panel power supply short circuit/RS-485 terminals power supply short circuit	193 (HC1)	132
E.P24	24 VDC power fault	194 (HC2)	132
E.IOH	Inrush current limit circuit fault	197 (HC5)	132
E.SER	Communication fault (inverter)	198 (HC6)	132
E.PBT	Internal circuit fault	202 (HCA)	132
E.13		253 (HFD)	
E.1	Option fault	241 (HF1)	133

If faults other than the above appear, contact your sales representative.

5.4 Causes and corrective actions

◆ Error message


A message regarding operational troubles is displayed. The inverter does not trip.

Abbreviation	LOCD
Name	Password locked
Description	Password function is active. Display and setting of parameters are restricted.
Check point	—————
Corrective action	Enter the password in Pr.297 Password lock/unlock to unlock the password function before operating. (Refer to page 64 .)

Abbreviation	Er1
Name	Parameter write error
Description	<ul style="list-style-type: none"> Parameter setting was attempted while Pr.77 Parameter write selection is set to disable parameter write. The operation panel and converter unit cannot make normal communication.
Check point	<ul style="list-style-type: none"> Check the Pr.77 setting. (Refer to page 63.) Check the connection between the operation panel and the converter unit.

Abbreviation	rE1
Name	Parameter read error
Description	A failure has occurred at the operation panel side EEPROM while reading the copied parameters.
Check point	—————
Corrective action	<ul style="list-style-type: none"> Perform parameter copy again. (Refer to the FR-LU08 Instruction Manual.) The operation panel may be faulty. Please contact your sales representative.

Abbreviation	rE2
Name	Parameter write error
Description	A failure has occurred at the operation panel side EEPROM while writing the copied parameters.
Check point	—————
Corrective action	<ul style="list-style-type: none"> The operation panel may be faulty. Please contact your sales representative. Perform parameter copy again. (Refer to the FR-LU08 Instruction Manual.)

Abbreviation	rE3
Name	Parameter verification error
Description	<ul style="list-style-type: none"> The data in the converter unit are different from the data in the operation panel. A failure has occurred at the operation panel side EEPROM during parameter verification.
Check point	Check the parameter setting of the source converter unit against the setting of the destination converter unit.
Corrective action	<ul style="list-style-type: none"> Continue the verification by pressing "  (NEXT)". Perform parameter verification again. (Refer to the FR-LU08 Instruction Manual.) The operation panel may be faulty. Please contact your sales representative.

Abbreviation	rE4
Name	Model error
Description	<ul style="list-style-type: none"> A different model was used when parameter copy from the operation panel or parameter verification was performed. The data in the operation panel were not correct when parameter copy from the operation panel or parameter verification was performed.
Check point	<ul style="list-style-type: none"> Check that the parameter copy or verification source converter unit is of the same model. Check that parameter copy to the operation panel was not interrupted by switching OFF the power or by disconnecting the operation panel.
Corrective action	<ul style="list-style-type: none"> Perform parameter copy and parameter verification between converter units of the same model (FR-CC2 series). Perform parameter copy to the operation panel from the converter unit again.

Abbreviation	Err.
Description	<ul style="list-style-type: none"> • The RES signal is turned ON. • The operation panel and converter unit cannot make normal communication. (contact faults of the connector). • This error may occur when the voltage at the input side of the converter unit drops. • When using a separate power source for the control circuit power (R1/L11, S1/L21) from the main circuit power (R/L1, S/L2, T/L3), this error may appear at turning ON of the main circuit. It is not a fault.
Corrective action	<ul style="list-style-type: none"> • Turn OFF the RES signal. • Check the connection between the operation panel and the converter unit. • Check the voltage on the input side of the converter unit.

◆Warning

The inverter output is not shut off when a protective function is activated.

Abbreviation	TH
Name	Electronic thermal relay function pre-alarm
Description	If the accumulated electronic thermal value reaches 85%, TH is displayed and the THP signal is output. If the value reaches 100% of the setting, Converter overload trip (electronic thermal relay function) (E.THC) occurs. For the terminal used for the THP signal output, set "8 (positive logic)" or "108 (negative logic)" in any of Pr.190 to Pr.195 (output terminal function selection) to assign the function.
Check point	Check for large load or sudden acceleration.
Corrective action	Reduce the load and frequency of operation.

Abbreviation	MT1 to MT3
Name	Maintenance timer 1 to 3
Description	Appears when the converter unit's cumulative energization time reaches or exceeds the parameter set value. Set the time until the MT is displayed by setting Pr.504 Maintenance timer 1 warning output set time (MT1) , Pr.687 Maintenance timer 2 warning output set time (MT2) , and Pr.689 Maintenance timer 3 warning output set time (MT3) . MT does not appear when the settings of Pr.504 , Pr.687 , and Pr.689 are initial values (9999).
Check point	The set time of maintenance timer has been exceeded. (Refer to page 68.)
Corrective action	Take appropriate countermeasures according to the purpose of the maintenance timer setting. Setting "0" in Pr.503 Maintenance timer 1 , Pr.686 Maintenance timer 2 , and Pr.688 Maintenance timer 3 erases the indication.

Abbreviation	EV
Name	24 V external power supply operation
Description	Flickers when the main circuit power supply is off and the 24 V external power supply is being input.
Check point	Power is supplied from a 24 V external power supply.
Corrective action	<ul style="list-style-type: none"> • Turning ON the power supply (main circuit) of the converter unit clears the indication. • If the indication is still displayed after turning ON of the power supply (main circuit) of the converter unit, the power supply voltage may be low.

Abbreviation	ED
Name	Emergency drive in operation
Description	Appears during emergency drive operation.
Check point	Emergency drive operation is performed by turning ON the X84 signal.
Corrective action	The display is cleared when the emergency drive operation ends. (Refer to page 73.)

◆Alarm

The inverter output is not shut off when a protective function is activated. An alarm can also be output with a parameter setting.

(Set "98" in **Pr.190 to Pr.195 (output terminal function selection)**. (Refer to [page 81.](#))

Abbreviation	FN
Name	Fan alarm
Description	FN appears on the operation panel when the cooling fan of the converter unit stops due to a fault or when the speed decreases.
Check point	Check the cooling fan for a failure.
Corrective action	Check for fan failure. Please contact your sales representative.

Causes and corrective actions

◆ Fault

When a protective function activates, the inverter trips and a fault signal is output.

Abbreviation	E.OVT
Name	Overvoltage trip
Description	If the converter unit's internal main circuit DC voltage reaches or exceeds the specified value, 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	<ul style="list-style-type: none"> • Check for sudden load change or excessive regeneration. • Check for power fault.
Corrective action	<ul style="list-style-type: none"> • Keep the load stable. • Check the power supply.

Abbreviation	E.THCH
Name	Converter overload trip (electronic thermal relay function)*1
Description	For the protection of converter unit diode, the electronic thermal O/L relay is activated in inverse-time characteristics against the converter unit input current to shut off the inverter output.
Check point	<ul style="list-style-type: none"> • Check the motor for the use under overload. • Check that the capacity of the inverter used is not larger than that of the converter unit.
Corrective action	<ul style="list-style-type: none"> • Reduce the load. • Check the configuration of the inverter and the converter unit again.

*1 Resetting the converter unit initializes the internal cumulative heat value of the electronic thermal O/L relay function.

Abbreviation	E.FIN
Name	Heatsink overheat
Description	When the heatsink overheats, the temperature sensor activates, and the inverter output is stopped. The FIN signal can be output when the temperature reaches approximately 85% of the heatsink overheat protection operation temperature. For the terminal used for the FIN signal output, assign the function by setting "26 (positive logic) or 126 (negative logic)" in any of Pr.190 to Pr.195 (output terminal function selection) . (Refer to page 81 .)
Check point	<ul style="list-style-type: none"> • Check for too high surrounding air temperature. • Check for heatsink clogging. • Check that the cooling fan is not stopped. (Check that FN is not displayed on the operation panel.)
Corrective action	<ul style="list-style-type: none"> • Set the surrounding air temperature to within the specifications. • Clean the heatsink. • Replace the cooling fan.

Abbreviation	E.IPF
Name	Instantaneous power failure
Description	If a power failure occurs for longer than 15 ms (this also applies to converter unit input shut-off), the instantaneous power failure protective function is activated to trip the inverter in order to prevent the control circuit from malfunctioning. If a power failure persists for 100 ms or longer, the fault output is not provided, and the inverter restarts if the inverter start signal is ON upon power restoration. (The inverter operation continues if an instantaneous power failure is within 15 ms.) In some operating status (load magnitude, acceleration/deceleration time setting, etc.), overcurrent or other protection may be activated by the inverter upon power restoration. When instantaneous power failure protection is activated, the IPF signal is output. (Refer to page 89 .)
Check point	Find the cause of the instantaneous power failure occurrence.
Corrective action	<ul style="list-style-type: none"> • Recover from the instantaneous power failure condition. • Prepare a backup power supply in case of an instantaneous power failure. • Set the function of automatic restart after instantaneous power failure (Pr.57). (Refer to page 89.)

Abbreviation	E.UVT
Name	Undervoltage
Description	If the power supply voltage of the converter unit decreases, the control circuit will not perform normal functions. In addition, the motor torque will be insufficient and/or heat generation will increase. To prevent this, if the power supply voltage decreases to about 440 VAC or below, this function shuts off the inverter output. When undervoltage protection is activated, the IPF signal is output. (Refer to page 89 .)
Check point	Check if a high-capacity motor is driven.
Corrective action	<ul style="list-style-type: none"> • Check the power supply system equipment such as the power supply. • If the problem still persists after taking the above measure, contact your sales representative.

Abbreviation	E.ILF
Name	Input phase loss
Description	The inverter trips if the function is enabled in Pr.872 Input phase loss protection selection (the parameter is set to "1") and one of the three power input phases is lost. This protective function is not available in the initial setting of Pr.872 (Pr.872 = "0") . (Refer to page 69 .)
Check point	Check for a break in the cable for the three-phase power supply input.
Corrective action	<ul style="list-style-type: none"> • Wire the cables properly. • Repair a break portion in the cable.

Abbreviation	E.OHT
Name	External thermal relay operation
Description	While "1" (NC contact) or "2" (NO contact) is set in Pr.876 OH input selection to enable the function, the inverter trips if output of the device such as a thermostat is input as the OH signal, and the OH signal turns ON (NO contact input) or turns OFF (NC contact input). The OH signal function is assigned to the terminal OH in the initial status. This protective function is not available in the initial setting of Pr.876 (Pr.876 = "0") . (Refer to page 86 .)
Check point	<ul style="list-style-type: none"> • Check for overheating of the thermostat for overheat protection of peripheral devices. • Check that the value "7" (OH signal) is set correctly to any of Pr.178, Pr.187 or Pr.189 (input terminal function selection).
Corrective action	<ul style="list-style-type: none"> • Reduce the load and operation duty. • Even if the thermostat automatically returns to normal, the converter unit (inverter) will not restart unless it is reset.

Abbreviation	E.PE
Name	Parameter storage device fault (control circuit board)
Description	The inverter trips if a fault occurs in the parameter stored. (EEPROM failure)
Check point	Check for too many number of parameter write times.
Corrective action	Please contact your sales representative. When performing parameter writing frequently for communication purposes, set "1" in Pr.342 Communication EEPROM write selection to enable RAM write. Note that writing to RAM goes back to the initial status at power OFF.


Abbreviation	E.PUE
Name	PU disconnection
Description	<ul style="list-style-type: none"> • The inverter trips if the communication between PU and the converter unit is canceled by removing the operation panel with the disconnected PU detection function enabled by Pr.75 Reset selection/disconnected PU detection/reset limit. • The inverter trips if communication errors occur consecutively for the permissible number of retries or more during the RS-485 communication from the PU connector with Pr.121 Number of PU communication retries ≠ "9999." • The inverter trips if communication is broken for the period of time set in Pr.122 PU communication check time interval during the RS-485 communication from the PU connector.
Check point	<ul style="list-style-type: none"> • Check that the operation panel is connected properly. • Check the Pr.75 setting.
Corrective action	Connect the operation panel securely.

Abbreviation	E.RET
Name	Retry count excess
Description	The inverter trips if it has tried and failed to properly restart the operation exceeding the number of retries set in Pr.67 Number of retries at fault occurrence . This function is available when Pr.67 is set. This protective function is not available in the initial setting (Pr.67 = "0").
Check point	Find the cause of the fault occurrence.
Corrective action	Eliminate the cause of the error preceding this error indication.

Abbreviation	E.PE2
Name	Parameter storage device fault (main circuit board)
Description	The inverter trips if a fault occurs in the parameter stored. (EEPROM failure)
Check point	—————
Corrective action	Please contact your sales representative.

Causes and corrective actions

Abbreviation	E.CPU, E.5, E.6, E.7
Name	CPU fault
Description	The inverter trips if the communication fault of the built-in CPU occurs.
Check point	Check for devices producing excess electrical noises around the converter unit.
Corrective action	<ul style="list-style-type: none"> • Take measures against noises if there are devices producing excess electrical noises around the converter unit. • Please contact your sales representative.

Abbreviation	E.CTE
Name	Operation panel power supply short circuit/RS-485 terminals power supply short circuit
Description	<ul style="list-style-type: none"> • When the power supply for the operation panel (PU connector) is shorted, the power output is shutoff and the inverter trips. At this time, the use of the operation panel and the RS-485 communication via the PU connector are disabled. To reset, enter the RES signal, reset via communication through the RS-485 terminals, or switch power OFF then ON again. • When the power supply for the RS-485 terminals are short circuited, this function shuts off the power output. <p>At this time, communication from the RS-485 terminals cannot be made. To reset, use  of the operation panel, enter the RES signal, or switch power OFF then ON again.</p>
Check point	<ul style="list-style-type: none"> • Check that the PU connector cable is not shorted. • Check that the RS-485 terminals are connected correctly.
Corrective action	<ul style="list-style-type: none"> • Check the operation panel and the cable. • Check the connection of the RS-485 terminals.

Abbreviation	E.P24
Name	24 VDC power fault
Description	<ul style="list-style-type: none"> • If the 24 VDC power supply output from the terminal PC is shorted, or the voltage of the external 24 VDC power supply is low, the power output is shutoff. At this time, all external contact inputs turn OFF. The inverter cannot be reset by inputting the RES signal. To reset it, use the operation panel, or switch power OFF, then ON again.
Check point	<ul style="list-style-type: none"> • Check for a short circuit in the PC terminal output. • Check if the voltage supplied from the 24 V external power supply is correct.
Corrective action	<ul style="list-style-type: none"> • Repair the short-circuited portion. • Supply the power at 24 V. (If the power with insufficient voltage is supplied to the 24 V input circuit for a long time, the internal circuit may heat up. Input power at correct voltage although it will not damage the converter unit.)

Abbreviation	E.IOH
Name	Inrush current limit circuit fault
Description	The inverter trips when the resistor of the inrush current limit circuit is overheated. The inrush current limit circuit failure
Check point	<ul style="list-style-type: none"> • Check that frequent power ON/OFF is not repeated. • Check if the input side fuse (5A) in the power supply circuit of the inrush current limit circuit contactor is blown. • Check that the power supply circuit of inrush current limit circuit contactor is not damaged.
Corrective action	<ul style="list-style-type: none"> • Configure a circuit where power ON/OFF is not repeated. • If the situation does not improve after taking the above measure, please contact your sales representative.

Abbreviation	E.SER
Name	Communication fault (inverter)
Description	The inverter trips when communication error occurs consecutively for the permissible number of retries or more when Pr.335 RS-485 communication retry count ≠ "9999" during RS-485 communication from the RS-485 terminals. The inverter also trips if communication is broken for the period of time set in Pr.336 RS-485 communication check time interval .
Check point	Check the RS-485 terminal wiring.
Corrective action	Perform wiring of the RS-485 terminals properly.

Abbreviation	E.PBT, E.13
Name	Internal circuit fault
Description	The inverter trips when an internal circuit fault occurs in the converter unit.
Corrective action	Please contact your sales representative.

Abbreviation	E. 1
Name	Option fault
Description	The inverter trips if a plug-in option is disconnected while the converter unit power is ON.
Check point	<ul style="list-style-type: none"> • Check if a plug-in option is connected. • Check for excessive noise around the converter unit.
Corrective action	<ul style="list-style-type: none"> • Disconnect the plug-in option. (Plug-in options cannot be used.) • Take measures against noises if there are devices producing excess electrical noises around the converter unit. <p>If the situation does not improve after taking the above measure, please contact your sales representative.</p>

 **NOTE**

- If faults other than the above appear, contact your sales representative.

5.5 Check first when you have 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.

5.5.1 Converter unit does not operate properly

Checkpoints	Cause	Countermeasure	Refer to page
Main circuit Control Circuit	Wiring or installation is improper.	Check for the wiring and the installation.	25
Main circuit	Appropriate power supply voltage is not applied. (Operation panel display is not provided.)	Power on a molded case circuit breaker (MCCB), an earth leakage circuit breaker (ELB), or a magnetic contactor (MC).	—
		Check for the decreased input voltage, input phase loss, and wiring.	—
		If only the control power is ON when using a separate power source for the control circuit, turn ON the main circuit power.	38

5.5.2 The power lamp is OFF

Checkpoints	Cause	Countermeasure	Refer to page
Main circuit Control Circuit	Wiring or installation is improper.	Check for the wiring and the installation. Power lamp is lit when power is supplied to the control circuit (R1/L11, S1/L21).	27

5.5.3 The charge lamp is OFF

Checkpoints	Cause	Countermeasure	Refer to page
Main circuit Control Circuit	Wiring or installation is improper.	Check for the wiring and the installation. Charge lamp is lit when power is supplied to the control circuit (R1/L1, S/L2, T/L3).	27

5.5.4 Operation panel display is not operating

Checkpoints	Cause	Countermeasure	Refer to page
Main circuit Control Circuit	Power is not input.	Input the power.	25
Front cover	Operation panel is not properly connected to the converter unit.	Check that the front cover is installed securely.	15

5.5.5 Inverter cannot be operated

Checkpoints	Cause	Countermeasure	Refer to page
Control Circuit	The terminals RDA and SE of the converter unit are not connected to the terminals MRS (X10 signal) and SD of the inverter respectively.	Check for the wiring.	25
PARAMETER	Inverter parameter settings are incorrect.	Check for the inverter parameter settings.	Refer to the Instruction Manual (Detailed) of the inverter.

5.5.6 Unable to write parameter setting

Checkpoints	Cause	Countermeasure	Refer to page
Parameter setting	Parameter is disabled by the Pr.77 Parameter write selection setting.	Check the Pr.77 setting.	63

5.5.7 Breaker trips

Checkpoints	Cause	Countermeasure	Refer to page
Main circuit	Wiring or installation is improper.	Check for the wiring and the installation.	25
	Appropriate power supply voltage is not applied.	Check that the power supply voltage is applied.	—

5.5.8 Converter unit generates abnormal noise

Checkpoints	Cause	Countermeasure	Refer to page
fan	Fan cover was not correctly installed when a cooling fan was replaced.	Install a fan cover correctly.	143

MEMO

6 PRECAUTIONS FOR MAINTENANCE AND INSPECTION

This chapter explains the "PRECAUTIONS FOR MAINTENANCE AND INSPECTION" for this product.

Always read the instructions before using the equipment.

6.1	Inspection item.....	138
6.2	Measurement of main circuit voltages, currents and powers	145

Inspection item

The converter unit is a static unit mainly consisting of semiconductor devices. Daily inspection must be performed to prevent any fault from occurring due to the adverse effects of the operating environment, such as temperature, humidity, dust, dirt and vibration, changes in the parts with time, service life, and other factors.

● Precautions for maintenance and inspection

When accessing the converter unit for inspection, wait for at least 10 minutes after the power supply has been switched OFF because the smoothing capacitor voltage remains high for a while, and then make sure that the voltage across the main circuit terminals P/+ and N/- of the converter unit is not more than 30 VDC using a tester, etc.

6.1 Inspection item

6.1.1 Daily inspection

Basically, check for the following faults during operation.

- Motor operation fault
- Improper installation environment
- Cooling system fault
- Abnormal vibration, abnormal noise
- Abnormal overheat, discoloration

6.1.2 Periodic inspection

Check the areas inaccessible during operation and requiring periodic inspection.

Consult us for periodic inspection.

- Check and clean the cooling system. Clean the air filter, etc.
- Check the tightening and retighten. 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 29.](#))
- Check the conductors and insulating materials for corrosion and damage.
- Measure the insulation resistance.
- Check and change the cooling fan and relay.

6.1.3 Daily and periodic inspection

Area of inspection	Inspection item	Description	Inspection interval		Corrective action at fault occurrence	Check by the user		
			Daily	Periodic *3				
General	Surrounding environment	Check the surrounding air temperature, humidity, dirt, corrosive gas, oil mist, etc.	○		Improve the environment.			
	Overall unit	Check for unusual vibration and noise.	○		Check fault location and retighten.			
		Check for dirt, oil, and other foreign material.*1	○		Clean.			
	Power supply voltage	Check that the main circuit voltages and control voltages are normal.*2	○		Inspect the power supply.			
Main circuit	General	(1) Check with megger (across main circuit terminals and earth (ground) terminal).		○	Contact the manufacturer.			
		(2) Check for loose screws and bolts.		○	Retighten.			
		(3) Check for overheat traces on the parts.		○	Contact the manufacturer.			
		(4) Check for stain.		○	Clean.			
	Conductors, cables	(1) Check conductors for distortion. (2) Check cable sheaths for breakage and deterioration (crack, discoloration, etc.).			○	Contact the manufacturer.		
					○	Contact the manufacturer.		
	Transformer/reactor	Check for unusual odor and abnormal increase of whining sound.	○		Stop the equipment and contact the manufacturer.			
Terminal block	Check for a damage.			○	Stop the equipment and contact the manufacturer.			
Smoothing aluminum electrolytic capacitor	(1) Check for liquid leakage. (2) Check for safety valve projection and bulge. (3) Visual check and judge by the life check of the main circuit capacitor. (Refer to page 142.)			○	Contact the manufacturer.			
				○	Contact the manufacturer.			
Relay/contactor	Check that the operation is normal and no chattering sound is heard.			○	Contact the manufacturer.			
Control circuit protection circuit	Operation check	(1) Check that the output voltages across phases are balanced while operating the inverter alone.			○	Contact the manufacturer.		
		(2) Check that no fault is found in protective and display circuits in a sequence protective operation test.			○	Contact the manufacturer.		
	Components check	Overall	(1) Check for unusual odor and discoloration.			○	Stop the equipment and contact the manufacturer.	
			(2) Check for serious rust development.			○	Contact the manufacturer.	
	Aluminum electrolytic capacitor	(1) Check for liquid leakage in a capacitor and deformation trace. (2) Visual check and judge by the life check of the control circuit capacitor. (Refer to page 142.)			○	Contact the manufacturer.		
					○	Contact the manufacturer.		
Cooling system	Cooling fan	(1) Check for unusual vibration and noise.	○		Replace the fan.			
		(2) Check for loose screws and bolts.			○	Fix with the fan cover fixing screws		
(3) Check for stain.				○	Clean.			
	Heatsink	(1) Check for clogging.			○	Clean.		
		(2) Check for stain.			○	Clean.		

Inspection item

Area of inspection	Inspection item	Description	Inspection interval		Corrective action at fault occurrence	Check by the user
			Daily	Periodic *3		
Display	Indication	(1) Check that display is normal. (2) Check for stain.	○	○	Contact the manufacturer. Clean.	
	Meter	Check that reading is normal.	○		Stop the equipment and contact the manufacturer.	
Load motor	Operation check	Check for vibration and abnormal increase in operation noise.	○		Stop the equipment and contact the manufacturer.	

*1 Oil component of the heat dissipation grease used inside the converter unit may leak out. The oil component, however, is not flammable, corrosive, nor conductive and is not harmful to humans. Wipe off such oil component.

*2 It is recommended to install a voltage monitoring device for checking the voltage of the power supplied to the converter unit.

*3 One to two years of periodic inspection cycle is recommended. However, it differs according to the installation environment. Consult us for periodic inspection.

NOTE

- Continuous use of a leaked, deformed, or degraded smoothing aluminum electrolytic capacitor (as shown in the table above) may lead to a burst, breakage or fire. Replace such capacitor without delay.

6.1.4 Checking the converter semiconductor devices

◆Preparation

- Disconnect the external power supply cables (R/L1, S/L2, T/L3, P/+, and N/-).
- Prepare a continuity tester. (For the resistance measurement, use the 100 Ω range.)

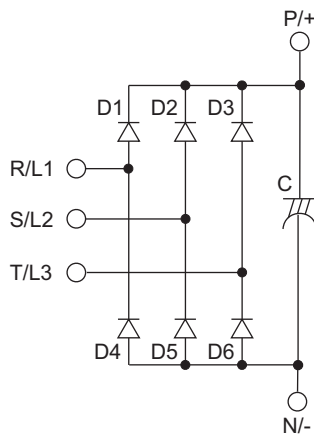
◆Checking method

Change the polarity of the tester alternately at the converter unit terminals R/L1, S/L2, T/L3, P/+, and N/- and check the electric continuity.

NOTE

- Before measurement, check that the smoothing capacitor is discharged.
- At the time of electric discontinuity, the measured value is almost ∞. When there is an instantaneous electric continuity, due to the smoothing capacitor, the tester may not indicate ∞. At the time of electric continuity, the measured value is several Ω to several tens of Ω. When all measured values are almost the same (although values may not be constant depending on the tester type), it shows that there are no electrical paths with problems.

◆Semiconductor device numbers and terminals to be checked



Converter unit	Tester polarity		Continuity
	⊕	⊖	
D1	R/L1	P/+	No
	P/+	R/L1	Yes
D2	S/L2	P/+	No
	P/+	S/L2	Yes
D3	T/L3	P/+	No
	P/+	T/L3	Yes
D4	R/L1	N/-	Yes
	N/-	R/L1	No
D5	S/L2	N/-	Yes
	N/-	S/L2	No
D6	T/L3	N/-	Yes
	N/-	T/L3	No

(Assuming that an analog meter is used.)

6.1.5 Cleaning

Always run the converter unit in a clean status.

When cleaning the converter unit, 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 these will cause the converter unit surface paint to peel off.
- The display, etc. of the operation panel are vulnerable to detergent and alcohol. Therefore, avoid using them for cleaning.

6.1.6 Replacement of parts

The converter unit 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 converter unit. For preventive maintenance, the parts must be replaced periodically.

Use the life check function as a guidance of parts replacement.

Part name	Estimated lifespan*1	Description
Cooling fan	10 years	Replace (as required)
Main circuit smoothing capacitor	10 years*2	Replace (as required)
On-board smoothing capacitor	10 years*2	Replace the board (as required)
Relays	—	As required
Main circuit fuse	10 years	Replace (as required)

*1 Estimated lifespan for when the yearly average surrounding air temperature is 40°C.
(without corrosive gas, flammable gas, oil mist, dust and dirt etc.)

*2 Input current: 80% of the converter unit rating



- For parts replacement, contact the nearest Mitsubishi FA center.

◆ Converter unit parts life display

The converter unit diagnoses the control circuit capacitor, cooling fan, and inrush current limit circuit by itself and estimates their lives.

The self-diagnostic warning is output when the life span of each part is near its end. It gives an indication of replacement time.

The life warning output can be used as a guideline for life judgment.

Parts	Judgment level
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 specified speed.



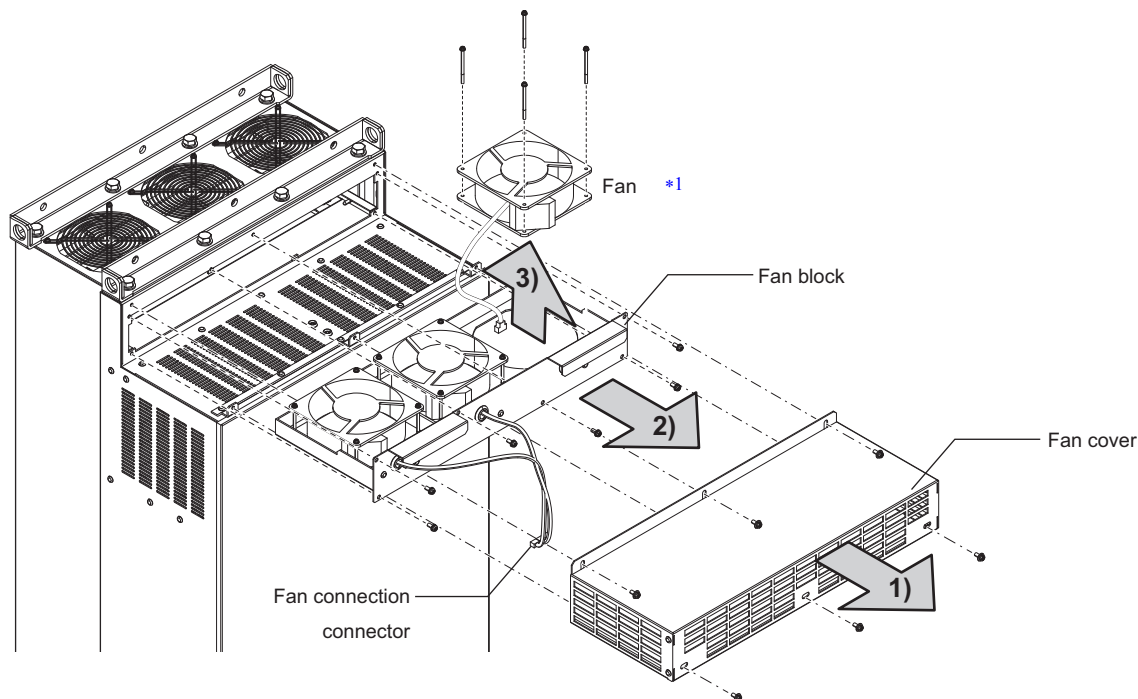
- Refer to [page 66](#) to perform the life check of the converter unit parts.

◆ Replacement procedure of the cooling fan

The replacement interval of the cooling fan used for cooling the parts generating heat such as the main circuit semiconductor is greatly affected by the surrounding air temperature. When unusual noise and/or vibration are noticed during inspection, the cooling fan must be replaced immediately.

◆ Removal

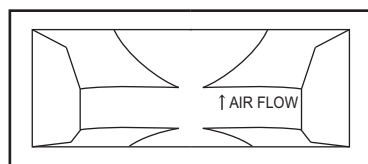
- 1) Remove the fan cover fixing screws, and remove the fan cover.
- 2) Disconnect the fan connector and remove the fan block.
- 3) Remove the fan fixing screws, and remove the fan.



*1 The number of cooling fans differs according to the converter unit capacity.

◆ Reinstallation

- 1) After confirming the orientation of the fan, reinstall the fan so that the "AIR FLOW" faces up.



<Fan side face>

- 2) For reconnection of the fan, refer to the above figure. The tightening torque of the fan fixing screws is 0.73 NΠm.

NOTE

- Installing the fan in the opposite direction of air flow can cause the converter unit life to be shorter.
- Prevent the cable from being caught when installing a fan.
- Switch OFF the power before starting the fan replacement work. Before starting the replacement, power OFF the converter unit, wait for at least 10 minutes, and then check that the charge lamp is OFF to prevent an electric shock accident as the converter unit circuits are charged with voltage even after power OFF.

◆Smoothing capacitors

A large-capacity aluminum electrolytic capacitor is used for smoothing in the DC section of the main circuit, and an aluminum electrolytic capacitor is used for stabilizing the control power in the control circuit. Adverse effects from ripple currents deteriorate capacitors. Replacement intervals of capacitors vary greatly with surrounding temperatures and operating conditions. Replace them roughly every 10 years when used in normal air-conditioned environments.

Inspecting the product visually:

- Case: Check that the sides and bottom of the capacitor have not ruptured.
- Rubber seal: Check for any noticeable bulging or severe cracks.
- Check for external cracks, discoloration, leakage, etc. It is assumed that the capacitor has reached the end of its life when its capacity has dropped below 80% of its rated capacity.

NOTE

- The converter unit diagnoses the control circuit capacitor by itself and can estimate its remaining life. (Refer to [page 66](#).)

◆Relays

The contacts of relays deteriorate over time. To prevent faults from occurring, relays must be replaced when they have reached the maximum number of switching operations (switching life).

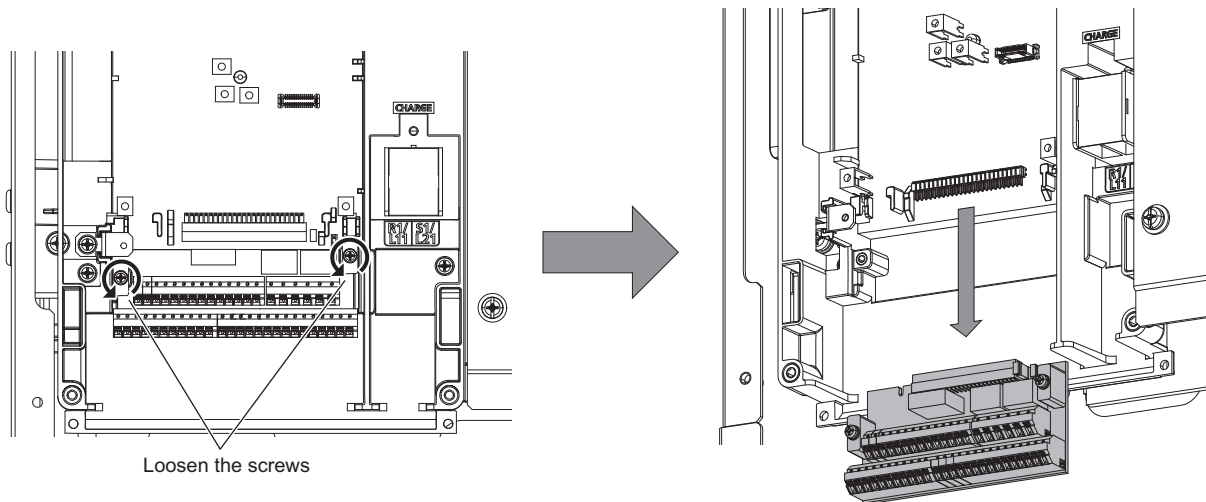
◆Main circuit fuse

A fuse is used inside the converter unit. Replacement intervals of fuses vary with surrounding temperatures and operating conditions. Replace them roughly every 10 years when used in normal air-conditioned environments.

6.1.7 Converter unit replacement

The converter unit can be replaced with the control circuit wiring kept connected.

- 1) Loosen the two mounting screws at the both sides of the control circuit terminal block. (These screws cannot be removed.)
Slide down the control circuit terminal block to remove it.



- 2) Be careful not to bend the pins of the converter unit's control circuit connector, reinstall the control circuit terminal block, and fix it with the mounting screws.

NOTE

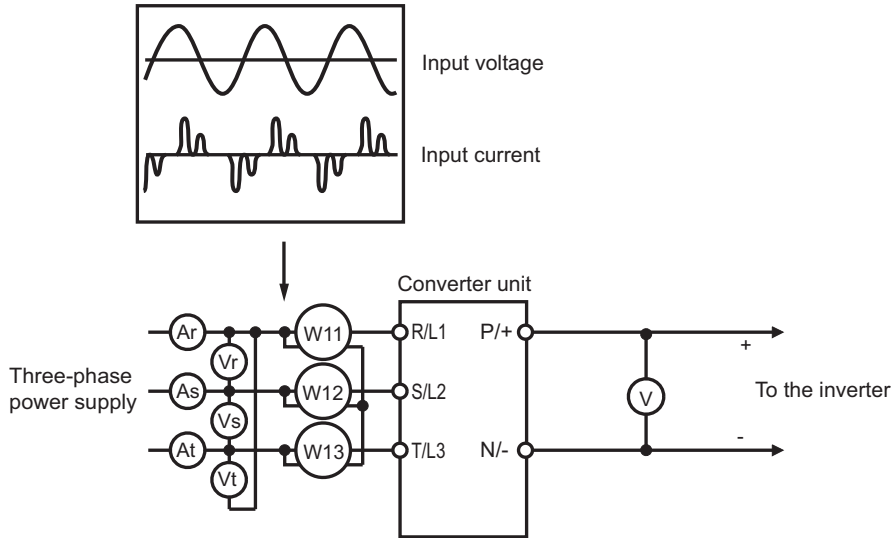
- Before starting converter unit replacement, switch power OFF, wait for at least 10 minutes, and then check the voltage with a tester and such to ensure safety.

6.2 Measurement of main circuit voltages, currents and powers

Since the voltages and currents on the converter unit 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.

NOTE

- When installing meters etc. on the converter unit output side
When the wiring length between the converter unit and the inverter is large, 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.



◆ Measuring points and instruments

Item	Measuring point	Measuring instrument	Remarks (reference measured value)
Power supply voltage V1	Across R/L1 and S/L2, S/L2 and T/L3, T/L3 and R/L1	Digital power meter (designed for inverter)	Commercial power supply Within permissible AC voltage fluctuation (Refer to page 148.)
Power supply side current I1	R/L1, S/L2, T/L3 line current		
Power supply side power P1	R/L1, S/L2, T/L3 and Across R/L1 and S/L2, S/L2 and T/L3, T/L3 and R/L1		P1=W11 + W12 + W13 (3-wattmeter method)
Power supply side power factor Pf1	Calculate after measuring power supply voltage, power supply side current and power supply side power. $Pf_1 = \frac{P_1}{\sqrt{3}V_1 \times I_1} \times 100 \%$		
Converter output	Across P/+ and N/-	Tester such as a digital multimeter.	Converter unit LED is ON. 1.35 × V1
Input signal	Across RDI, OH, RES(+) and SD (for sink logic)	Tester such as a digital multimeter, or moving-coil type instrument (internal resistance 50 kΩ or more)	When open 20 to 30 VDC ON voltage: 1 V or less "SD" is common
Fault signal	Across A1 and C1 Across B1 and C1	Tester such as a digital multimeter.	Continuity check*1 [Normal] [Fault] Across A1 and C1 Discontinuity Continuity Across B1 and C1 Continuity Discontinuity

*1 When the setting of Pr.195 ABC1 terminal function selection is the positive logic

6.2.1 Measurement of powers

Use a digital power meter (for inverter) for the input side of the converter unit.

6.2.2 Measurement of voltages

Use a digital power meter (for inverter) for the input side of the converter unit.

6.2.3 Measurement of currents

Use a digital power meter (for inverter) for the input side of the converter unit.

Since the converter unit input current tends to be unbalanced, measurement of three phases is recommended. The correct value cannot be obtained by measuring only one or two phases.

The converter unit input current can be monitored on the operation panel. The value displayed on the operation panel is accurate. Hence, it is recommended to monitor values on the operation panel. Install the operation panel of the inverter on the converter unit.

6.2.4 Example of measuring converter unit input power factor

Calculate the factor from the effective power and the apparent power. A power-factor meter cannot indicate an exact value.

$$\begin{aligned} \text{Total power factor of the inverter} &= \frac{\text{Effective power}}{\text{Apparent power}} \\ &= \frac{\text{Three-phase input power found by the 3-wattmeter method}}{\sqrt{3} \times V \text{ (power supply voltage)} \times I \text{ (input current effective value)}} \end{aligned}$$

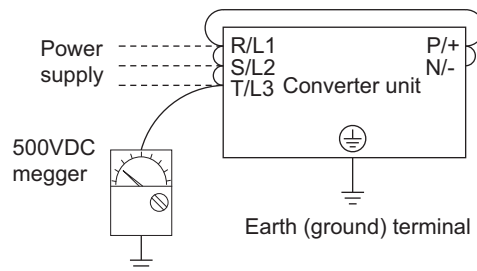
6.2.5 Measurement of converter output voltage (across terminals P and N)

The output voltage of the Converter unit can be measured with a voltmeter (such as a digital multimeter) between terminals P and N. The voltage varies according to the power supply voltage. Approximately 540 to 600 VDC is output when no load is applied. The voltage decreases when a load is applied.

When energy is regenerated from the motor during deceleration, for example, the converter output voltage rises to nearly 800 to 900 VDC maximum.

6.2.6 Insulation resistance test using megger

- For the converter unit, conduct the insulation resistance test on the main circuit only as follows and do not perform the test on the control circuit. (Use a 500 VDC megger.)
- Before the test, remove the wiring for terminals R/L1, S/L2, and T/L3 (indicated by dashed lines in the diagram).



NOTE

- Before performing the insulation resistance test on the external circuit, disconnect the cables from all terminals of the converter unit so that the test voltage is not applied to the converter unit.
- For the continuity test of the control circuit, use a tester for high resistance range and do not use the megger or buzzer.

6.2.7 Withstand voltage test

Do not conduct a withstand voltage test. Deterioration may occur.

7 SPECIFICATIONS

This chapter explains the "SPECIFICATIONS" of this product.
Always read the instructions before using the equipment.

7.1 Converter unit rating	148
7.2 Common specifications	148
7.3 Outline dimension drawings.....	149

7.1 Converter unit rating

Model FR-CC2-[]		Inverter rating	C355K	C400K	C560K
Output	Overload current rating *1, *5	SLD	110% 60 s, 120% 3 s (inverse-time characteristics) at surrounding air temperature 40°C		
		LD	120% 60 s, 150% 3 s (inverse-time characteristics) at surrounding air temperature 50°C		
		ND	150% 60 s, 200% 3 s (inverse-time characteristics) at surrounding air temperature 50°C		
		HD	200% 60 s, 250% 3 s, 280% 0.5 s (inverse-time characteristics) at surrounding air temperature 40°C		
	Rated voltage *2	618 to 933V *4			
Power supply	Rated input AC voltage/frequency		Three-phase 525 to 600 V 60 Hz		
	Permissible AC voltage fluctuation		472 to 660 V 60 Hz		
	Permissible frequency fluctuation		±5%		
	Rated input current (A) *5	SLD	545	647	850
		LD	496	589	773
		ND	402	496	663
		HD	304	402	589
	Power supply capacity (kVA) *3, *5	SLD	543	644	847
		LD	494	587	770
		ND	400	494	660
HD		303	400	587	
Protective structure (IEC 60529)		Open type (IP00)			
Cooling system		Forced air cooling			
DC reactor		Built-in			
Approx. mass (kg)		205	255	269	

- *1 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 converter unit and the inverter to return to or below the temperatures under 100% load.
- *2 The converter unit output voltage varies according to the input power supply voltage and the load. The maximum point of the voltage waveform at the converter unit output side is approximately the power supply voltage multiplied by $\sqrt{2}$.
- *3 The power supply capacity is the value when at the rated output current. It varies by the impedance at the power supply side (including those of the input reactor and cables).
- *4 The permissible voltage imbalance ratio is 3% or less. (Imbalance ratio = (highest voltage between lines - average voltage between three lines) / average voltage between three lines × 100)
- *5 The overload current rating, the rated input current, and the power supply capacity depend on the inverter rating.

7.2 Common specifications

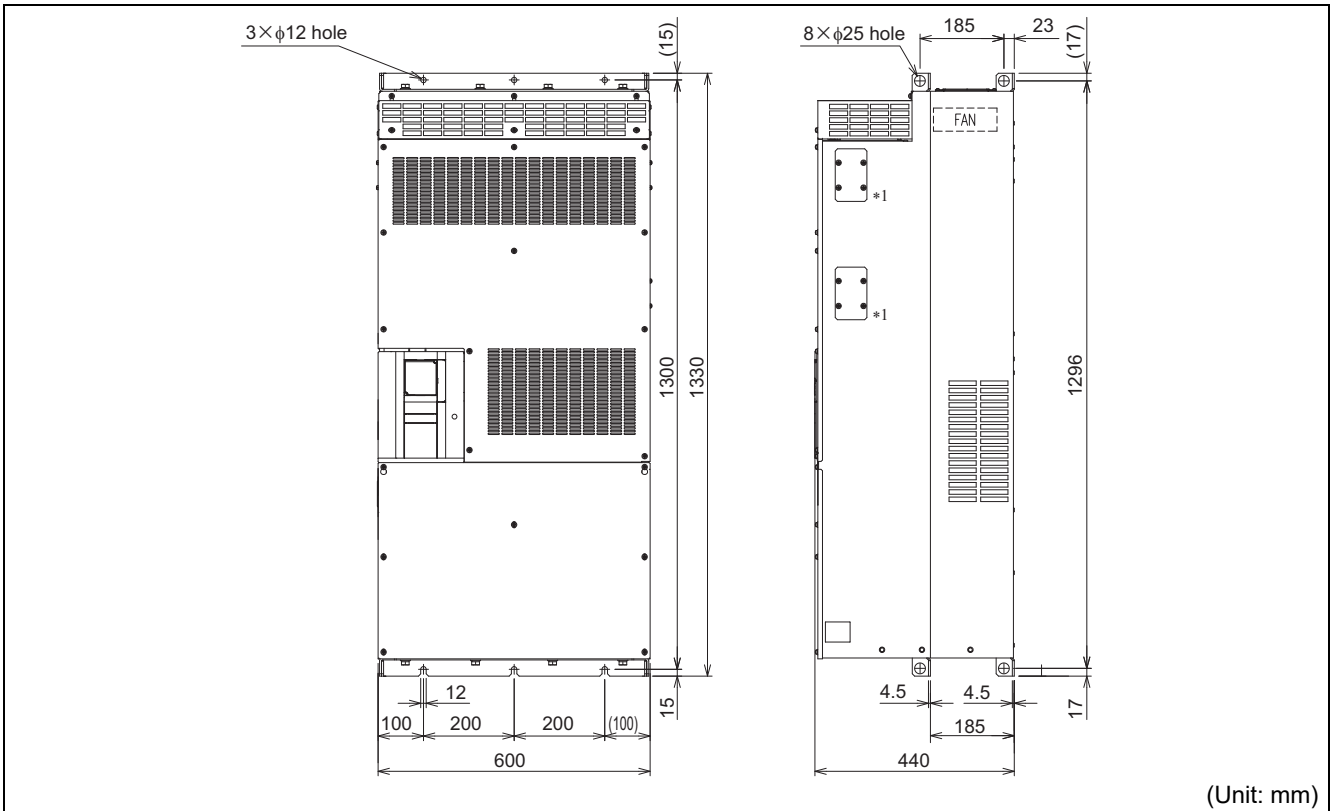
Input signals (three terminals)		External thermal relay input, Converter reset The input signal can be changed using Pr.178, Pr.187, and Pr.189 (input terminal function selection) .
Operational functions		Thermal protection, DC injection brake, automatic restart after instantaneous power failure, retry function, RS-485 communication, life diagnosis, maintenance timer, 24 V power supply input for control circuit
Output signal Open collector output (five terminals) Relay output (one terminal)		Inverter operation enable (positive logic, negative logic), Instantaneous power failure/undervoltage, Inverter reset, Fan fault output, Fault The output signal can be changed using Pr.190 to Pr.195 (output terminal function selection) .
Protective/warning function	Protective function	Overvoltage trip, Converter overload trip (electronic thermal relay function), Heatsink overheat, Instantaneous power failure, Undervoltage, Input phase loss*3, External thermal relay operation, PU disconnection*3, Retry count excess*3, Parameter storage device fault, CPU fault, 24 VDC power fault, Inrush current limit circuit fault, Communication fault (inverter), Option fault, Operation panel power supply short circuit/RS-485 terminals power supply short circuit, Internal circuit fault
	Warning function	Fan alarm, Electronic thermal relay function pre-alarm, Maintenance timer 1 to 3*3, Password locked*3, Parameter write error, Copy operation error, 24 V external power supply operation, Emergency drive in operation*2
Environment	Surrounding air temperature	When the inverter rating is the LD or ND rating: -10 to +50°C (non-freezing), When the inverter rating is the SLD or HD rating: -10 to +40°C (non-freezing)
	Surrounding air humidity	With circuit board coating (conforming to IEC60721-3-3:1994 3C2/3S2): 95% RH or less (non-condensing)
	Storage temperature*1	-20°C to +65°C
	Atmosphere	Indoors (without corrosive gas, flammable gas, oil mist, dust and dirt, etc.)
Altitude/vibration		Maximum 1000 m above sea level, 2.9 m/s ² or less*2 at 10 to 55 Hz (directions of X, Y, Z axes)

- *1 Temperature applicable for a short time, e.g. in transit.
- *2 For the installation in an altitude above 1000 m (up to 2500 m), derate the rated current 3% per 500 m.
- *3 This protective function is not available in the initial status.

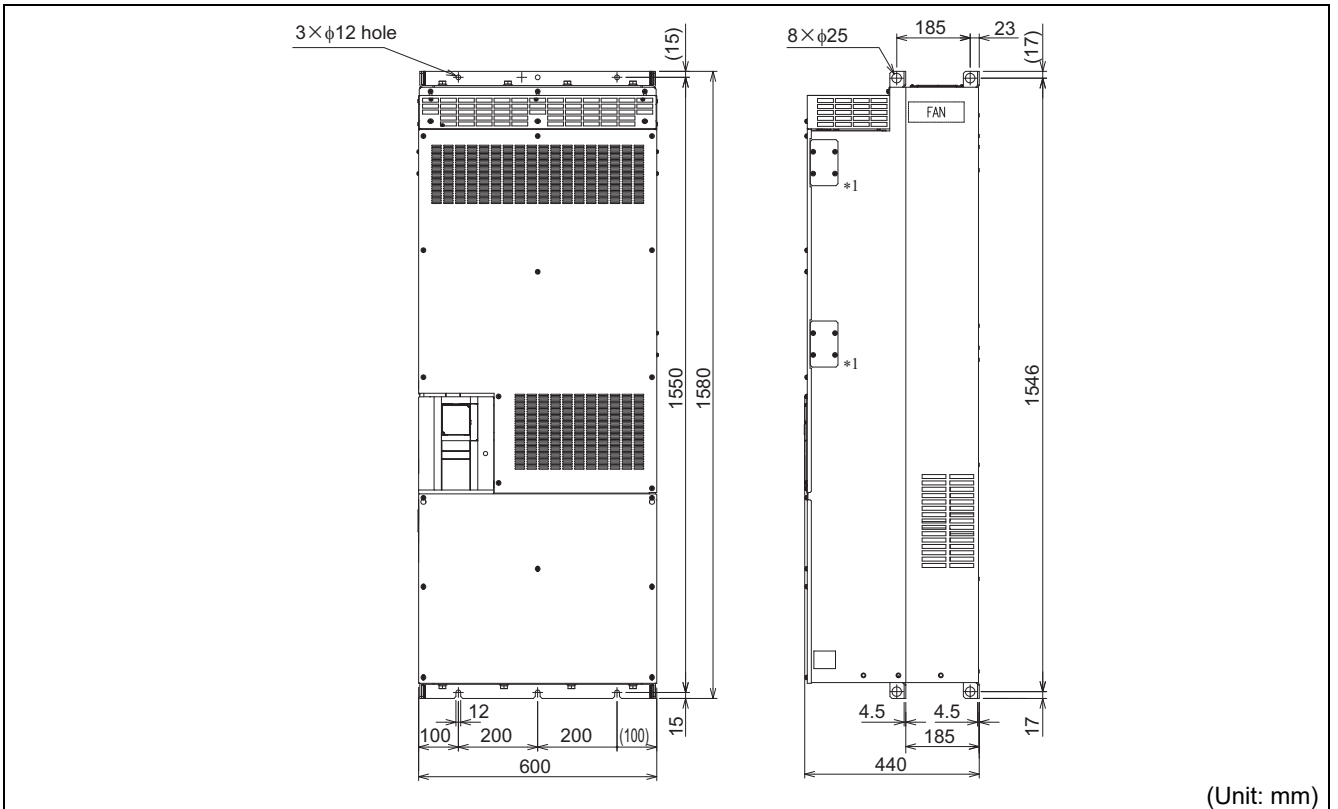
7.3 Outline dimension drawings

7.3.1 Converter unit outline dimension drawings

FR-CC2-C355K



FR-CC2-C400K, C560K



*1 Do not remove the cover on the side of the converter unit.

MEMO



APPENDIX

APPENDIX provides the reference information for use of this product.

Refer to **APPENDIX** as required.

Appendix 1	Instruction code list.....	152
Appendix 2	Instructions for UL and cUL (Standard to comply with: UL 508C, CSA C22.2).....	154
Appendix 3	Instructions for UL and cUL (Standard to comply with: UL 61800-5-1, CSA C22.2 No. 274)	155
Appendix 4	Restricted Use of Hazardous Substances in Electronic and Electrical Products	157
Appendix 5	Referenced Standard (Requirement of Chinese standardized law).....	157
Appendix 6	UL-certified combinations of converter units and inverters.....	157

Appendix 1 Instruction code list

- *1 Instruction codes are used to read and write parameters by using the Mitsubishi inverter protocol via RS-485 communication. (For the RS-485 communication, refer to [page 98](#).)
- *2 For "parameter copy", "parameter clear", and "all parameter clear", "O" indicates the function is available, and × indicates the function is not available.
- *3 Communication parameters that are not cleared by parameter clear (all clear) via the RS-485 communication. (For the RS-485 communication, refer to [page 98](#).)
- *4 Reading/writing is enabled only during communication via the PU connector.

Pr.	Name	Instruction code*1			PARAMETER		
		Read	Write	Extended	Copy *2	Clear *2	All clear *2
30	Reset selection during power supply to main circuit	1E	9E	0	○	○	○
57	Restart selection	39	B9	0	○	○	○
65	Retry selection	41	C1	0	○	○	○
67	Number of retries at fault occurrence	43	C3	0	○	○	○
68	Retry waiting time	44	C4	0	○	○	○
69	Retry count display erase	45	C5	0	○	○	○
75	Reset selection/disconnected PU detection/reset limit	4B	CB	0	○	×	×
77*4	Parameter write selection	4D	CD	0	○	○	○
117	PU communication station number	11	91	1	○	○*3	○*3
118	PU communication speed	12	92	1	○	○*3	○*3
119	PU communication stop bit length / data length	13	93	1	○	○*3	○*3
120	PU communication parity check	14	94	1	○	○*3	○*3
121	Number of PU communication retries	15	95	1	○	○*3	○*3
122	PU communication check time interval	16	96	1	○	○*3	○*3
123	PU communication waiting time setting	17	97	1	○	○*3	○*3
124	PU communication CR/LF selection	18	98	1	○	○*3	○*3
161	Parameter for manufacturer setting. Do not set.						
168	Parameter for manufacturer setting.						
169	Parameter for manufacturer setting.						
170	Watt-hour meter clear	0A	8A	2	○	×	○
178	RDI terminal function selection	12	92	2	○	×	○
187	OH terminal function selection	1B	9B	2	○	×	○
189	RES terminal function selection	1D	9D	2	○	×	○
190	RDB terminal function selection	1E	9E	2	○	×	○
191	RDA terminal function selection	1F	9F	2	○	×	○
192	IPF terminal function selection	20	A0	2	○	×	○
193	RSO terminal function selection	21	A1	2	○	×	○
194	FAN terminal function selection	22	A2	2	○	×	○
195	ABC1 terminal function selection	23	A3	2	○	×	○

Pr.	Name	Instruction code*1			PARAMETER		
		Read	Write	Extended	Copy *2	Clear *2	All clear *2
244	Cooling fan operation selection	34	B4	2	○	○	○
248	Self power management selection	38	B8	2	○	○	○
255	Life alarm status display	3F	BF	2	×	×	×
256	Inrush current limit circuit life display	40	C0	2	×	×	×
257	Control circuit capacitor life display	41	C1	2	×	×	×
261	Power failure stop selection	45	C5	2	○	○	○
268	Monitor decimal digits selection	4C	CC	2	○	○	○
269	Parameter for manufacturer setting. Do not set.						
290	Monitor negative output selection	62	E2	2	○	○	○
296	Password lock level	68	E8	2	○	×	○
297	Password lock/unlock	69	E9	2	○	○*4	○
331	RS-485 communication station number	1F	9F	3	○	○*3	○*3
332	RS-485 communication speed	20	A0	3	○	○*3	○*3
333	RS-485 communication stop bit length / data length	21	A1	3	○	○*3	○*3
334	RS-485 communication parity check selection	22	A2	3	○	○*3	○*3
335	RS-485 communication retry count	23	A3	3	○	○*3	○*3
336	RS-485 communication check time interval	24	A4	3	○	○*3	○*3
337	RS-485 communication waiting time setting	25	A5	3	○	○*3	○*3
341	RS-485 communication CR/LF selection	29	A9	3	○	○*3	○*3
342	Communication EEPROM write selection	2A	AA	3	○	○	○
343	Communication error count	2B	AB	3	×	×	×
503	Maintenance timer 1	03	83	5	×	×	×
504	Maintenance timer 1 warning output set time	04	84	5	○	×	○
514	Emergency drive dedicated retry waiting time	0E	8E	5	○	×	○
515	Emergency drive dedicated retry count	0F	8F	5	○	×	○
523	Emergency drive mode selection	17	97	5	○	×	○
539	MODBUS RTU communication check time interval	27	A7	5	○	○*3	○*3
549	Protocol selection	31	B1	5	○	○*3	○*3

Pr.	Name	Instruction code*1			PARAMETER		
		Read	Write	Extended	Copy *2	Clear *2	All clear *2
563	Energization time carrying-over times	3F	BF	5	×	×	×
663	Control circuit temperature signal output level	3F	BF	6	○	○	○
686	Maintenance timer 2	56	D6	6	×	×	×
687	Maintenance timer 2 warning output set time	57	D7	6	○	×	○
688	Maintenance timer 3	58	D8	6	×	×	×
689	Maintenance timer 3 warning output set time	59	D9	6	○	×	○
774	Operation panel monitor selection 1	4A	CA	7	○	○	○
775	Operation panel monitor selection 2	4B	CB	7	○	○	○
776	Operation panel monitor selection 3	4C	CC	7	○	○	○
872	Input phase loss protection selection	48	C8	8	○	○	○
876	OH input selection	4C	CC	8	○	○	○
888	Free parameter 1	58	D8	8	○	×	×
889	Free parameter 2	59	D9	8	○	×	×
891	Cumulative power monitor digit shifted times	5B	DB	8	○	○	○
990	PU buzzer control	5A	DA	9	○	○	○
992	Parameter for manufacturer setting. Do not set.						
997	Fault initiation	61	E1	9	×	×	×
1006	Clock (year)	06	86	A	×	×	×
1007	Clock (month, day)	07	87	A	×	×	×
1008	Clock (hour, minute)	08	88	A	×	×	×
1048	Parameter for manufacturer setting. Do not set.						

Appendix 2 Instructions for UL and cUL (Standard to comply with: UL 508C, CSA C22.2)

◆ 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, and check for residual voltage between terminal P/+ and N/- with a meter etc., to avoid a hazard of electrical shock.

WARNING

Operation of the converter unit requires detailed installation and operation instructions provided in the manuals intended for use with the converter unit. Please forward relevant manuals to the end user. The manuals can also be downloaded in PDF form from the Mitsubishi Electric FA Global Website. To order manuals, please contact your sales representative.

WARNING

If the fuse melts down or the breaker trips on the input side of this product, check for wiring faults (such as short circuits). Identify and remove the cause of melting down or the trip before replacing the fuse or resetting the tripped breaker (or before applying the power to the converter unit again).

◆ Installation

The below types of converter unit have been approved as products for use in enclosure.

Design the enclosure so that the surrounding air temperature, humidity and ambience of the converter unit will satisfy the specifications. (Refer to [page 17](#).)

◆ Wiring protection

For installation in the United States, Class T, Class J, Class CC, or Class L fuse must be provided, in accordance with the National Electrical Code and any applicable local codes.

For installation in Canada, Class T, Class J, Class CC, or Class L fuse must be provided, in accordance with the Canadian Electrical Code and any applicable local codes.

FR-CC2-□	C355K	C400K	C560K
Rated fuse voltage (V)	600 V or more		
Fuse maximum allowable rating (A)	700	800	1000

◆ Wiring to the power supply and the motor

Refer to the National Electrical Code (Article 310) regarding the allowable current of the cable. Select the cable size for 125% of the rated current according to the National Electrical Code (Article 430).

For wiring the input (R/L1, S/L2, T/L3) terminals of the converter unit and output (U, V, W) terminals of the inverter, use the UL listed copper, stranded wires (rated at 75°C) and round crimping terminals. Crimp the crimping terminals with the crimping tool recommended by the terminal maker.

◆ Short circuit ratings

Suitable For Use in A Circuit Capable of Delivering Not More Than 100 kA rms Symmetrical Amperes, 600 V Maximum.

Appendix 3 Instructions for UL and cUL (Standard to comply with: UL 61800-5-1, CSA C22.2 No. 274)

◆ Applicable models

- FR-A862-05450 to 08500
FR-F862-05450 to 08500
- The above models are compliant with both UL 508C and UL 61800-5-1, CSA C22.2 No. 274.
For the instructions for UL 61800-5-1, CSA C22.2 No. 274, refer to this Instruction Manual Supplement.
For the instructions for UL 508C, refer to the FR-A862 (SEPARATED CONVERTER TYPE) INSTRUCTION MANUAL (HARDWARE) and FR-F862 (SEPARATED CONVERTER TYPE) INSTRUCTION MANUAL (HARDWARE).

◆ Product handling information / Informations sur la manipulation du produit

-WARNING-

Operation of this product requires detailed installation and operation instructions provided in this Instruction Manual intended for use with this product.

-AVERTISSEMENT

L'utilisation de ce produit nécessite des instructions détaillées d'installation et d'utilisation fournies dans les manuels d'instructions en anglais destinés à être utilisés avec ce produit. Veuillez transmettre les manuels correspondants à l'utilisateur final.

◆ Precautions for compliance with CSA C22.2 No.274

Use the converter unit under the conditions of overvoltage category III and pollution degree 2 or lower specified in IEC60664.

◆ Branch circuit protection

For installation in the United States, branch circuit protection must be provided in accordance with the National Electrical Code and any applicable provincial codes.

For installation in Canada, branch circuit protection must be provided in accordance with the Canadian Electrical Code and any applicable provincial codes. Short circuit protection of the converter unit cannot be used as branch circuit protection. Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local code.

■ Precautions for opening the branch-circuit protective device / Precautions pour ouvrir le dispositif de protection du circuit de dérivation

-WARNING- If the fuse melts down or the breaker trips on the input side of this product, check for wiring faults (such as short circuits). Identify and remove the cause of melting down or the trip before replacing the fuse or resetting the tripped breaker (or before applying the power to the converter unit again).

-AVERTISSEMENTS:

le fusible fond ou si le disjoncteur se déclenche du côté entrée de ce produit, vérifier les défauts de câblage (tels que les courts-circuits). Identifier et éliminer la cause de la fonte ou du déclenchement avant de remplacer le fusible ou de réinitialiser le disjoncteur déclenché (ou avant de remettre sous tension le bloc convertisseur).

■ Fuse selection

Fuses are selected based on IEC/EN/UL 61800-5-1 and CSA C22.2 No. 274.

For installation in the United States, the following semi-conductor fuses must be provided, in accordance with the National Electrical Code and any applicable local codes. For installation in Canada, the following semi-conductor fuses must be provided, in accordance with the Canada Electrical Code and any applicable provincial codes. Always install the following semiconductor fuses for branch circuit protection.

Converter unit model	Cat. No.	Manufacturer	Rating (A)
FR-CC2-C355K	PC33UD69V800TF	Mersen	800
FR-CC2-C400K	PC33UD69V1250TF	Mersen	1250
FR-CC2-C560K	PC33UD69V1250TF	Mersen	1250

◆ Capacitor discharge time / Temps de decharge du condensateur

CAUTION -Risk of Electric Shock-

Before wiring or inspection, check that the LED indicator turns OFF. Any person who is involved in wiring or inspection shall wait for 10 minutes or longer after power OFF and check that there are no residual voltage using a digital multimeter or the like. The capacitor is charged with high voltage for some time after power OFF, and it is dangerous.

ATTENTION -Risque de choc électrique-

Avant le câblage ou l'inspection, vérifier que le témoin LED s'éteint. Toute personne impliquée dans le câblage ou l'inspection doit attendre 10 minutes ou plus après la mise hors tension et vérifier l'absence de tension résiduelle à l'aide d'un multimètre numérique ou similaire. Le condensateur est chargé avec une haute tension pendant un certain temps après la mise hors tension, ce qui est dangereux. Précautions pour ouvrir le dispositif de protection du circuit de dérivation.

◆ Wiring to the power supply and the motor

- Refer to the National Electrical Code (Article 310) regarding the allowable current of the cable. Select the cable size for 125% of the rated current according to the National Electrical Code (Article 430). For wiring the input (R/ L1, S/L2, T/L3) and output (U, V, W) terminals of the converter unit, use the UL listed copper, stranded wires (rated at 75°C) and round crimp terminals. Crimp the terminals with the crimping tool recommended by the terminal manufacturer.

◆ Short circuit ratings

- Suitable for use in a circuit capable of delivering not more than 100 kA rms symmetrical amperes, 600 V maximum.

◆ Applicable power supply

For use at an altitude above 2000 m (maximum 2500 m), only a neutral-point earthed (grounded) power supply can be used.

Appendix 4 Restricted Use of Hazardous Substances in Electronic and Electrical Products

The mark of restricted use of hazardous substances in electronic and electrical products is applied to the product as follows based on the "Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products" of the People's Republic of China.

电器电子产品有害物质限制使用标识要求



本产品中所含有的有害物质的名称、含量、含有部件如下表所示。

- 产品中所含有害物质的名称及含量

部件名称*2	有害物质*1					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr (VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
电路板组件 (包括印刷电路板及其构成的零部件, 如电阻、电容、集成电路、连接器等)、电子部件	×	○	×	○	○	○
金属壳体、金属部件	×	○	○	○	○	○
树脂壳体、树脂部件	○	○	○	○	○	○
螺丝、电线	○	○	○	○	○	○

上表依据SJ/T11364的规定编制。

○: 表示该有害物质在该部件所有均质材料中的含量均在GB/T26572规定的限量要求以下。

×: 表示该有害物质在该部件的至少一种均质材料中的含量超出GB/T26572规定的限量要求。

*1 即使表中记载为 ×, 根据产品型号, 也可能会有有害物质的含量为限制值以下的情况。

*2 根据产品型号, 一部分部件可能不包含在产品中。

Appendix 5 Referenced Standard (Requirement of Chinese standardized law)

This Product is designed and manufactured accordance with following Chinese standards.

Electrical safety	GB/T 12668.501
EMC	GB/T 12668.3

Appendix 6 UL-certified combinations of converter units and inverters

To use converter units with inverters, refer to the "Compatible inverters" section in 2.1.2 Peripheral devices (page 14). Other Mitsubishi Electric inverters are also available. For details, contact the nearest Mitsubishi Electric FA center.

MEMO

WARRANTY

When using this product, make sure to understand the warranty described below.

1. Warranty period and coverage

We will repair any failure or defect (hereinafter referred to as "failure") in our FA equipment (hereinafter referred to as the "Product") arisen during warranty period at no charge due to causes for which we are responsible through the distributor from which you purchased the Product or our service provider. However, we will charge the actual cost of dispatching our engineer for an on-site repair work on request by customer in Japan or overseas countries. We are not responsible for any on-site readjustment and/or trial run that may be required after a defective unit are repaired or replaced.

[Term]

The term of warranty for Product is twelve months after your purchase or delivery of the Product to a place designated by you or eighteen months from the date of manufacture whichever comes first ("Warranty Period"). Warranty period for repaired Product cannot exceed beyond the original warranty period before any repair work.

[Limitations]

- (1) You are requested to conduct an initial failure diagnosis by yourself, as a general rule. It can also be carried out by us or our service company upon your request and the actual cost will be charged.
However, it will not be charged if we are responsible for the cause of the failure.
- (2) This limited warranty applies only when the condition, method, environment, etc. of use are in compliance with the terms and conditions and instructions that are set forth in the instruction manual and user manual for the Product and the caution label affixed to the Product.
- (3) Even during the term of warranty, the repair cost will be charged on you in the following cases;
 - a failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem
 - a failure caused by any alteration, etc. to the Product made on your side without our approval
 - a failure which may be regarded as avoidable, if your equipment in which the Product is incorporated is equipped with a safety device required by applicable laws and has any function or structure considered to be indispensable according to a common sense in the industry
 - a failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
 - any replacement of consumable parts (condenser, cooling fan, etc.)
 - a failure caused by external factors such as inevitable accidents, including without limitation fire and abnormal fluctuation of voltage, and acts of God, including without limitation earthquake, lightning and natural disasters
 - a failure generated by an unforeseeable cause with a scientific technology that was not available at the time of the shipment of the Product from our company
 - any other failures which we are not responsible for or which you acknowledge we are not responsible for

2. Term of warranty after the stop of production

- (1) We may accept the repair at charge for another seven (7) years after the production of the product is discontinued. The announcement of the stop of production for each model can be seen in our Sales and Service, etc.
- (2) Please note that the Product (including its spare parts) cannot be ordered after its stop of production.

3. Service in overseas

Our regional FA Center in overseas countries will accept the repair work of the Product; however, the terms and conditions of the repair work may differ depending on each FA Center. Please ask your local FA center for details.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to:

- (1) Damages caused by any cause found not to be the responsibility of Mitsubishi.
- (2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.
- (3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.
- (4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Change of Product specifications

Specifications listed in our catalogs, manuals or technical documents may be changed without notice.

6. Application and use of the Product

- (1) For the use of our product, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in product, and a backup or fail-safe function should operate on an external system to product when any failure or malfunction occurs.
- (2) Our product is designed and manufactured as a general purpose product for use at general industries.
Therefore, applications substantially influential on the public interest for such as atomic power plants and other power plants of electric power companies, and also which require a special quality assurance system, including applications for railway companies and government or public offices are not recommended, and we assume no responsibility for any failure caused by these applications when used.
In addition, applications which may be substantially influential to human lives or properties for such as airlines, medical treatments, railway service, incineration and fuel systems, man-operated material handling equipment, entertainment machines, safety machines, etc. are not recommended, and we assume no responsibility for any failure caused by these applications when used.
We will review the acceptability of the abovementioned applications, if you agree not to require a specific quality for a specific application. Please contact us for consultation.

REVISIONS

*The manual number is given on the bottom left of the back cover.

Revision date	*Manual number	Revision
Nov. 2014	IB(NA)-0600572ENG-A	First edition
Sep. 2016	IB(NA)-0600572ENG-B	Added · Compatibility with the FR-F800 series
Jul. 2021	IB(NA)-0600572ENG-C	Added · Appendix 4 Referenced Standard (Requirement of Chinese standardized law) · Appendix 5 UL-certified combinations of converter units and inverters
Aug. 2023	IB(NA)-0600572ENG-D	Added · Cooling fan operation selection (Pr.244) · Instructions for UL and cUL
Mar. 2024	IB(NA)-0600572ENG-E	Added · Emergency drive Emergency drive dedicated retry waiting time (Pr.514) Emergency drive dedicated retry count (Pr.515) Emergency drive selection (Pr.523)
Oct. 2024	IB(NA)-0600572ENG-F	Added · Setting values "252 and 253" of Pr.190 to Pr.195 · IPL signal

mitsubishi **ELECTRIC CORPORATION**
HEAD OFFICE: TOKYO BUILDING 2-7-3, MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN