MITSUBISHI ELECTRIC

700 series

INVERTER
FR-E700
INSTALLATION GUIDELINE

Ethernet communication function

FR-E740-016SC to 300SC-ENE
FR-E720S-008SC to 110SC-ENE

Thank you for choosing this Mitsubishi Electric Inverter.
Please read through this Installation Guideline and a CD-ROM enclosed to operate this inverter correctly.
Do not use this product until you have a full knowledge of the equipment, safety information and instructions.
Please forward this Installation Guideline and the CD-ROM to the end user.

CONTENTS

This Installation Guideline provides handling information and precautions for use of the equipment.
Please forward this Installation Guideline to the end user.

This section is specifically about safety matters

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

In this Installation Guideline, the safety instruction levels are classified into "WARNING" and "CAUTION".

⚠**WARNING** — Incorrect handling may cause hazardous conditions, resulting in death or severe injury.

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

The ⚠CAUTION level may even lead to a serious consequence according to conditions. Both instruction levels must be followed because these are important to personal safety.

1. Electric Shock Prevention

⚠**WARNING**

● While the inverter power is ON, do not remove the front cover or the wiring cover. Do not run the inverter with the front cover or the wiring 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. You may accidentally touch the charged inverter circuits and get an electric shock.
● Before wiring or inspection, power must be switched OFF. To confirm that, LED indication of the operation panel must be checked. (It must be OFF.) Any person who is involved in wiring or inspection shall wait for at least 10 minutes after the power supply has been switched OFF and check that there are no residual voltage using a tester or the like. The capacitor is charged with high voltage for some time after power OFF, and it is dangerous.
● This inverter must be earthed (grounded). Earthing (grounding) must conform to the requirements of national and local safety regulations and electrical code (NEC section 250, IEC 61140 class 1 and other applicable standards).
A neutral-point earthed (grounded) power supply for 400V class inverter in compliance with EN standard must be used.
● Any person who is involved in wiring or inspection of this equipment shall be fully competent to do the work.
● The inverter must be installed before wiring. Otherwise, you may get an electric shock or be injured.
● Setting dial and key operations must be performed with dry hands to prevent an electric shock. 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. Otherwise you may get an electric shock.
● When measuring the main circuit capacitor capacity, the DC voltage is applied to the motor for 1s at powering OFF. Never touch the motor terminal, etc. right after powering OFF to prevent an electric shock.

2. Fire Prevention

⚠**CAUTION**

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

3.Injury Prevention

⚠**CAUTION**

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

4. Additional Instructions

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

(1) Transportation and Mounting

⚠**CAUTION**

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

Environment		
	Surrounding air temperature	-10°C to +50°C (non-freezing)
	Ambient humidity	90%RH or less (non-condensing)
	Storage temperature	-20°C to +65°C *1
	Atmosphere	Indoors (free from corrosive gas, flammable gas, oil mist, dust and dirt)
	Altitude/ vibration	Maximum 1000m for standard operation *2 5.9m/s² or less at 10 to 55Hz (directions of X, Y, Z axes)

*1 Temperature applicable for a short time, e.g. in transit.
*2 For the installation at an altitude above 1000m up to 2500m, consider a 3% reduction in the rated current per 500m increase in altitude.

⚠CAUTION

- If halogen-based materials (fluorine, chlorine, bromine, iodine, etc.) infiltrate into a Mitsubishi Electric product, the product will be damaged. Halogenbased materials are often included in fumigant, which is used to sterilize or disinfest wooden packages. When packaging, prevent residual fumigant components from being infiltrated into Mitsubishi Electric products, or use an alternative sterilization or disinfection method (heat disinfection, etc.) for packaging. Sterilization of disinfection of wooden package should also be performed before packaging the product.

(2) Wiring

⚠CAUTION

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

(3) Trial run

⚠CAUTION

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

(4) Usage

⚠WARNING

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

⚠CAUTION

- The electronic thermal relay function does not guarantee protection of the motor from overheating. It is recommended to install both an external thermal and PTC thermistor for overheat protection.
- Do not use a magnetic contactor on the inverter input for frequent starting/stopping of the inverter. Otherwise the life of the inverter decreases.
- The effect of electromagnetic interference must be reduced by using a noise filter or by other means. Otherwise nearby electronic equipment may be affected.
- Appropriate measures must be taken to suppress harmonics. Otherwise power supply harmonics from the inverter may heat/damage the power factor correction capacitor and generator.
- When driving a 400V class motor by the inverter, the motor must be an insulation-enhanced motor or measures must be taken to suppress surge voltage. Surge voltage attributable to the wiring constants may occur at the motor terminals, deteriorating the insulation of the motor.
- When parameter clear or all parameter clear is performed, the required parameters must be set again before starting operations because all parameters return to the initial value.

⚠CAUTION

- The inverter can be easily set for high-speed operation. Before changing its setting, the performances of the motor and machine must be fully examined.
- Stop status cannot be hold by the inverter's brake function. In addition to the inverter's brake function, a holding device must be installed to ensure safety.
- Before running an inverter which had been stored for a long period, inspection and test operation must be performed.
- Static electricity in your body must be discharged before you touch the product. Otherwise the product may be damaged.
- If you are installing the inverter to drive a three-phase device while you are contracted for lighting and power service, consult your electric power supplier.
- In order to protect the inverter and the system against unauthorized access by external systems via network, take security measures including firewall settings.
- Depending on the network environment, the inverter may not operate as intended due to delays or disconnection in communication. Carefully consider the conditions and safety for the inverter on site.

(5) Emergency stop

⚠CAUTION

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

(6) Maintenance, inspection and parts replacement

⚠CAUTION

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

(7) Disposal

⚠CAUTION

- The inverter must be treated as industrial waste.

General instruction

Many of the diagrams and drawings in this Installation Guideline 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 this Installation Guideline must be followed when operating the product.

1 PRODUCT CHECKING AND PARTS IDENTIFICATION

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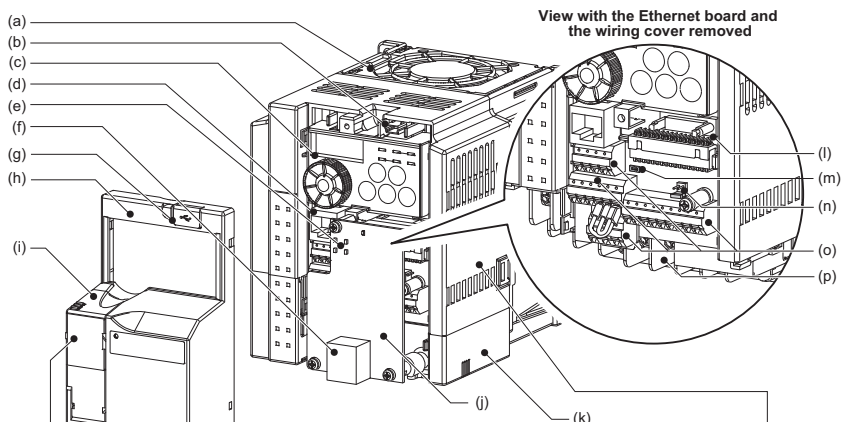
● **Inverter model**

FR - **E740** - **016** **SC** - E **NE**

Symbol	Voltage Class
E740	Three-phase 400V class
E720S	Single-phase 200V class

Represents the rated current

Symbol	Control Circuit Terminal Specification
SC	Safety stop function model

Symbol	Function
NE	Ethernet communication

● **Component names (FR-E740-016SC-ENE)**

View with the Ethernet board and the wiring cover removed

Capacity plate

FR-E740-016SC-ENE ←Inverter model

SERIAL : **XXXXXX** ←Serial number

Rating plate

Inverter model
Input rating
Output rating
Serial number
Country of origin

MITSUBISHI ELECTRIC (PASSED) INVERTER
MODEL FR-E740-016SC-ENE
INPUT :XXXXX
OUTPUT :XXXXX
SERIAL :
MITSUBISHI ELECTRIC CORPORATION
MADE IN JAPAN
SAMPLE

Symbol	Name	Refer to Page
(a)	Cooling fan	*1
(b)	USB connector (mini-B connector)	6
(c)	Operation panel	*1
(d)	PU connector	6
(e)	LED indicator for communication status	*2
(f)	Ethernet communication connector	14
(g)	USB connector cover	*1
(h)	Front cover	*1
(i)	PU connector cover	14

Symbol	Name	Refer to Page
(j)	Ethernet board	13
(k)	Combed shaped wiring cover	*1
(l)	Ethernet board connector	13
(m)	Voltage/current input switch	6
(n)	Control logic switchover jumper connector*3	*1
(o)	Control circuit terminal block	*1
(p)	Main circuit terminal block	*1

*1   Refer to the FR-E700-EC Instruction Manual.
*2   Refer to the FR-E700-NE Ethernet Function Manual.
*3   The jumper connector is set in the source logic (SOURCE) position when shipped from the factory.

NOTE
• **All the switches (SW1 to SW3) on the Ethernet board are for manufacturer setting. Do not change the initial setting (OFF).**

REMARKS
• For how to find the SERIAL number, refer to *page 29*.

● Installation of the inverter

Enclosure surface mounting

Before installation, remove the front cover and the wiring cover. (Remove the covers in the directions of the arrows.)
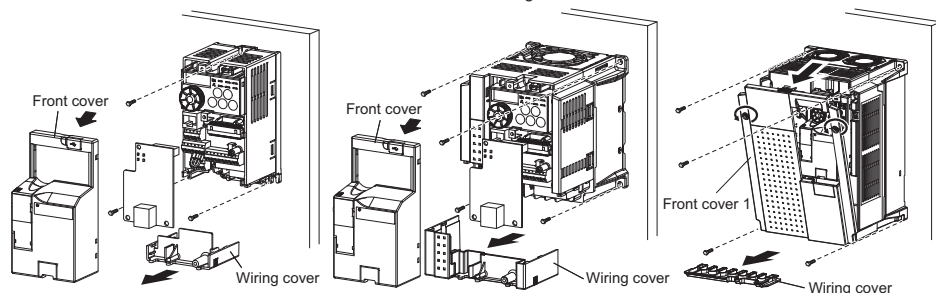
For the FR-E740-170SC or lower or FR-E720S-110SC or lower inverter, additionally remove the Ethernet board. *(Refer to page 13.)*

●FR-E720S-008SC to 030SC   ●FR-E740-016SC to 170SC   ●FR-E740-230SC, 300SC
                            ●FR-E720S-050SC or higher

Front cover

Wiring cover

Front cover

Wiring cover

Front cover 1

Wiring cover

NOTE
• When encasing multiple inverters, install them in parallel as a cooling measure.
• When using the inverters at the surrounding air temperature of 40°C or less, the inverters can be installed without any clearance between them (0cm clearance). When surrounding air temperature exceeds 40°C, clearances between the inverters should be 1cm or more (5cm or more for the FR-E740-120SC or higher).
• Install the inverter vertically.

10cm or more

10cm or more

Vertical

Refer to the clearances on the left.
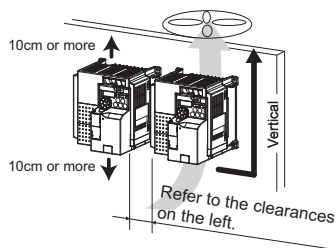
● General Precaution

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.

● Environment

Before installation, check that the environment meets following specifications.

Surrounding air temperature	-10°C to +50°C (non-freezing)	
Ambient humidity	90% RH or less (non-condensing)	
Storage temperature	-20°C to +65°C ∗1	
Ambience	Indoors (free from corrosive gas, flammable gas, oil mist, dust and dirt)	
Altitude, vibration	Maximum 1000m for standard operation ∗2 5.9m/s² or less at 10 to 55Hz (directions of X, Y, Z axes)	

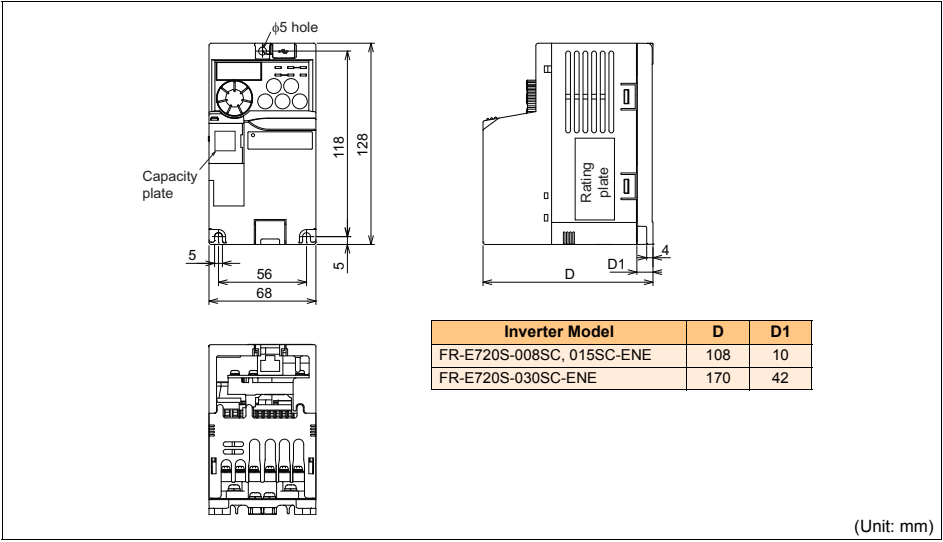∗1   Temperature applicable for a short time, e.g. in transit.

∗2   For the installation at an altitude above 1000m up to 2500m, consider a 3% reduction in the rated current per 500m increase in altitude.
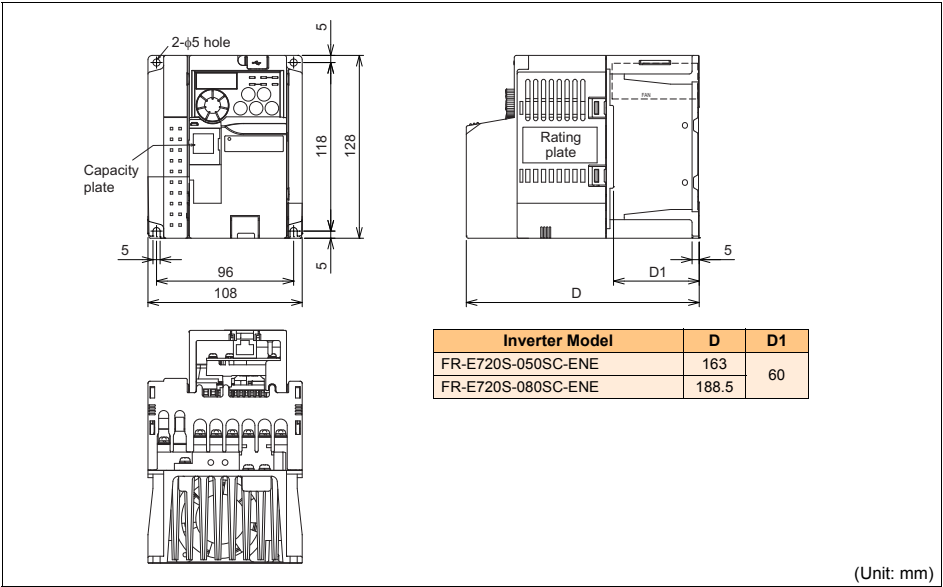
Note
• Install the inverter on a strong surface securely and vertically with bolts.
• Leave enough clearances and take cooling measures.
• Avoid places where the inverter is subjected to direct sunlight, high temperature and high humidity.
• Install the inverter on a non-combustible wall surface.
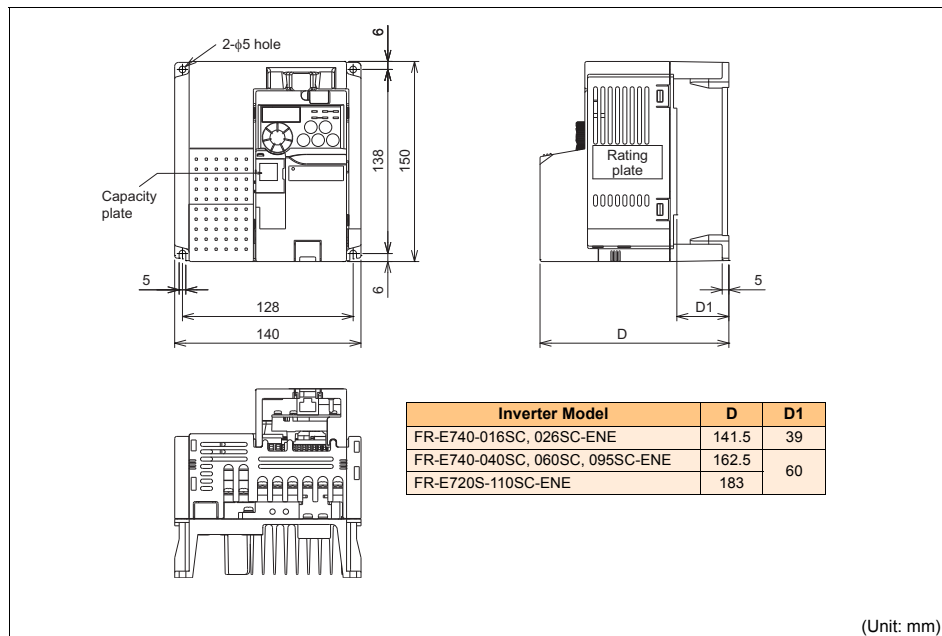
2 OUTLINE DIMENSION DRAWINGS

● FR-E720S-008SC to 030SC-ENE

Inverter Model	D	D1
FR-E720S-008SC, 015SC-ENE	108	10
FR-E720S-030SC-ENE	170	42

(Unit: mm)

● FR-E720S-050SC, 080SC-ENE

Inverter Model	D	D1
FR-E720S-050SC-ENE	163	60
FR-E720S-080SC-ENE	188.5	

(Unit: mm)

● FR-E740-016SC to 095SC-ENE
● FR-E720S-110SC-ENE

Inverter Model	D	D1
FR-E740-016SC, 026SC-ENE	141.5	39
FR-E740-040SC, 060SC, 095SC-ENE	162.5	60
FR-E720S-110SC-ENE	183	

(Unit: mm)

● FR-E740-120SC, 170SC-ENE

(Unit: mm)

4

● FR-E740-230SC, 300SC-ENE

2-φ6 hole

8

244

260

6

195

220

8

Capacity plate

Rating plate

10.5

84.5

217.5

211

(Unit: mm)

3 WIRING

3.1 Terminal connection diagram

Source logic
⊙ Main circuit terminal
◯ Control circuit terminal

Single-phase power input

MCCB   MC

Single-phase
AC power
supply

L1
N

*1. DC reactor (FR-HEL)
When connecting a DC reactor, remove the jumper across P1 and P/+.

Brake unit (Option)

*6 A brake transistor is not built-in to the FR-E720S-008SC and 015SC.

*7 Brake resistor (FR-ABR, MRS type)
Install a thermal relay to prevent an overheat and burnout of the brake resistor. (The brake resistor cannot be connected to the FR-E720S-008SC and 015SC.)

Earth (Ground)

*1
*7

Jumper   PR   N/-
P1   P/+   *6

MCCB   MC

Three-phase
AC power
supply

R/L1
S/L2
T/L3

Earth (Ground)

Main circuit

Control circuit

U
V
W

Motor

IM

Earth (Ground)

Control input signals (No voltage input allowed)

Terminal functions vary with the input terminal assignment (*Pr. 178 to Pr. 182 and Pr. 184*)

Forward rotation start — STF
Reverse rotation start — STR

Multi-speed selection
High speed — RH
Middle speed — RM
Low speed — RL

*2 When using terminals PC-SD as a 24VDC power supply, take care not to short across terminals PC-SD.

Reset — RES

SD   SOURCE SINK

Contact input common
24VDC power supply
(Common for external power supply transistor)
Safety stop input common terminal — PC *2

Safety stop input (Channel 1) — S1
Safety stop input (Channel 2) — S2

Shorting wire

Frequency setting signals (Analog)

*3 Terminal input specifications can be changed by analog input specifications switchover (*Pr. 73*).

*4 It is recommended to use 2W1kΩ when the frequency setting signal is changed frequently.

Frequency setting potentiometer 1/2W1kΩ

10(+5V)
2 0 to 5VDC *3 (0 to 10VDC)
5 (Analog common)

Terminal 4 input (+)
(Current input) (-)

4 4 to 20mADC
(0 to 5VDC)
(0 to 10VDC) *5

*5 Terminal input specifications can be changed by analog input specifications switchover (*Pr. 267*). Set the voltage/current input switch in the "V" position to select voltage input (0 to 5V/0 to10V) and "I" (initial value) to select current input (4 to 20mA).
To use terminal 4 (initial setting is current input), set "4" in any of *Pr.178 to Pr.184 (input terminal function selection)* to assign the function, and turn ON AU signal.

V ▭ I
Voltage/current input switch *5

Relay output

C
B
A

Relay output (Fault output)

Terminal functions vary by *Pr. 192 A,B,C terminal function selection*

Open collector output

RUN — Running
FU — Frequency detection

Terminal functions vary with the output terminal assignment (*Pr. 190 and Pr. 191*)

SE — Open collector output common Sink/source common

AM — Analog signal output (0 to 10VDC)
(+)
(-)

5

PU connector

USB connector

*8

Ethernet connector

*8 A personal computer and an inverter can be connected with a USB (Ver1.1) cable. You can perform parameter setting and monitoring with the FR Configurator2 (SW1DND-FRC2-□).
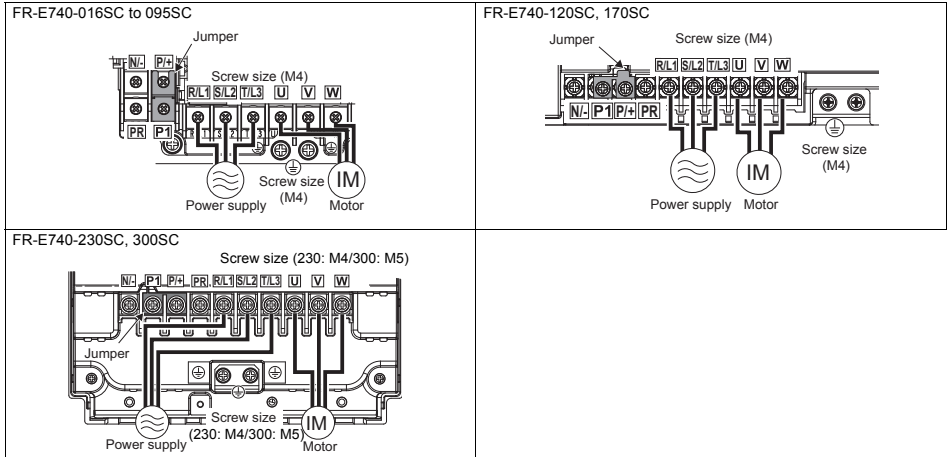
NOTE

- To prevent a malfunction caused by noise, separate the signal cables more than 10cm from the power cables. Also separate the main circuit wire of the input side and the output side.
- After wiring, wire offcuts must not be left in the inverter.
  Wire offcuts can cause an alarm, failure or malfunction. Always keep the inverter clean. When drilling mounting holes in an enclosure etc., take care not to allow chips and other foreign matter to enter the inverter.
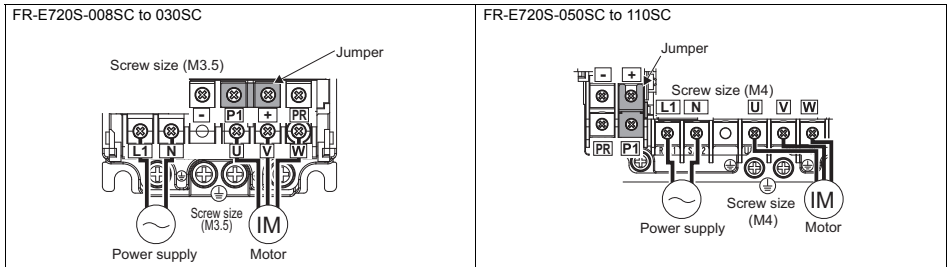- The output of the single-phase power input model is three-phase 200V.

3.2 Main circuit terminal specifications

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

● **Three-phase 400V class**

FR-E740-016SC to 095SC	FR-E740-120SC, 170SC

FR-E740-230SC, 300SC

● **Single-phase 200V class**

FR-E720S-008SC to 030SC	FR-E720S-050SC to 110SC

NOTE

- Before wiring cables to the main circuit terminals, remove the wiring cover. (For the FR-E740-170SC or lower or FR-E720S-110SC or lower inverter, additionally remove the Ethernet board.)
  To remove the Ethernet board, refer to *page 13*. To remove the wiring cover, refer to *page 2*.
- Make sure the power cables are connected to the R/L1, S/L2, T/L3. Never connect the power cable to the U, V, W of the inverter. (Phase need not be matched.) Doing so will damage the inverter.
- Connect the motor to U, V, W. Turning ON the forward rotation switch (signal) at this time rotates the motor counterclockwise when viewed from the load shaft.

3.2.2 Cables and wiring length

(1) Cable size and other specifications of the main circuit terminals and the earthing terminal

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

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

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

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

Applicable Inverter Model	Terminal Screw Size *4	Tightening Torque N·m	Crimp Terminal		Cable Size							
					HIV Cables, etc. (mm^2) *1			AWG *2		PVC Cables, etc. (mm^2) *3		
			R/L1 S/L2 T/L3	U, V, W	R/L1 S/L2 T/L3	U, V, W	Earthing cable	R/L1 S/L2 T/L3	U, V, W	R/L1 S/L2 T/L3	U, V, W	Earthing cable
FR-E740-016SC to 095SC	M4	1.5	2-4	2-4	2	2	2	14	14	2.5	2.5	2.5
FR-E740-120SC	M4	1.5	5.5-4	2-4	3.5	2	3.5	12	14	4	2.5	4
FR-E740-170SC	M4	1.5	5.5-4	5.5-4	3.5	3.5	3.5	12	12	4	4	4
FR-E740-230SC	M4	1.5	5.5-4	5.5-4	5.5	5.5	5.5	10	10	6	6	10
FR-E740-300SC	M5	2.5	8-5	8-5	8	8	5.5	8	8	10	10	10

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

Applicable Inverter Model	Terminal Screw Size *4	Tightening Torque N·m	Crimp Terminal		Cable Size							
					HIV Cables, etc. (mm^2) *1			AWG *2		PVC Cables, etc. (mm^2) *3		
			L1 N	U, V, W	L1 N	U, V, W	Earthing cable	L1 N	U, V, W	L1 N	U, V, W	Earthing cable
FR-E720S-008SC to 030SC	M3.5	1.2	2-3.5	2-3.5	2	2	2	14	14	2.5	2.5	2.5
FR-E720S-050SC	M4	1.5	2-4	2-4	2	2	2	14	14	2.5	2.5	2.5
FR-E720S-080SC	M4	1.5	2-4	2-4	2	2	2	14	14	2.5	2.5	2.5
FR-E720S-110SC	M4	1.5	5.5-4	2-4	3.5	2	2	12	14	4	2.5	2.5

*1   The cable size is that of the cable (HIV cable (600V class 2 vinyl-insulated cable) etc.) with continuous maximum permissible temperature of 75°C. Assumes that the surrounding air temperature is 50°C or less and the wiring distance is 20m or less.

*2   The recommended cable size is that of the cable (THHW cable) with continuous maximum permissible temperature of 75°C. Assumes that the surrounding air temperature is 40°C or less and the wiring distance is 20m or less.
(For the use in the United States or Canada, refer to *page 28*.)

*3   The recommended cable size is that of the cable (PVC cable) with continuous maximum permissible temperature of 70°C. Assumes that the surrounding air temperature is 40°C or less and the wiring distance is 20m or less.
(Selection example for use mainly in Europe.)

*4   The terminal screw size indicates the terminal size for R/L1, S/L2, T/L3, U, V, W, PR, P/+, N/-, P1 and a screw for earthing (grounding).
(For single-phase power input, the terminal screw size indicates the size of terminal screw for L1, N, U, V, W, PR, +, -, P1 and a screw for earthing (grounding).)

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

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.

(2) Total wiring length

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

200V class

Pr. 72 PWM frequency selection Setting (carrier frequency)	008	015	030	050	080	110	175 or higher
1 (1kHz) or less	200m	200m	300m	500m	500m	500m	500m
2 to15 (2kHz to 14.5kHz)	30m	100m	200m	300m	500m	500m	500m

400V class

Pr. 72 PWM frequency selection Setting (carrier frequency)	016	026	040	060	095 or higher
1 (1kHz) or less	200m	200m	300m	500m	500m
2 to15 (2kHz to 14.5kHz)	30m	100m	200m	300m	500m

Total wiring length (FR-E740-095SC or higher)

500m or less

300m

300m

300m+300m=600m
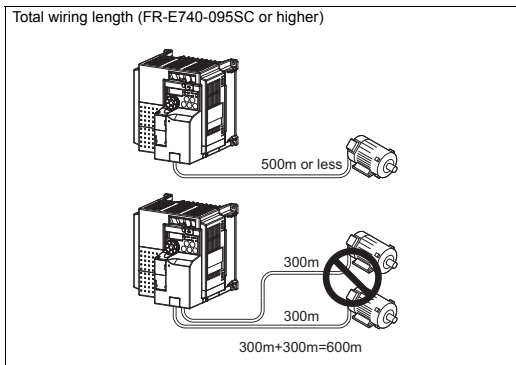
When driving a 400V class motor by the inverter, surge voltages attributable to the wiring constants may occur at the motor terminals, deteriorating the insulation of the motor. Take the following measures 1) or 2) in this case.

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

	Wiring Length		
	50m or less	50m to 100m	Exceeding 100m
Carrier frequency	14.5kHz or less	8kHz or less	2kHz or less

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

NOTE
- Especially for long-distance wiring, the inverter may be affected by a charging current caused by the stray capacitances of the wiring, leading to a malfunction of the overcurrent protective function, fast response current limit function, or stall prevention function or a malfunction or fault of the equipment connected on the inverter output side. If malfunction of fast-response current limit function occurs, disable this function. If malfunction of stall prevention function occurs, increase the stall level. (*Refer to Pr. 22 Stall prevention operation level* and *Pr. 156 Stall prevention operation selection in Chapter 4 of the FR-E700-EC Instruction Manual*)
- *Refer to Chapter 4 of the FR-E700-EC Instruction Manual* for details of *Pr. 72 PWM frequency selection*. Refer to the manual of the option for details of surge voltage suppression filter (FR-ASF-H/FR-BMF-H).
- When using the automatic restart after instantaneous power failure function with wiring length exceeding than 100m, select without frequency search (*Pr. 162* = "1, 11"). (*Refer to Chapter 4 of the FR-E700-EC Instruction Manual*)

3.3 Control circuit specifications

● **Control circuit terminal layout**

Recommend wire size:

0.3mm^2 to 0.75mm^2
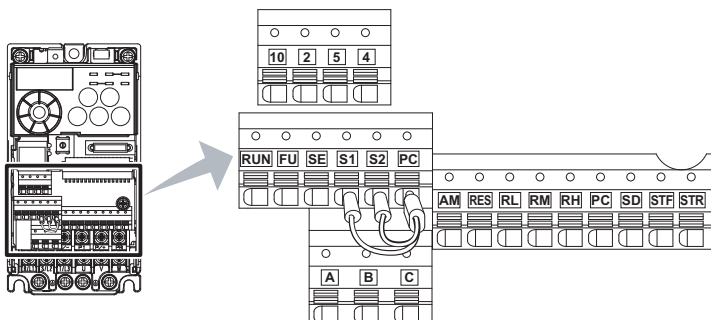
● **Wiring method**

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

1) Strip off the sheath about the size below. If the length of the sheath peeled is too long, a short circuit may occur among neighboring wires. If the length is too short, wires might come off.
Wire the stripped wire after twisting it to prevent it from becoming loose. In addition, do not solder it.

Wire stripping length

10mm
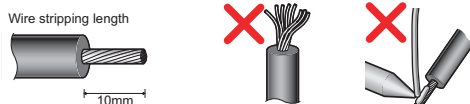
2) Crimp the blade terminal.
Insert wires to a blade terminal, and check that the wires come out for about 0 to 0.5mm from a sleeve.
Check the condition of the blade terminal after crimping. Do not use a blade terminal of which the crimping is inappropriate, or the face is damaged.

Damaged   Crumpled tip   Wires are not inserted into the sleeve

Unstranded wires
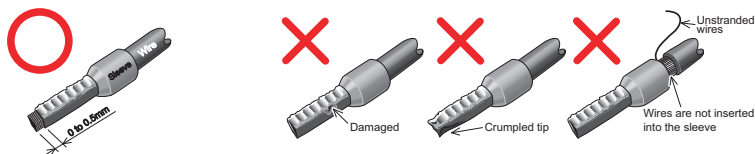
Blade terminals available on the market (as of Jan. 2017)

●Phoenix Contact Co., Ltd.

Wire Size (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	A1-10	AI 1-10RD/1000GB	
1.25, 1.5	AI 1,5-10BK	A1,5-10	AI 1,5-10BK/1000GB *2	
0.75 (for two wires)	AI-TWIN 2 x 0,75-10GY	—	—	

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

*2   Applicable for terminal ABC.

●NICHIFU Co., Ltd.

Wire Size (mm^2)	Blade Terminal Product Number	Insulation Cap Product Number	Crimping Tool Product Number
0.3 to 0.75	BT 0.75-11	VC 0.75	NH 69

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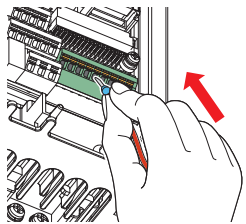
When using a single wire or stranded wire without a blade terminal, push an open/close button all the way down with a flathead screw driver, and insert the wire.
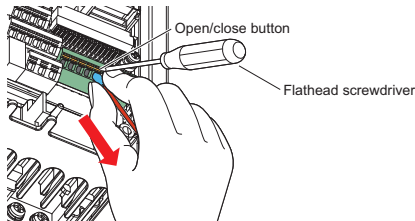

Open/close button

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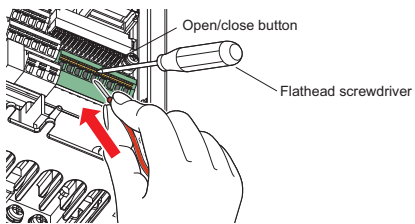
NOTE
- When using a stranded wire without a blade terminal, twist enough to avoid short circuit with a nearby terminals or wires.
- Place the flathead screwdriver vertical to the open/close button. In case the blade tip slips, it may cause an inverter damage or injury.

● Wire removal

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

Open/close button

Flathead screwdriver

NOTE
- During wiring, 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: 0.4mm / tip width: 2.5mm).
  If a flathead screwdriver with a narrow tip is used, terminal block may be damaged.
  Introduced products (as of Jan. 2017)

Product	Type	Manufacturer
Flathead screwdriver	SZF 0- 0,4 x 2,5	Phoenix Contact Co., Ltd.

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

(1) Wiring instructions

- It is recommended to use the cables of 0.3mm^2 to 0.75mm^2 gauge for connection to the control circuit terminals.
- The maximum wiring length should be 30m .
- Do not short terminal PC and SD. Inverter may be damaged.
- Terminals PC, SE and 5 are common to the I/O signals. Do not earth them.
- Use shielded or twisted cables for connection to the control circuit terminals and run them away from the main and power circuits (including the 200V relay sequence circuit).
- When using contact inputs, use two or more parallel micro-signal contacts or twin contacts to prevent contact faults since the control circuit input signals are micro-currents.
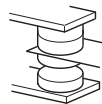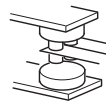
Micro signal contacts   Twin contacts

- To suppress EMI, use shielded or twisted cables for the control circuit terminals and run them away from the main and power circuits (including the 200V relay sequence circuit). For the cables connected to the control circuit terminals, connect their shields to the common terminal of the connected control circuit terminal. When connecting an external power supply to terminal PC, however, connect the shield of the power supply cable to the negative side of the external power supply. Do not directly earth (ground) the shield to the enclosure, etc.
- Always apply a voltage to the fault output terminals (A, B, C) via a relay coil, lamp, etc.
- When using an external power supply for transistor output, note the following points to prevent a malfunction caused by undesirable current.
  Do not connect any terminal SD on the inverter and the 0V terminal of the external power supply (when the sink logic is selected).
  Do not connect terminal PC on the inverter and the +24V terminal of the external power supply (when the source logic is selected).
  Do not install an external power source in parallel with the internal 24VDC power source (connected to terminals PC and SD) to use them together.
  Refer to Chapter 2 of the FR-E700-EC Instruction Manual for the detail.

3.4   Removal of the Ethernet board

The Ethernet board is installed in the initial status. Before wiring cables to the control circuit terminals or to the main circuit terminals on the FR-E740-170SC or lower or FR-E720S-050SC or lower inverter, remove the Ethernet board as follows.
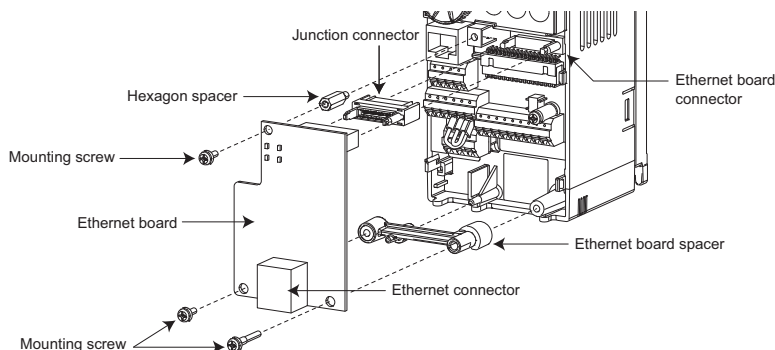
1) Remove the inverter front cover. (Refer to *page 2* to remove the front cover.)
2) Remove the three mounting screws to remove the Ethernet board, Ethernet board spacer, junction connector, and hexagon spacer.

NOTE

- **After the installation of the inverter or the wiring of the cables to the main or control circuit terminals, ensure to reinstall the Ethernet board to the inverter in the reverse order. The tightening torque for the mounting screws of the Ethernet board is 0.2 to 0.4N·m.**
- **Plug-in options cannot be used with this inverter.**

3.5   Ethernet communication specifications

Item	Description
Category	100BASE-TX/10BASE-T
Data transmission speed	100Mbps (100BASE-TX) / 10Mbps (10BASE-T)
Transmission method	Baseband
Maximum segment length	100m between the hub and the inverter
Number of cascade connection stages	Up to 2 (100BASE-TX) / up to 4 (10BASE-T)
Interface	RJ-45
Number of interfaces available	1
IP version	IPv4

3.6 Ethernet cable connection

Connect the Ethernet cable to the Ethernet connector.

• Connection cable

Use Ethernet cables compliant with the following standards.

Communication Speed	Cable	Connector	Type
100Mbps	Category 5 or higher, (shielded / STP) straight cable		100BASE-TX
10Mbps	Category 3 or higher, (shielded / STP) straight cable	RJ-45 connector	10BASE-T
	Category 3 or higher, (UTP) straight cable		

• Hub

Use a hub that supports a desired transmission speed of the Ethernet.

NOTE

• **Do not connect the Ethernet cable to the PU connector. The product could be damaged due to differences in electrical specifications.**

3.7 Earthing (grounding) for Ethernet board

To reduce noise of the Ethernet cable, connect an earth (ground) cable from the lower left M3 mounting screw on the Ethernet board to the inverter enclosure (the earth cable must be as short as possible).

For earth (ground) connection to the enclosure
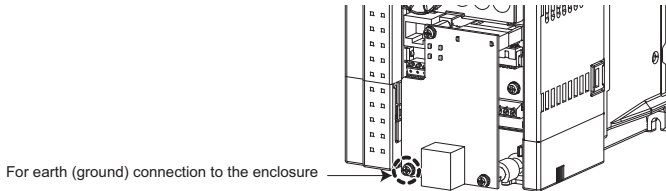
3.8 Connection to the PU connector

The PU connector can be used to connect the parameter unit (FR-PU07), enclosure surface operation panel (FR-PA07), personal computer, etc. for the inverter operation.

How to open the cover
Put a finger on top of the front cover and pull it open.

PU connector
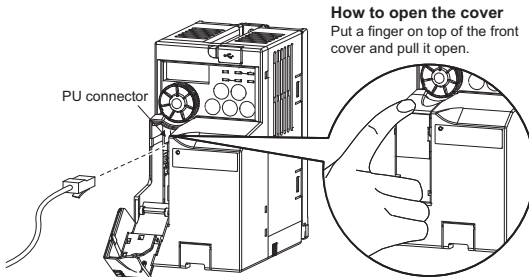
4 PRECAUTIONS FOR USE OF THE INVERTER

The FR-E700 series is a highly reliable product, but using incorrect peripheral circuits or incorrect operation/handling methods may shorten the product life or damage the product.
Before starting operation, always recheck the following items.

(1) **Use crimp terminals with insulation sleeve to wire the power supply and motor.**

(2) **Application of power to the output terminals (U, V, W) of the inverter will damage the inverter. Never perform such wiring.**

(3) **After wiring, wire offcuts must not be left in the inverter.**

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

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

(4) **Use cables of the appropriate size to make a voltage drop of 2% or less.**

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

   Refer to *page 8* for the recommended wire sizes.

(5) **The total wiring length should be within the prescribed length.**

   Especially for long distance wiring, the fast-response current limit function may decrease, or the equipment connected to the output side may malfunction. This is caused by a charging current due to the stray capacity of the wiring. Therefore, note the overall wiring length. *(Refer to page 9)*

(6) **Electromagnetic wave interference**

   The input/output (main circuit) of the inverter includes high frequency components, which may interfere with the communication devices (such as AM radios) used near the inverter. In this case, install the FR-BIF optional capacitor type filter (for use in the input side only) or FR-BSF01 line noise filter to minimize interference.

(7) **Electrical corrosion of the bearing**

   When a motor is driven by the inverter, axial voltage is generated on the motor shaft, which may cause electrical corrosion of the bearing in rare cases depending on the wiring, load, operating conditions of the motor or specific inverter settings (high carrier frequency, use of a capacitive filter∗1).

   The following shows examples of countermeasures for the inverter.

   • Decrease the carrier frequency.

   • Remove the capacitive filter.

   • Provide a common mode choke∗2 on the output side of the inverter. (This is effective regardless of the use of the capacitive filter.)

   ∗1   Mitsubishi Electric capacitive filter: FR-BIF, SF[], FR-E5NF-[], FR-S5NFSA[], FR-BFP2-[]

   ∗2   Recommended common mode choke: FT-3KM F series FINEMET® common mode choke cores manufactured by Hitachi Metals, Ltd. FINEMET is a registered trademark of Hitachi Metals, Ltd.

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

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

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

   When accessing the inverter for inspection, wait for at least 10 minutes after the power supply has been switched OFF, and then make sure that the voltage across the main circuit terminals P/+ and N/- of the inverter is no more than 30VDC using a tester.

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

   • Fully check the insulation resistance of the circuit prior to inverter operation since repeated short circuits may damage the inverter modules. These short circuits may be caused by peripheral circuit inadequacy, an earth (ground) fault caused by wiring inadequacy, or reduced motor insulation resistance.

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

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

Since repeated inrush currents at power ON will shorten the life of the converter circuit (switching life is about 1,000,000 times), frequent starts and stops of the MC must be avoided. Turn ON/OFF the inverter start controlling terminals (STF, STR) to run/stop the inverter. *(▥ Refer to the FR-E700-EC Instruction Manual)*

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

Do not connect a mechanical brake.

The brake resistor cannot be connected to the FR-E720S-008SC or 015SC. Leave terminals + and PR open.

Also, never short between these terminals.

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

Application of a voltage higher than the permissible voltage to the inverter I/O signal circuits or opposite polarity may damage the I/O devices. Especially check the wiring to prevent the speed setting potentiometer from being connected incorrectly to short terminals 10-5.

(14) To use the commercial power supply, be sure to provide electrical and mechanical interlocks between the electronic bypass contactors MC1 and MC2.

When using a switching circuit as shown right, chattering due to misconfigured sequence or arc generated at switching may allow undesirable current to flow in and damage the inverter. Miswiring may also damage the inverter.
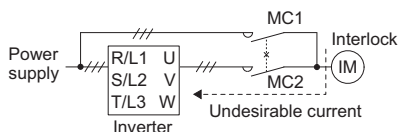
(15) If the machine must not be restarted when power is restored after a power failure, provide a magnetic contactor in the inverter's input side and also make up a sequence which will not switch ON the start signal.

If the start signal (start switch) remains ON after a power failure, the inverter will automatically restart as soon as the power is restored.

(16) Inverter input side magnetic contactor (MC)

On the inverter input side, connect a MC for the following purposes. (▥ *Refer to the FR-E700-EC Instruction Manual* for selection.)

1) To release the inverter from the power supply when a fault occurs or when the drive is not functioning (e.g. emergency stop operation). For example, MC avoids overheat or burnout of the brake resistor when heat capacity of the resistor is insufficient or brake regenerative transistor is damaged with short while connecting an optional brake resistor.

2) To prevent any accident due to an automatic restart at restoration of power after an inverter stop made by a power failure

3) To separate the inverter from the power supply to ensure safe maintenance and inspection work.

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

(17) Handling of inverter output side magnetic contactor

Switch the magnetic contactor between the inverter and motor only when both the inverter and motor are at a stop. When the magnetic contactor is turned ON while the inverter is operating, overcurrent protection of the inverter and such will activate. When MC is provided for switching to the commercial power supply, for example, switch it ON/OFF after the inverter and motor have stopped.

(18) Countermeasures against inverter-generated EMI

If electromagnetic noise generated from the inverter causes frequency setting signal to fluctuate and motor rotation speed to be unstable when changing motor speed with analog signal, the following countermeasures are effective.

• Do not run the signal cables and power cables (inverter I/O cables) in parallel with each other and do not bundle them.

• Run signal cables as far away as possible from power cables (inverter I/O cables).

• Use shield cables as signal cables.

• Install a ferrite core on the signal cable (Example: ZCAT3035-1330 TDK).

(19) Instructions for overload operation

When performing operation of frequent start/stop of the inverter, rise/fall in the temperature of the transistor element of the inverter will repeat due to a repeated flow of large current, shortening the life from thermal fatigue. Since thermal fatigue is related to the amount of current, the life can be increased by reducing current at locked condition, starting current, etc. Decreasing current may increase the life. However, decreasing current will result in insufficient torque and the inverter may not start. Therefore, choose the inverter which has enough allowance for current (up to 2 rank larger in capacity).

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

5 FAILSAFE OF THE SYSTEM WHICH USES THE INVERTER

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

(1) Interlock method which uses the inverter status output signals
      By combining the inverter status output signals to provide an interlock as shown below, an inverter alarm can be detected.

No.	Interlock Method	Check Method	Used Signals	Refer to Page
1)	Inverter protective function operation	Operation check of an alarm contact Circuit error detection by negative logic	Fault (ALM) signal	*Refer to Chapter 4 of the FR-E700-EC Instruction Manual*
2)	Inverter running status	Operation ready signal check	Operation ready (RY) signal	*Refer to Chapter 4 of the FR-E700-EC Instruction Manual*
3)	Inverter running status	Logic check of the start signal and running signal	Start signal (STF signal, STR signal) Inverter running (RUN) signal	*Refer to Chapter 4 of the FR-E700-EC Instruction Manual*
4)	Inverter running status	Logic check of the start signal and output current	Start signal (STF signal, STR signal) Output current detection (Y12) signal	*Refer to Chapter 4 of the FR-E700-EC Instruction Manual*

(2) Backup method outside the inverter
      Even if the interlock is provided by the inverter status signal, enough failsafe is not ensured depending on the failure status of the inverter itself. For example, even if the interlock is provided using the inverter fault output signal, start signal and RUN signal output, there is a case where a fault output signal is not output and RUN signal is kept output even if an inverter fault occurs.
   Provide a speed detector to detect the motor speed and current detector to detect the motor current and consider the backup system such as checking up as below according to the level of importance of the system.

  1) Start signal and actual operation check
      Check the motor running and motor current while the start signal is input to the inverter by comparing the start signal to the inverter and detected speed of the speed detector or detected current of the current detector. Note that the motor current runs as the motor is running for the period until the motor stops since the inverter starts decelerating even if the start signal turns off. For the logic check, configure a sequence considering the inverter deceleration time. In addition, it is recommended to check the three-phase current when using the current detector.

  2) Command speed and actual operation check
      Check if there is no gap between the actual speed and commanded speed by comparing the inverter speed command and detected speed of the speed detector.
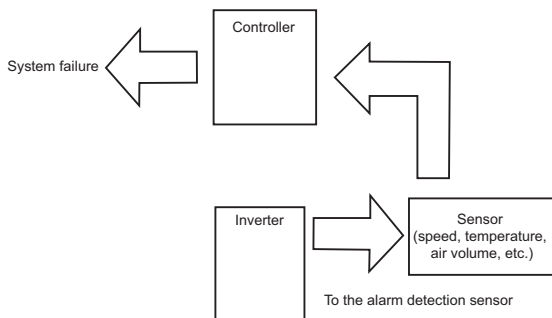
6 PARAMETER LIST

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

> **REMARKS**
> - When the Ethernet board is removed, the parameters for Ethernet communication cannot be read or written.
> - ◎ indicates simple mode parameters. (initially set to extended mode)
> - The parameters surrounded by a black border in the table allow its setting to be changed during operation even if "0" (initial value) is set in *Pr. 77 Parameter write selection*.
> - Refer to the FR-E700-NE Ethernet Function Manual for details of the Ethernet communication parameters, and refer to Chapter 4 of the FR-E700-EC Instruction Manual for details of the other parameters.

Pr.	Name	Setting Range	Initial Value
◎ 0	Torque boost	0 to 30%	6/4/3/2% *1
◎ 1	Maximum frequency	0 to 120Hz	120Hz
◎ 2	Minimum frequency	0 to 120Hz	0Hz
◎ 3	Base frequency	0 to 400Hz	50Hz
◎ 4	Multi-speed setting (high speed)	0 to 400Hz	50Hz
◎ 5	Multi-speed setting (middle speed)	0 to 400Hz	30Hz
◎ 6	Multi-speed setting (low speed)	0 to 400Hz	10Hz
◎ 7	Acceleration time	0 to 3600/360s	5/10/15s *2
◎ 8	Deceleration time	0 to 3600/360s	5/10/15s *2
◎ 9	Electronic thermal O/L relay	0 to 500A	Inverter rated current
10	DC injection brake operation frequency	0 to 120Hz	3Hz
11	DC injection brake operation time	0 to 10s	0.5s
12	DC injection brake operation voltage	0 to 30%	6/4/2% *3
13	Starting frequency	0 to 60Hz	0.5Hz
14	Load pattern selection	0 to 3	0
15	Jog frequency	0 to 400Hz	5Hz
16	Jog acceleration/deceleration time	0 to 3600/360s	0.5s
17	MRS input selection	0, 2, 4	0
18	High speed maximum frequency	120 to 400Hz	120Hz
19	Base frequency voltage	0 to 1000V, 8888, 9999	8888
20	Acceleration/deceleration reference frequency	1 to 400Hz	50Hz
21	Acceleration/deceleration time increments	0, 1	0
22	Stall prevention operation level	0 to 200%	150%
23	Stall prevention operation level compensation factor at double speed	0 to 200%, 9999	9999
24	Multi-speed setting (speed 4)	0 to 400Hz, 9999	9999
25	Multi-speed setting (speed 5)	0 to 400Hz, 9999	9999
26	Multi-speed setting (speed 6)	0 to 400Hz, 9999	9999
27	Multi-speed setting (speed 7)	0 to 400Hz, 9999	9999

Pr.	Name	Setting Range	Initial Value
29	Acceleration/deceleration pattern selection	0, 1, 2	0
30	Regenerative function selection	0, 1, 2	0
31	Frequency jump 1A	0 to 400Hz, 9999	9999
32	Frequency jump 1B	0 to 400Hz, 9999	9999
33	Frequency jump 2A	0 to 400Hz, 9999	9999
34	Frequency jump 2B	0 to 400Hz, 9999	9999
35	Frequency jump 3A	0 to 400Hz, 9999	9999
36	Frequency jump 3B	0 to 400Hz, 9999	9999
37	Speed display	0, 0.01 to 9998	0
40	RUN key rotation direction selection	0, 1	0
41	Up-to-frequency sensitivity	0 to 100%	10%
42	Output frequency detection	0 to 400Hz	6Hz
43	Output frequency detection for reverse rotation	0 to 400Hz, 9999	9999
44	Second acceleration/deceleration time	0 to 3600/360s	5/10/15s *2
45	Second deceleration time	0 to 3600/360s, 9999	9999
46	Second torque boost	0 to 30%, 9999	9999
47	Second V/F (base frequency)	0 to 400Hz, 9999	9999
48	Second stall prevention operation current	0 to 200%, 9999	9999
51	Second electronic thermal O/L relay	0 to 500A, 9999	9999
52	DU/PU main display data selection	0, 5, 7 to 12, 14, 20, 23 to 25, 52 to 57, 61, 62, 100	0
55	Frequency monitoring reference	0 to 400Hz	50Hz
56	Current monitoring reference	0 to 500A	Inverter rated current
57	Restart coasting time	0, 0.1 to 5s, 9999	9999
58	Restart cushion time	0 to 60s	1s
59	Remote function selection	0, 1, 2, 3	0
60	Energy saving control selection	0, 9	0
61	Reference current	0 to 500A, 9999	9999
62	Reference value at acceleration	0 to 200%, 9999	9999
63	Reference value at deceleration	0 to 200%, 9999	9999

Pr.	Name	Setting Range	Initial Value
65	Retry selection	0 to 5	0
66	Stall prevention operation reduction starting frequency	0 to 400Hz	50Hz
67	Number of retries at fault occurrence	0 to 10, 101 to 110	0
68	Retry waiting time	0.1 to 360s	1s
69	Retry count display erase	0	0
70	Special regenerative brake duty	0 to 30%	0%
71	Applied motor	0, 1, 3 to 6, 13 to 16, 23, 24, 40, 43, 44, 50, 53, 54	0
72	PWM frequency selection	0 to 15	1
73	Analog input selection	0, 1, 10, 11	1
74	Input filter time constant	0 to 8	1
75	Reset selection/disconnected PU detection/PU stop selection	0 to 3, 14 to 17	14
77	Parameter write selection	0, 1, 2	0
78	Reverse rotation prevention selection	0, 1, 2	0
◎ 79	Operation mode selection	0, 1, 2, 3, 4, 6, 7	0
80	Motor capacity	0.1 to 15kW, 9999	9999
81	Number of motor poles	2, 4, 6, 8, 10, 9999	9999
82	Motor excitation current	0 to 500A, 9999 *4	9999
83	Rated motor voltage	0 to 1000V	200V/ 400V *6
84	Rated motor frequency	10 to 120Hz	50Hz
89	Speed control gain (Advanced magnetic flux vector)	0 to 200%, 9999	9999
90	Motor constant (R1)	0 to 50Ω, 9999 *4	9999
91	Motor constant (R2)	0 to 50Ω, 9999 *4	9999
92	Motor constant (L1)	0 to 1000mH, 9999 *4	9999
93	Motor constant (L2)	0 to 1000mH, 9999 *4	9999
94	Motor constant (X)	0 to 100%, 9999 *4	9999
96	Auto tuning setting/status	0, 1, 11, 21	0
117	PU communication station number	0 to 31 (0 to 247)	0
118	PU communication speed	48, 96, 192, 384	192
119	PU communication stop bit length	0, 1, 10, 11	1
120	PU communication parity check	0, 1, 2	2
121	Number of PU communication retries	0 to 10, 9999	1
122	PU communication check time interval	0, 0.1 to 999.8s, 9999	0
123	PU communication waiting time setting	0 to 150ms, 9999	9999
124	PU communication CR/LF selection	0, 1, 2	1
◎ 125	Terminal 2 frequency setting gain frequency	0 to 400Hz	50Hz
◎126	Terminal 4 frequency setting gain frequency	0 to 400Hz	50Hz
127	PID control automatic switchover frequency	0 to 400Hz, 9999	9999

Pr.	Name	Setting Range	Initial Value
128	PID action selection	0, 20, 21, 40 to 43, 50, 51, 60, 61	0
129	PID proportional band	0.1 to 1000%, 9999	100%
130	PID integral time	0.1 to 3600s, 9999	1s
131	PID upper limit	0 to 100%, 9999	9999
132	PID lower limit	0 to 100%, 9999	9999
133	PID action set point	0 to 100%, 9999	9999
134	PID differential time	0.01 to 10.00s, 9999	9999
145	PU display language selection	0 to 7	1
146	Parameter for manufacturer setting. Do not set.		
147	Acceleration/deceleration time switching frequency	0 to 400Hz, 9999	9999
150	Output current detection level	0 to 200%	150%
151	Output current detection signal delay time	0 to 10s	0s
152	Zero current detection level	0 to 200%	5%
153	Zero current detection time	0 to 1s	0.5s
156	Stall prevention operation selection	0 to 31, 100, 101	0
157	OL signal output timer	0 to 25s, 9999	0s
158	AM terminal function selection	1 to 3, 5, 7 to 12, 14, 21, 24, 52, 53, 61, 62	1
◎ 160	User group read selection	0, 1, 9999	0
161	Frequency setting/key lock operation selection	0, 1, 10, 11	0
162	Automatic restart after instantaneous power failure selection	0, 1, 10, 11	1
165	Stall prevention operation level for restart	0 to 200%	150%
168	Parameter for manufacturer setting. Do not set.		
169			
170	Watt-hour meter clear	0, 10, 9999	9999
171	Operation hour meter clear	0, 9999	9999
172	User group registered display/ batch clear	9999, (0 to 16)	0
173	User group registration	0 to 999, 9999	9999
174	User group clear	0 to 999, 9999	9999
178	STF terminal function selection	0 to 5, 7, 8, 10, 12, 14 to 16, 18, 24, 25, 60, 62, 65 to 67, 9999	60
179	STR terminal function selection	0 to 5, 7, 8, 10, 12, 14 to 16, 18, 24, 25, 61, 62, 65 to 67, 9999	61
180	RL terminal function selection	0 to 5, 7, 8, 10, 12, 14 to 16, 18, 24, 25, 62, 65 to 67, 9999	0
181	RM terminal function selection		1
182	RH terminal function selection		2
183 *8	MRS terminal function selection		24
184	RES terminal function selection		62

Pr.	Name	Setting Range	Initial Value
190	RUN terminal function selection	0, 1, 3, 4, 7, 8, 11 to 16, 20, 25, 26, 46, 47, 64, 80, 81, 90, 91, 93, 95, 96, 98, 99, 100, 101, 103, 104, 107, 108, 111 to 116, 120, 125, 126, 146, 147, 164, 180, 181, 190, 191, 193, 195, 196, 198, 199, 9999	0
191	FU terminal function selection		4
192	A,B,C terminal function selection	0, 1, 3, 4, 7, 8, 11 to 16, 20, 25, 26, 46, 47, 64, 80, 81, 90, 91, 95, 96, 98, 99, 100, 101, 103, 104, 107, 108, 111 to 116, 120, 125, 126, 146, 147, 164, 180, 181, 190, 191, 195, 196, 198, 199, 9999	99
232	Multi-speed setting (speed 8)	0 to 400Hz, 9999	9999
233	Multi-speed setting (speed 9)	0 to 400Hz, 9999	9999
234	Multi-speed setting (speed 10)	0 to 400Hz, 9999	9999
235	Multi-speed setting (speed 11)	0 to 400Hz, 9999	9999
236	Multi-speed setting (speed 12)	0 to 400Hz, 9999	9999
237	Multi-speed setting (speed 13)	0 to 400Hz, 9999	9999
238	Multi-speed setting (speed 14)	0 to 400Hz, 9999	9999
239	Multi-speed setting (speed 15)	0 to 400Hz, 9999	9999
240	Soft-PWM operation selection	0, 1	1
241	Analog input display unit switchover	0, 1	0
244	Cooling fan operation selection	0, 1	1
245	Rated slip	0 to 50%, 9999	9999
246	Slip compensation time constant	0.01 to 10s	0.5s
247	Constant-power range slip compensation selection	0, 9999	9999
249	Earth (ground) fault detection at start	0, 1	1
250	Stop selection	0 to 100s, 1000 to 1100s, 8888, 9999	9999
251	Output phase loss protection selection	0, 1	1
255	Life alarm status display	(0 to 15)	0
256	Inrush current limit circuit life display	(0 to 100%)	100%
257	Control circuit capacitor life display	(0 to 100%)	100%
258	Main circuit capacitor life display	(0 to 100%)	100%
259	Main circuit capacitor life measuring	0, 1 (2, 3, 8, 9)	0
261	Power failure stop selection	0, 1, 2	0
267	Terminal 4 input selection	0, 1, 2	0
268	Monitor decimal digits selection	0, 1, 9999	9999
269	Parameter for manufacturer setting. Do not set.		

Pr.	Name	Setting Range	Initial Value
270	Stop-on contact control selection	0, 1	0
275	Stop-on contact excitation current low-speed multiplying factor	0 to 300%, 9999	9999
276	PWM carrier frequency at stop-on contact	0 to 9, 9999	9999
277	Stall prevention operation current switchover	0, 1	0
278	Brake opening frequency	0 to 30Hz	3Hz
279	Brake opening current	0 to 200%	130%
280	Brake opening current detection time	0 to 2s	0.3s
281	Brake operation time at start	0 to 5s	0.3s
282	Brake operation frequency	0 to 30Hz	6Hz
283	Brake operation time at stop	0 to 5s	0.3s
286	Droop gain	0 to 100%	0%
287	Droop filter time constant	0 to 1s	0.3s
292	Automatic acceleration/deceleration	0, 1, 7, 8, 11	0
293	Acceleration/deceleration separate selection	0 to 2	0
295	Magnitude of frequency change setting	0, 0.01, 0.1, 1, 10	0
296	Password lock level	0 to 6, 99, 100 to 106, 199, 9999	9999
297	Password lock/unlock	1000 to 9998, 9999, (0 to 5)	9999
298	Frequency search gain	0 to 32767, 9999	9999
299	Rotation direction detection selection at restarting	0, 1, 9999	0
◎ 313	DO0 output selection	0, 1, 3, 4, 7, 8, 11 to 16, 20, 25, 26, 46, 47, 64, 80, 81, 90, 91, 93, 95, 96, 98, 99, 100, 101, 103, 104, 107, 108, 111 to 116, 120, 125, 126, 146, 147, 164, 180, 181, 190, 191, 193, 195, 196, 198, 199, 9999	9999
◎ 314	DO1 output selection		9999
◎ 315	DO2 output selection		9999
338	Communication operation command source	0, 1	0
339	Communication speed command source	0, 1, 2	0
340	Communication startup mode selection	0, 1, 10	0
342	Communication EEPROM write selection	0, 1	0
343	Communication error count	—	0
◎ 349	Communication reset selection	0, 1	0
◎ 442	Default gateway address 1	0 to 255	0
◎ 443	Default gateway address 2	0 to 255	0
◎ 444	Default gateway address 3	0 to 255	0
◎ 445	Default gateway address 4	0 to 255	0
450	Second applied motor	0, 1, 9999	9999
495	Remote output selection	0, 1, 10, 11	0
496	Remote output data 1	0 to 4095	0
497	Remote output data 2	0 to 4095	0
◎ 501	Communication error occurrence count display	0	0

Pr.	Name	Setting Range	Initial Value
502	Stop mode selection at communication error	0, 1, 2, 3	0
503	Maintenance timer	0 (1 to 9998)	0
504	Maintenance timer alarm output set time	0 to 9998, 9999	9999
◎ 541	Frequency command sign selection (CC-Link)	0, 1	0
◎ 544	CC-Link extended setting	0, 1, 12, 14, 18	0
547	USB communication station number	0 to 31	0
548	USB communication check time interval	0 to 999.8s, 9999	9999
549	Protocol selection	0, 1	0
550	NET mode operation command source selection	0, 2	0
551	PU mode operation command source selection	2 to 4, 9999	9999
555	Current average time	0.1 to 1.0s	1s
556	Data output mask time	0 to 20s	0s
557	Current average value monitor signal output reference current	0 to 500A	Inverter rated current
563	Energization time carrying-over times	(0 to 65535)	0
564	Operating time carrying-over times	(0 to 65535)	0
571	Holding time at a start	0 to 10s, 9999	9999
611	Acceleration time at a restart	0 to 3600s, 9999	9999
645	AM 0V adjustment	970 to 1200	1000
653	Speed smoothing control	0 to 200%	0%
665	Regeneration avoidance frequency gain	0 to 200%	100%
◎ 805	Ethernet IP address 1	0 to 255	192
◎ 806	Ethernet IP address 2	0 to 255	168
◎ 807	Ethernet IP address 3	0 to 255	50
◎ 808	Ethernet IP address 4	0 to 255	1
◎ 809	Subnet mask 1	0 to 255	255
◎ 810	Subnet mask 2	0 to 255	255
◎ 811	Subnet mask 3	0 to 255	255
◎ 812	Subnet mask 4	0 to 255	0
◎ 830	Ethernet communication network number	1 to 239	1
◎ 831	Ethernet communication station number	1 to 120	1
◎ 832	Link speed and duplex mode selection	0 to 4	0
◎ 833	Ethernet function selection 1	0, 10, 20, 30, 31, 36, 38, 9999	31
◎ 834	Ethernet function selection 2		20
◎ 835	Ethernet function selection 3		9999
◎ 837	Ethernet IP filter address 1	0 to 255	0
◎ 838	Ethernet IP filter address 2	0 to 255	0
◎ 839	Ethernet IP filter address 3	0 to 255	0
◎ 840	Ethernet IP filter address 4	0 to 255	0
◎ 841	Ethernet IP filter address 2 range specification	0 to 255, 9999	9999
◎ 842	Ethernet IP filter address 3 range specification	0 to 255, 9999	9999
◎ 843	Ethernet IP filter address 4 range specification	0 to 255, 9999	9999
◎ 844	Ethernet command source selection IP address 1	0 to 255	0
◎ 845	Ethernet command source selection IP address 2	0 to 255	0
◎ 846	Ethernet command source selection IP address 3	0 to 255	0

Pr.	Name	Setting Range	Initial Value
◎ 847	Ethernet command source selection IP address 4	0 to 255	0
◎ 848	Ethernet command source selection IP address 3 range specification	0 to 255, 9999	9999
◎ 849	Ethernet command source selection IP address 4 range specification	0 to 255, 9999	9999
◎ 850	Ethernet TCP disconnection time coefficient	1 to 7200	3600
◎ 851	Ethernet signal loss detection function selection	0, 2, 3	3
◎ 852	Ethernet communication check time interval	0, 0.1 to 999.8s, 9999	1.5s
859	Torque current	0 to 500A (0 to ****), 9999 *4	9999
872 *7	Input phase loss protection selection	0, 1	1
882	Regeneration avoidance operation selection	0, 1, 2	0
883	Regeneration avoidance operation level	300 to 800V	400VDC/ 780VDC *6
885	Regeneration avoidance compensation frequency limit value	0 to 10Hz, 9999	6Hz
886	Regeneration avoidance voltage gain	0 to 200%	100%
888	Free parameter 1	0 to 9999	9999
889	Free parameter 2	0 to 9999	9999
C1 (901) *5	AM terminal calibration	-	-
C2 (902) *5	Terminal 2 frequency setting bias frequency	0 to 400Hz	0Hz
C3 (902) *5	Terminal 2 frequency setting bias	0 to 300%	0%
125 (903) *5	Terminal 2 frequency setting gain frequency	0 to 400Hz	50Hz
C4 (903) *5	Terminal 2 frequency setting gain	0 to 300%	100%
C5 (904) *5	Terminal 4 frequency setting bias frequency	0 to 400Hz	0Hz
C6 (904) *5	Terminal 4 frequency setting bias	0 to 300%	20%
126 (905) *5	Terminal 4 frequency setting gain frequency	0 to 400Hz	50Hz
C7 (905) *5	Terminal 4 frequency setting gain	0 to 300%	100%
C22 (922) *5	Parameter for manufacturer setting. Do not set.		
C23 (922) *5			
C24 (923) *5			
C25 (923) *5			
990	PU buzzer control	0, 1	1

Pr.	Name	Setting Range	Initial Value
991	PU contrast adjustment	0 to 63	58
Pr.CL	Parameter clear	0, 1	0
ALLC	All parameter clear	0, 1	0
Er.CL	Faults history clear	0, 1	0
Pr.CH	Initial value change list	—	—

∗1   Differ according to capacities.
     6%: FR-E740-026SC or lower, FR-E720S-050SC or lower
     4%: FR-E740-040SC to 095SC, FR-E720S-080SC and 110SC
     3%: FR-E740-120SC and 170SC
     2%: FR-E740-230SC and 300SC
∗2   Differ according to capacities.
     5s: FR-E740-095SC or lower, FR-E720S-008SC to 110SC
     10s: FR-E740-120SC and 170SC
     15s: FR-E740-230SC and 300SC
∗3   Differ according to capacities.
     6%: FR-E720S-008SC and 015SC
     4%: FR-E740-016SC to 170SC, FR-E720S-030SC to 110SC
     2%: FR-E740-230SC and 300SC
∗4   The range differs according to the *Pr. 71* setting.
∗5   The parameter number in parentheses is the one for use with the
     parameter unit (FR-PU04/FR-PU07).
∗6   The initial value differs according to the voltage class. (200V class/400V
     class)
∗7   Available only for the three-phase power input specification model.
∗8   This setting is active only during the communication operation.

7 TROUBLESHOOTING

When a fault occurs in the inverter, the inverter output is shut off and the PU display automatically changes to one of the following fault or alarm indications.
If the fault does not correspond to any of the following faults or if you have any other problem, please contact your sales representative.

- Retention of fault output signal ...When the magnetic contactor (MC) provided on the input side of the inverter is opened when a fault occurs, the inverter's control power will be lost and the fault output will not be held.
- Fault or alarm indication...........When a fault or alarm occurs, the operation panel display automatically switches to the fault or alarm indication.
- Resetting method ....When a fault occurs, the inverter output is kept stopped. Unless reset, therefore, the inverter cannot restart.
- When any fault occurs, take the appropriate corrective action, then reset the inverter, and resume operation.
  Not doing so may lead to the inverter fault and damage.

Inverter fault or alarm indications are roughly categorized as below.

(1) Error message
   A message regarding operational fault and setting fault by the operation panel and parameter unit (FR-PU04 /FR-PU07) is displayed. The inverter output is not shut off.
(2) Warning
   The inverter output is not shut off even when a warning is displayed. However, failure to take appropriate measures will lead to a fault.
(3) Alarm
   The inverter output is not shut off. You can also output an alarm signal by making parameter setting.
(4) Fault
   When a fault occurs, the inverter output is shut off and a fault signal is output.

REMARKS

- For the details of fault displays and other malfunctions, also *refer to the FR-E700-EC Instruction Manual*.
- Past eight faults can be displayed using the setting dial. (*Refer to the FR-E700-EC Instruction Manual* for the operation.)

7.1 Reset method of protective function

(1) Resetting the inverter
The inverter can be reset by performing any of the following operations. Note that the internal accumulated heat value of the electronic thermal relay function and the number of retries are cleared (erased) by resetting the inverter.
Inverter recovers about 1s after reset is released.

Operation 1: .... Using the operation panel, press (STOP/RESET) to reset the inverter.

(This may only be performed when a fault occurs.)
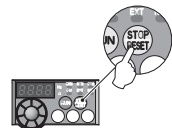
Operation 2: .... Turn ON the reset signal (RES) for more than 0.1s. (If the RES signal is kept ON, "Err." appears (blinks) to indicate that the inverter is in a reset status.)

Inverter

RES

PC
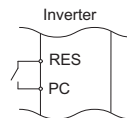
Operation 3: .... Switch power OFF once. After the indicator of the operation panel turns OFF, switch it ON again.

ON

OFF

NOTE

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

7.2 List of fault or alarm indications

Operation Panel Indication		Name
Error message	$E---$ **E---**	Faults history
	$HOLd$ **HOLD**	Operation panel lock
	$LOCd$ **LOCD**	Password locked
	$Er1$ to $Er4$ **Er1 to 4**	Parameter write error
	$Err.$ **Err.**	Inverter reset
Warning	OL **OL**	Stall prevention (overcurrent)
	oL **oL**	Stall prevention (overvoltage)
	rb **RB**	Regenerative brake pre-alarm
	TH **TH**	Electronic thermal relay function pre-alarm
	PS **PS**	PU stop
	MT **MT**	Maintenance signal output
	Uv **UV**	Undervoltage
	SA **SA**	Safety stop
Alarm	Fn **FN**	Fan alarm
Fault	$E.OC1$ **E.OC1**	Overcurrent trip during acceleration
	$E.OC2$ **E.OC2**	Overcurrent trip during constant speed
	$E.OC3$ **E.OC3**	Overcurrent trip during deceleration or stop
	$E.Ov1$ **E.OV1**	Regenerative overvoltage trip during acceleration
	$E.Ov2$ **E.OV2**	Regenerative overvoltage trip during constant speed
	$E.Ov3$ **E.OV3**	Regenerative overvoltage trip during deceleration or stop
	$E.THT$ **E.THT**	Inverter overload trip (electronic thermal O/L relay function)
	$E.THM$ **E.THM**	Motor overload trip (electronic thermal O/L relay function)
	$E.FIn$ **E.FIN**	Heatsink overheat

Operation Panel Indication		Name
Fault	$E.ILF$ **E.ILF** *1, *2	Input phase loss
	$E.OLT$ **E.OLT**	Stall prevention stop
	$E. bE$ **E. BE**	Brake transistor alarm detection
	$E. GF$ **E.GF**	Output side earth (ground) fault overcurrent at start
	$E. LF$ **E.LF**	Output phase loss
	$E.OHT$ **E.OHT**	External thermal relay operation
	$E.OPT$ **E.OPT**	Option fault
	$E.OP1$ **E.OP1**	Ethernet communication fault
	$E. 1$ **E. 1**	Ethernet board fault
	$E. PE$ **E.PE**	Parameter storage device fault
	$E.PE2$ **E.PE2** *1	Internal board fault
	$E.PUE$ **E.PUE**	PU disconnection
	$E.rET$ **E.RET**	Retry count excess
	$E. 51$ $E. 61$ $E. 71$ $E.CPU$ **E. 5/ E. 6/ E. 7/ E.CPU**	CPU fault
	$E.IOH$ **E.IOH** *1	Inrush current limit circuit fault
	$E.AIE$ **E.AIE** *1	Analog input fault
	$E.USb$ **E. USB** *1	USB communication fault
	$E.Mb4$ to $E.Mb7$ **E.MB4 to E.MB7**	Brake sequence fault
	$E.SAF$ **E. SAF** *1	Safety circuit fault
	$E. 13$ **E.13**	Internal circuit fault

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

*1   If a fault occurs when using with the FR-PU04, "Fault 14" is displayed on the FR-PU04.

*2   Available for the three-phase power input models.

Appendix 1   Instructions for Compliance with the EU Directives

The EU Directives are issued to standardize different national regulations of the EU Member States and to facilitate free movement of the equipment, whose safety is ensured, in the EU territory.
Since 1996, compliance with the EMC Directive that is one of the EU Directives has been legally required. Since 1997, compliance with the Low Voltage Directive, another EU Directive, has been also legally required. When a manufacturer confirms its equipment to be compliant with the EMC Directive and the Low Voltage Directive, the manufacturer must declare the conformity and affix the CE marking.

● **The authorized representative in the EU**

The authorized representative in the EU is shown below.
Name: Mitsubishi Electric Europe B.V.
Address: Mitsubishi-Electric-Platz 1, 40882 Ratingen, Germany

● Note

We declare that this inverter, when equipped with the dedicated EMC filter, conforms with the EMC Directive in industrial environments and affix the CE marking on the inverter. When using the inverter in a residential area, take appropriate measures and ensure the conformity of the inverter used in the residential area.

(1)   EMC Directive

We declare that this inverter, when equipped with the EMC Directive compliant EMC filter, conforms with the EMC Directive and affix the CE marking on the inverter.

- EMC Directive: 2004/108/EC
- Standard(s): EN61800-3:2004+A1:2012 (Second environment / PDS Category "C3")

Note: First environment
Environment including buildings/facilities which are directly connected to a low voltage main supply which also supplies residential buildings.
Directly connected means that there is no intermediate transformer between these buildings.
Second environment
Environment including all buildings/facilities which are not directly connected to a low voltage main supply which also supplies residential buildings.

● Note
* Set the EMC Directive compliant EMC filter to the inverter. Insert line noise filters and ferrite cores to the power and control cables as required.
* Connect the inverter to an earthed power supply.
* Install a motor, the EMC Directive compliant EMC filter, and a control cable according to the instructions written in the EMC Installation Guidelines (BCN-A21041-204). (Please contact your sales representative for the EMC Installation Guidelines.)
* The cable length to the motor should be 20m at maximum so that the EMC Directive compliant noise filter functions sufficiently.
* Confirm that the final integrated system with the inverter conforms with the EMC Directive.

(2) Low Voltage Directive

We have self-confirmed our inverters as products compliant to the Low Voltage Directive (Conforming standard EN 61800-5-1) and affix the CE marking on the inverters.

● Outline of instructions
  * Do not use an earth leakage circuit breaker as an electric shock protector without connecting the equipment to the earth. Connect the equipment to the earth securely.
  * Wire the earth (ground) terminal independently. (Do not connect two or more cables to one terminal.)
  * Use the cable sizes on *page 8* under the following conditions.
    •Surrounding air temperature: 40°C maximum
    If conditions are different from above, select appropriate wire according to EN60204 ANNEX C TABLE 5.
  * Use a tinned (plating should not include zinc) crimp terminal to connect the earth cable. When tightening the screw, be careful not to damage the threads.
    For use as a product compliant with the Low Voltage Directive, use PVC cable on *page 8*.
  * Use the molded case circuit breaker and magnetic contactor which conform to the EN or IEC Standard.
  * When using an earth leakage circuit breaker, use a residual current operated protective device (RCD) of type B (breaker which can detect both AC and DC). If not, provide double or reinforced insulation between the inverter and other equipment, or put a transformer between the main power supply and inverter.
  * Use the inverter under the conditions of overvoltage category II (usable regardless of the earth (ground) condition of the power supply), overvoltage category III (usable with the earthed-neutral system power supply, 400V class only) specified in IEC60664.
    •To use the inverter under the conditions of pollution degree 3, install it in the enclosure of IP54 or higher.
    •To use the inverter outside of an enclosure in the environment of pollution degree 2, fix the fan cover with fan cover fixing screws enclosed.

FR-E740-095SC or lower   FR-E740-120SC or higher
FR-E720S-050SC to 110SC
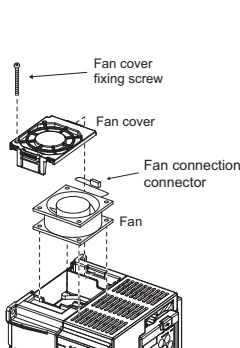
Example for FR-E740-095SC   Example for FR-E740-120SC
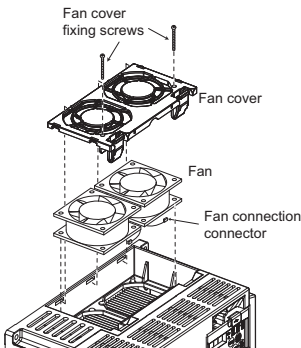
Note, the protection structure of the Inverter units is considered to be an IP00.

  * On the input and output of the inverter, use cables of the type and size set forth in EN60204 Appendix C.
  * The operating capacity of the relay outputs (terminal symbols A, B, C) should be 30VDC, 0.3A. (Relay output has basic isolation from the inverter internal circuit.)
  * Control circuit terminals on *page 6* are safely isolated from the main circuit.
  * Environment

	Running	In Storage	During Transportation
Surrounding Air Temperature	-10°C to +50°C	-20°C to +65°C	-20°C to +65°C
Humidity	90% RH or less (non-condensing)	90% RH or less (non-condensing)	90% RH or less (non-condensing)
Maximum Altitude	1000m∗1	1000m	10000m

∗1 For the installation at an altitude above 1000m up to 2500m, consider a 3% reduction in the rated current per 500m increase in altitude.

* For branch circuit protection, select an appropriate UL and cUL listed fuse with a cut-off speed of Class T, Class J, Class CC, or faster, or a UL 489 molded case circuit breaker (MCCB) in accordance with the following table.

FR-E740-□□□SC-ENE		016	026	040	060	095	120	170	230	300
Rated fuse voltage(V)		480V or more								
Fuse allowable rating (A)	Without power factor improving reactor	6	10	15	20	30	40	70	80	90
	With power factor improving reactor	6	10	10	15	25	35	60	70	90
Molded case circuit breaker (MCCB) Maximum allowable rating (A) *2, *3		15	15	15	15	20	30	40	50	70

FR-E720S-□□□SC-ENE		008	015	030	050	080	110
Rated fuse voltage(V)		240V or more					
Fuse allowable rating (A)	Without power factor improving reactor	15	20	20	30	40	60
	With power factor improving reactor	15	20	20	20	30	50
Molded case circuit breaker (MCCB) Maximum allowable rating (A) *2, *3		15	15	15	20	25	40

*2 Maximum allowable rating by US National Electrical Code. Exact size must be chosen for each installation.
*3 Select an appropriate molded case circuit breaker with a rating that is suitable for the size of the cable.

* When using the electronic thermal relay function as motor overload protection, set the rated motor current to *Pr. 9 Electronic thermal O/L relay*.

Electronic thermal relay function operation characteristic
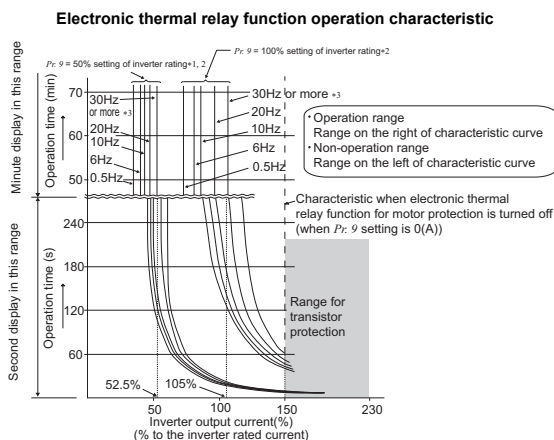
This function detects the overload (overheat) of the motor, stops the operation of the inverter's output transistor, and stops the output.
(The operation characteristic is shown on the left)
  When using the Mitsubishi Electric constant-torque motor
  1) Set "1" or any of "13" to "16", "50", "53", "54" in *Pr. 71*. (This provides a 100% continuous torque characteristic in the low-speed range.)
  2) Set the rated current of the motor in *Pr. 9*.

*1 When 50% of the inverter rated output current (current value) is set in *Pr. 9*
*2 The % value denotes the percentage to the inverter rated output current. It is not the percentage to the motor rated current.
*3 When you set the electronic thermal relay function dedicated to the Mitsubishi Electric constant-torque motor, this characteristic curve applies to operation at 6Hz or higher.
  (For selection of the operation characteristic, refer to Chapter 4 of the FR-E700-EC Instruction Manual.)

Note

· The internal accumulated heat value of the electronic thermal relay function is reset by inverter power reset and reset signal input. Avoid unnecessary reset and power-OFF.
· When multiple motors are operated by a single inverter, protection cannot be provided by the electronic thermal relay function. Install an external thermal relay to each motor.
· When the difference between the inverter and motor capacities is large and the setting is small, the protective characteristics of the electronic thermal relay function will be deteriorated. In this case, use an external thermal relay.
· A special motor cannot be protected by the electronic thermal relay function. Use the external thermal relay.
· Electronic thermal relay may not function when 5% or less of inverter rated current is set to electronic thermal relay setting.
· Motor over temperature sensing is not provided by the drive.

* Short circuit current ratings
  •200V class
  Suitable for use in a circuit capable of delivering not more than 5kA rms symmetrical amperes, 264V maximum.
  •400V class
  Suitable for use in a circuit capable of delivering not more than 5kA rms symmetrical amperes, 528V maximum.

Appendix 2 Instructions for UL and cUL

(Standard to comply with: UL 508C, CSA C22.2 No. 14)

1. General Precaution
CAUTION - Risk of Electric Shock -
  The bus capacitor discharge time is 10 minutes. Before starting wiring or inspection, switch power off, wait for more than 10 minutes.
ATTENTION - Risque de choc électrique -
  La durée de décharge du condensateur de bus est de 10 minutes. Avant de commencer le câblage ou l'inspection, mettez l'appareil hors tension et attendez plus de 10 minutes.
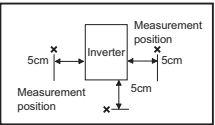
2. Environment
Before installation, check that the environment meets following specifications.

Surrounding air temperature ∗1	-10°C to + 50°C Maximum (non-freezing)	
Ambient humidity	90%RH or less (non-condensing)	
Storage temperature	-20°C to + 65°C	
Ambience	Indoors (No corrosive and flammable gases, oil mist, dust and dirt.)	
Altitude, vibration	Maximum 1000m for standard operation ∗2, 5.9m/s² or less at 10 to 55Hz (directions of X, Y, Z axes)	

∗1　Surrounding Air Temperature is a temperature measured at a measurement position in an enclosure.
　　Ambient Temperature is a temperature outside an enclosure.

∗2　For the installation at an altitude above 1000m up to 2500m, consider a 3% reduction in the rated current per 500m increase in altitude.

3. Installation
The below types of inverter have been approved as products for use in enclosure and approval tests were conducted under the following conditions. Design the enclosure so that the surrounding air temperature, humidity and ambience of the inverter will satisfy the above specifications.

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 for the U.S. or the Canadian Electrical Code for Canada and any additional codes. As specified, UL Class T, Class J, Class CC fuses, or any faster acting fuse with the appropriate rating or Listed UL 489 Molded Case Circuit Breaker (MCCB), or Type E combination motor controller must be employed.

FR-E740-□□□SC-ENE		016	026	040	060	095	120	170	230	300
Rated fuse voltage(V)		480V or more								
Fuse allowable rating (A)	Without power factor improving reactor	6	10	15	20	30	40	70	80	90
	With power factor improving reactor	6	10	10	15	25	35	60	70	90
Molded case circuit breaker (MCCB) Maximum allowable rating (A)∗3,∗4		15	15	15	15	20	30	40	50	70
Type E combination motor controller∗5	Maximum current rating (A)	4	6.3	8	10	18	25	32	—	—
	Maximum SCCR (kA)∗6	50	50	50	50	50	25	25	—	—

FR-E720S-□□□SC-ENE		008	015	030	050	080	110
Rated fuse voltage(V)		240V or more					
Fuse allowable rating (A)	Without power factor improving reactor	15	20	20	30	40	60
	With power factor improving reactor	15	20	20	20	30	50
Molded case circuit breaker (MCCB) Maximum allowable rating (A)∗3,∗4		15	15	15	20	25	40

∗3　Maximum allowable rating by US National Electrical Code. Exact size must be chosen for each installation.

∗4　Select an appropriate molded case circuit breaker with a rating that is suitable for the size of the cable.

∗5　For UL/cUL certification, use the following product.

Model	Manufacturer	Rated Voltage, Vac
MMP-T32	Mitsubishi Electric Corp.	480Y/277

∗6　Suitable for Use in a Circuit Capable of Delivering Not More Than 50 or 25 kA rms Symmetrical Amperes, 480Y/277 Volts Maximum when protected by the Type E Combination motor Controllers indicated in the above table.

4. Short circuit ratings
- **200V class**
  Suitable for use in a circuit capable of delivering not more than 100kA rms symmetrical amperes, 264V maximum.
- **400V class**
  Suitable for use in a circuit capable of delivering not more than 100kA rms symmetrical amperes, 528V maximum.

5. Wiring
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 inverter, 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 maker.

6. Motor overload protection

When using the electronic thermal relay function as motor overload protection, set the rated motor current to *Pr. 9 Electronic thermal O/L relay. (Refer to page 27)*

> **NOTE**
> · **The internal accumulated heat value of the electronic thermal relay function is reset by inverter power reset and reset signal input. Avoid unnecessary reset and power-OFF.**
> · **When multiple motors are operated by a single inverter, protection cannot be provided by the electronic thermal relay function. Install an external thermal relay to each motor.**
> · **When the difference between the inverter and motor capacities is large and the setting is small, the protective characteristics of the electronic thermal relay function will be deteriorated. In this case, use an external thermal relay.**
> · **A special motor cannot be protected by the electronic thermal relay function. Use the external thermal relay.**
> · **If electric thermal is set to 5% or lower of the inverter rated current, electronic thermal may not operate.**
> · **Motor over temperature sensing is not provided by the drive.**

Appendix 3   SERIAL number check

The SERIAL number can be checked on the inverter rating plate or package. *(Refer to page 1.)*

Rating plate example

□	○	○	○○○○○○
Symbol	Year	Month	Control number

SERIAL

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

Appendix 4   Instructions for EAC

The product certified in compliance with the Eurasian Conformity has the EAC marking.

Note: EAC marking
In 2010, three countries (Russia, Belarus, and Kazakhstan) established a Customs Union for the purposes of revitalizing the economy by forming a large economic bloc by abolishing or reducing tariffs and unifying regulatory procedures for the handling of articles.
Products to be distributed over these three countries of the Customs Union must comply with the Customs Union Technical Regulations (CU-TR), and the EAC marking must be affixed to the products.

For information on the country of origin, manufacture year and month, and authorized sales representative (importer) in the CU area of this product, refer to the following:

- Country of origin indication
  Check the rating plate of the product. *(Refer to page 1.)*
  Example: MADE IN JAPAN

- Manufactured year and month
  The SERIAL number *(refer to Appendix 3)* can be checked on the rating plate *(refer to page 1)* of the product.

- Authorized sales representative (importer) in the CU area
  The authorized sales representative (importer) in the CU area is shown below.
  Name: Mitsubishi Electric (Russia) LLC
  Address: 52, bld 1 Kosmodamianskaya Nab 115054, Moscow, Russia
  Phone: +7 (495) 721-2070
  Fax: +7 (495) 721-2071

Appendix 5 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

环境保护使用
期限标识
15

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。

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;
1) a failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem
2) a failure caused by any alteration, etc. to the Product made on your side without our approval
3) 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
4) a failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
5) any replacement of consumable parts (condenser, cooling fan, etc.)
6) 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
7) 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
8) 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 Electric shall not be liable for compensation to:
(1) Damages caused by any cause found not to be the responsibility of Mitsubishi Electric.
(2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi Electric products.
(3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi Electric 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.

■ About the enclosed CD-ROM

• The enclosed CD-ROM contains PDF copies of the manuals related to this product.

■ Before using the enclosed CD-ROM

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■ System requirements for the enclosed CD-ROM

• The following system is required to read instruction manuals contained in the enclosed CD-ROM.

Item	Specifications
OS	Microsoft® Windows Vista®, Windows® 7, Windows® 8, Windows® 8.1, Windows® 10
CPU	Intel® Pentium® or better processor
Memory	128 MB of RAM
Hard disk	90 MB of available hard-disk space
CD-ROM drive	Double speed or faster (more than quadruple speed is recommended)
Monitor	800×600 dot or more
Application	Adobe® Reader® 7.0 or later Internet Explorer® 6.0 or later

■ Operating method of the enclosed CD-ROM

• How to read instruction manuals
   Step 1. Start a personal computer and place the enclosed CD-ROM in the CD-ROM drive.
   Step 2. The main window automatically opens by the web browser.
   Step 3. Click a manual you want to read in the "INSTRUCTION MANUAL" list.
   Step 4. PDF manual you clicked opens.

• Manual opening of the enclosed CD-ROM
   Step 1. Start a personal computer and place the enclosed CD-ROM in the CD-ROM drive.
   Step 2. Open "index.html" file in the enclosed CD-ROM.
   Step 3. The main window opens by the web browser. Follow the instructions from Step 3 of "How to read instruction manuals".

• PDF data of the instruction manual are stored in "MANUAL" folder on the enclosed CD-ROM.

REVISIONS

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MITSUBISHI ELECTRIC CORPORATION

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