

INVERTER

FR-CC2 Converter Unit

INSTALLATION GUIDELINE

FR-CC2-H315K to H500K

Thank you for choosing this Mitsubishi converter unit.
This Installation guideline gives handling information and precautions for use of this product.
Do not use this product until you have a full knowledge of the equipment, the safety information and the instructions.
Please forward this Installation guideline to the end user.

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Version A

Version check

This section is specifically about safety matters

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

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

- A person who took a proper engineering training. Please note if you can take a proper engineering training at your local Mitsubishi Electric office. Such training may be available at your local Mitsubishi Electric office. Contact your local sales office for schedules and locations.
- A person who can access operating manuals for the protective devices (e.g. light curtain) connected to the safety control system.

A person who has read and familiarized himself/herself with the manuals.


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

WARNING

Assumes that incorrect handling may cause hazardous conditions, resulting in death or severe injury.

CAUTION

Assumes that incorrect handling may cause hazardous conditions, resulting in medium or slight injury, or may cause physical damage only.

Note that even the  **CAUTION** level may lead to a serious consequence according to conditions. Please follow strictly the instructions of both levels because they are important to personnel safety.

Electric Shock Prevention

WARNING

- While the converter power is ON, do not open the front cover or the wiring cover. Do not run the converter 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 access the charged converter circuits and get an electric shock.
- Before starting wiring or inspection, check to make sure that the operation panel indicator is off, 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.
- A neutral-point earthed power supply for converter unit in compliance with EN standard must be used.
- Any person who is involved in the wiring or inspection of this equipment should be fully competent to do the work.
- Always install the converter unit before wiring. Otherwise, you may get an electric shock or be injured.
- Perform setting dial and key operations 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 replace the cooling fan while power is on. It is dangerous to replace the cooling fan while power is on.
- Do not touch the printed circuit board or handle the cables with wet hands. You may get an electric shock.

Fire Prevention

CAUTION

- Mount the converter unit to incombustible material. Install the converter unit on a nonflammable wall without holes (so that nobody can touch the converter unit heatsink on the rear side, etc.). Mounting it to or near combustible material can cause a fire.
- If the converter unit has become faulty, switch off the converter unit power. A continuous flow of large current 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.

Injury Prevention

CAUTION

- Apply only the voltage specified in the instruction manual to each terminal. Otherwise, burst, damage, etc. may occur.
- Ensure that the cables are connected to the correct terminals. Otherwise, burst, damage, etc. may occur.
- Always make sure that polarity is correct to prevent damage, etc. Otherwise, burst, damage, etc. may occur.
- While power is on or for some time after power-off, do not touch the converter unit as it is hot and you may get burnt.

Additional Instructions

Also note the following points to prevent an accidental failure, injury, electric shock, etc.

Transportation and installation

CAUTION

- Any person who is opening a package using a sharp object, such as a knife and cutter, must wear gloves to prevent injuries caused by the edge of the sharp object.
- When carrying products, use correct lifting gear to prevent injury.
- Do not stand or rest heavy objects on the product.
- Do not stack the converter unit boxes higher than the number recommended.
- When carrying the converter, do not hold it by the front cover or setting dial; it may fall off or fail.
- During installation, caution must be taken not to drop the converter unit as doing so may cause injuries.
- Ensure that installation position and material can withstand the weight of the converter unit. Install according to the information in the instruction manual.
- Do not install the product on a hot surface.
- Check the converter unit mounting orientation is correct.
- The converter unit must be installed on a strong surface securely with screws so that it will not drop.
- Do not install or operate the converter unit if it is damaged or has parts missing. This can result in breakdowns.
- Prevent other conductive bodies such as screws and metal fragments or other flammable substance such as oil from entering the converter unit.
- As the converter unit is a precision instrument, do not drop or subject it to impact.
- Use the converter unit under the following environmental conditions. Otherwise, the converter unit may be damaged.

Operating condition	FR-CC2
Surrounding air temperature	-10°C to +50°C (non-freezing)
Ambient humidity	With circuit board coating: 95% RH or less (non-condensing), Without circuit board coating: 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	Maximum 1000m above sea level for standard operation. After that derate by 3% for every extra 500m up to 2500m (91%)
Vibration	2.9m/s ² or less at 10 to 55Hz (directions of X, Y, Z axes)

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

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


Test operation and adjustment

CAUTION

- Before starting operation, confirm and adjust the parameters. A failure to do so may cause some machines to make unexpected motions.

Operation

WARNING

- When you have chosen the retry function, stay away from the equipment as it will restart suddenly after an alarm stop.
- Since pressing the  key may not stop output depending on the function setting status, provide a circuit and switch separately to make an emergency stop (power off, mechanical brake operation for emergency stop, etc).
- Make sure that the start signal is off before resetting an inverter fault. Resetting a converter unit fault with the start signal ON restarts the motor suddenly.
- Do not modify the equipment.
- Do not perform parts removal which is not instructed in this manual. Doing so may lead to fault or damage of the product.

CAUTION

- Do not use a magnetic contactor on the converter unit input for frequent starting/stopping of the converter unit. Otherwise, the life of the converter unit decreases.
- Use a noise filter or other means to reduce the effect of electromagnetic interference. Otherwise nearby electronic equipment may be affected.
- Take appropriate measures regarding harmonics. Otherwise this can endanger compensation systems or overload generators.
- When parameter clear or all clear is performed, set again the required parameters before starting operations. Each parameter returns to the initial value.
- Before running a converter unit which had been stored for a long period, always perform inspection and test operation.
- For prevention of damage due to static electricity, touch nearby metal before touching this product to eliminate static electricity from your body.

Emergency stop

⚠ CAUTION

- Provide a safety backup such as an emergency brake which will prevent the machine and equipment from hazardous conditions if the converter unit fails.
- When the breaker on the converter unit's input side trips, check for the wiring fault (short circuit), damage to internal parts of the converter unit, etc. Identify the cause of the trip, then remove the cause and power on the breaker.
- When the protective function is activated, take the corresponding corrective action as described in the instruction manual, then reset the converter unit (inverter), and resume operation.

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.

Disposing of the converter

⚠ CAUTION

- Treat as industrial waste.

General instructions

Many of the diagrams and drawings in instruction manuals show the product without a cover, or partially open. Never run the product in this status. Always reinstall the cover and follow instruction manuals when operating the product.

1 INSTALLATION AND INSTRUCTIONS

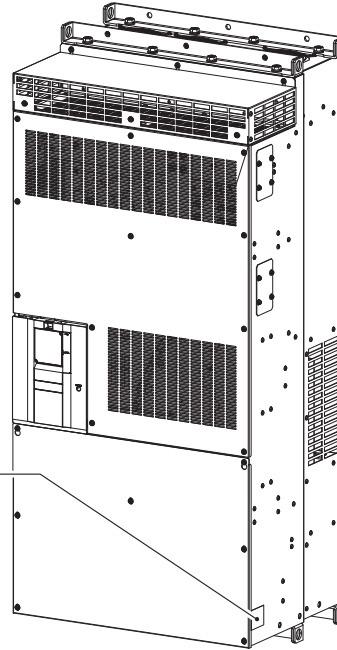
1.1 Converter unit model

Symbol	Voltage class
H	400V class


Symbol	Description
315 to 500K	Rated converter unit capacity [kW]

F R-CC2-H 315K -60

Symbol	Circuit board coating (3C2)	Plated conductor
-60	With	Without
-06	With	With



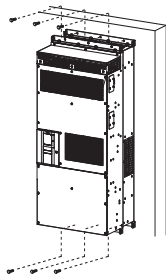
Rating plate

Converter unit model	→	 INVERTER PASSED
Input rating	→	MODEL FR-CC2-H315K-60
Output rating	→	INPUT : XXXXX
Serial number	→	OUTPUT : XXXXX
Production year and month	→	SERIAL : XXXXXXXXX DATE : XXXX-XX



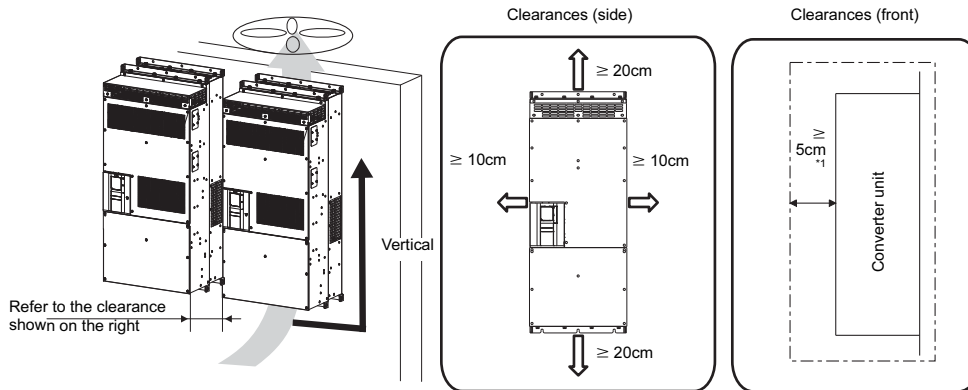
1.2 Installation of the converter unit

- Install the converter unit on a strong surface securely with bolts.



Fix six positions

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



*1 For replacing the cooling fan 30cm of space is necessary in front of the converter unit. Refer to the FR-CC2 Instruction Manual for fan replacement.

1.3 Environment

Before installation, check that the environment meets following specifications:

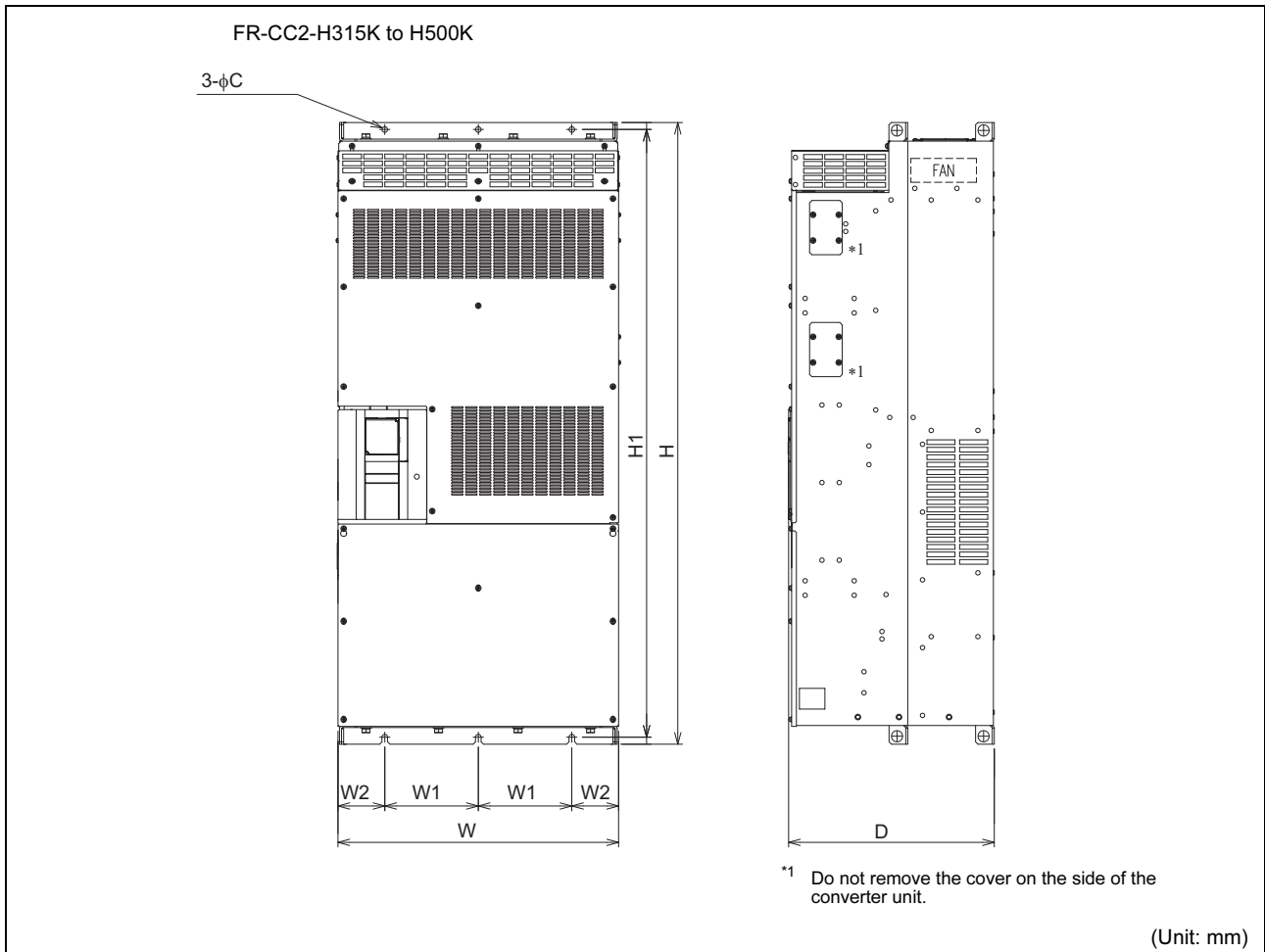
Surrounding air temperature *4	-10°C to +50°C (non-freezing)	
Ambient humidity	With circuit board coating: 95% RH or less (non-condensing), Without circuit board coating: 90% RH or less (non-condensing)	
Storage temperature	-20°C to +65°C *2	
Atmosphere	Indoors (No corrosive and flammable gases, oil mist, dust and dirt)	
Altitude	Maximum 2,500 m above sea level *3	
Vibration	2.9m/s ² or less at 10 to 55Hz (directions of X, Y, Z axes)	

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

*3 For the installation at an altitude above 1,000m up to 2,500m, derate the rated current 3% per 500 m.

*4 Surrounding air temperature is a temperature measured at a measurement position in an enclosure. Ambient temperature is a temperature outside an enclosure.

2 OUTLINE DRAWING

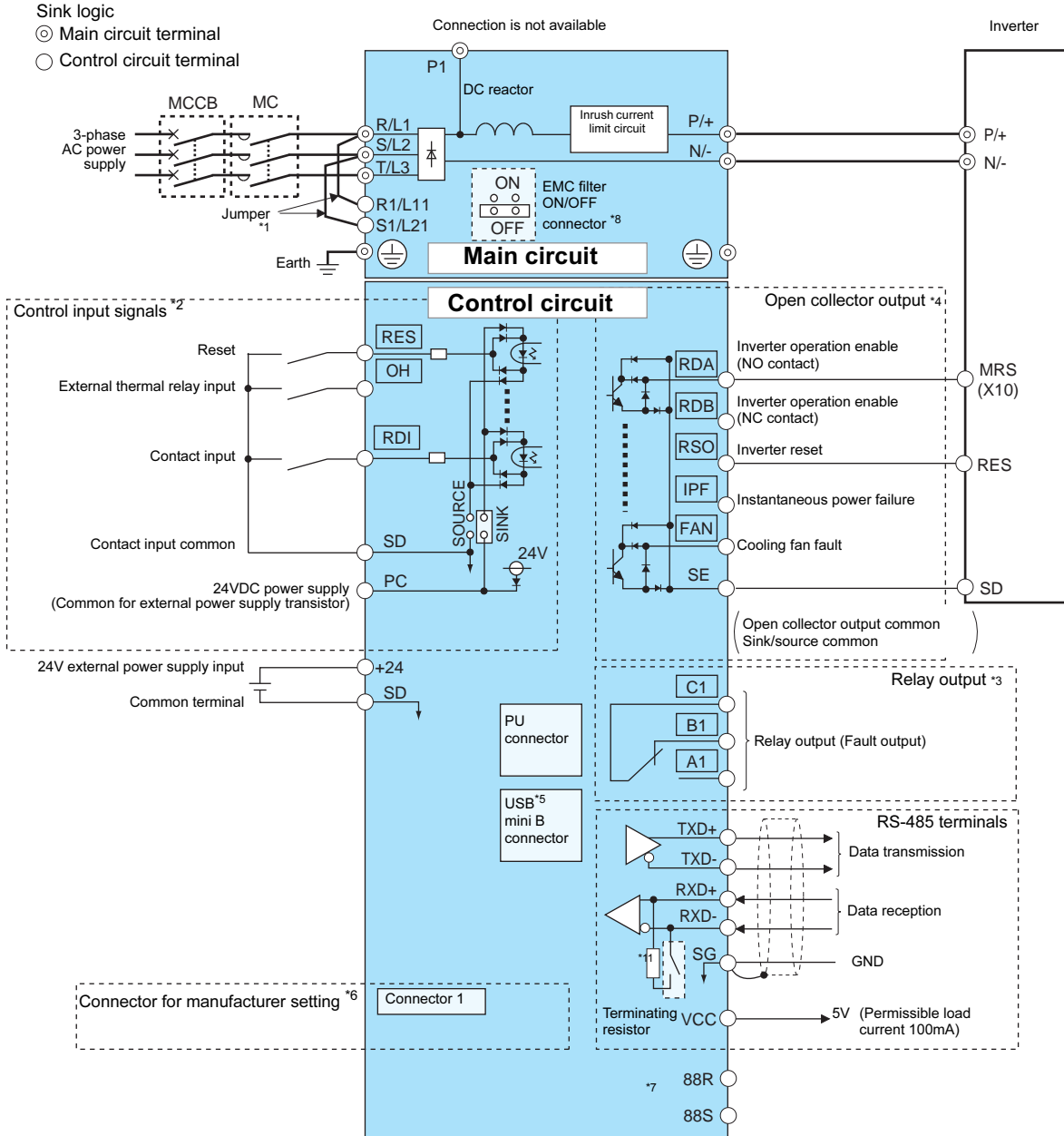


Converter unit model	W	W1	W2	H	H1	D	C
FR-CC2-H315K, H355K	600	200	100	1330	1300	440	12
FR-CC2-H400K, H450K, H500K				1580	1550		

3 WIRING

3.1 Terminal connection diagrams

● Sink logic



For footnotes *1 to *8 refer to next page.

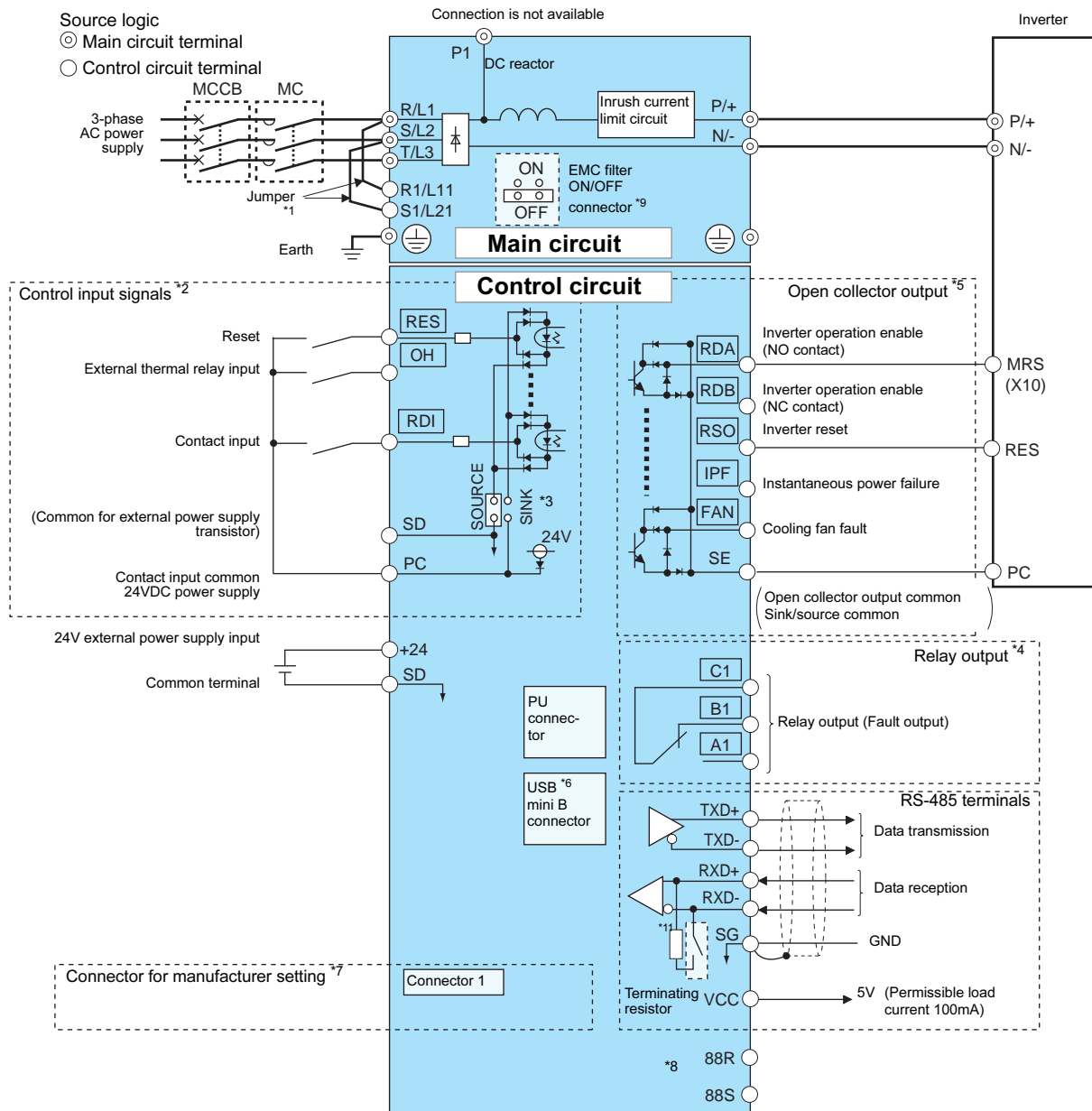
- *1 When using separate power supply for the control circuit, remove the jumper between R1/L11 and S1/L21.
- *2 No input voltage is allowed for these terminals. The function of these terminals can be changed with the input terminal assignment (Pr. 178, Pr. 187, Pr. 189). (Refer to *page 16*.)
- *3 The function of these terminals can be changed with the output terminal assignment (Pr. 195). (Refer to *page 16*.)
- *4 The function of these terminals can be changed with the output terminal assignment (Pr. 190 to Pr. 194). (Refer to *page 16*.)
- *5 The connector is for manufacturer setting. Do not use.
- *6 Plug-in options cannot be used.
- *7 For manufacturer setting. Do not use.
- *8 For the FR-CC2-H400K or higher, two EMC filter ON/OFF connectors are provided.

CAUTION

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



● Source logic



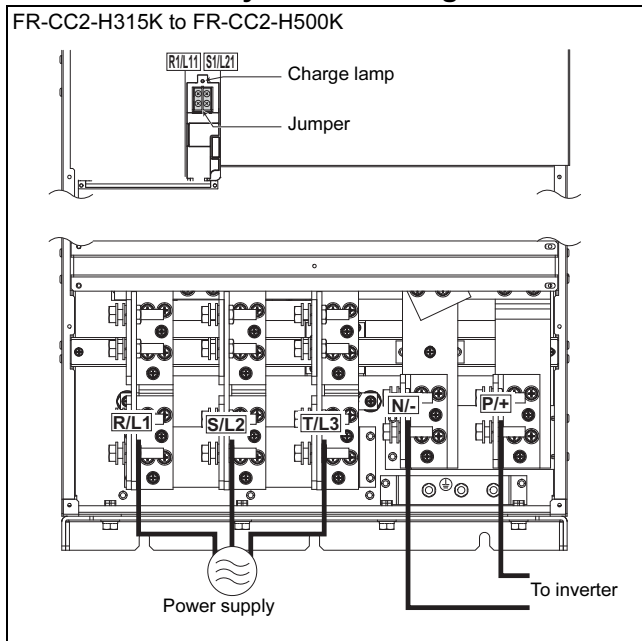
- *1 When using separate power supply for the control circuit, remove the jumper between R1/L11 and S1/L21.
- *2 No input voltage is allowed for these terminals. The function of these terminals can be changed with the input terminal assignment (Pr. 178, Pr. 187, Pr. 189). (Refer to page 16.)
- *3 The sink logic is initially set. The control logic can be changed with the jumper connector position.
- *4 The function of these terminals can be changed with the output terminal assignment (Pr. 195). (Refer to page 16.)
- *5 The function of these terminals can be changed with the output terminal assignment (Pr. 190 to Pr. 194). (Refer to page 16.)
- *6 The connector is for manufacturer setting. Do not use.
- *7 Plug-in options cannot be used.
- *8 For manufacturer setting. Do not use.
- *9 For the FR-CC2-H400K or higher, two EMC filter ON/OFF connectors are provided.

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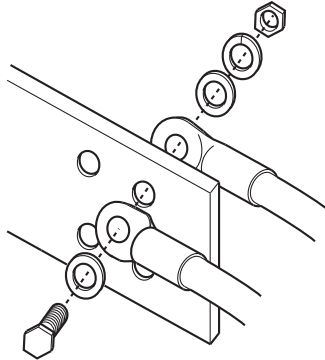
3.2 Main circuit terminal

3.2.1 Terminal layout and wiring



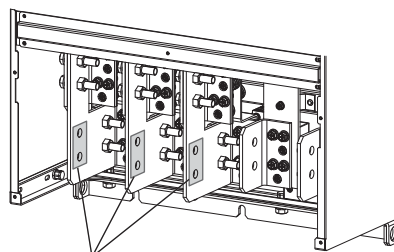
CAUTION

- The power supply cables must be connected to R/L1, S/L2, T/L3. (Phase sequence needs not to be matched.)
- When wiring the main circuit conductor tighten a nut from the right side of the conductor. When wiring two wires, place wires on both sides of the conductor (refer to the drawing). For wiring, use bolts (nuts) provided with the converter unit



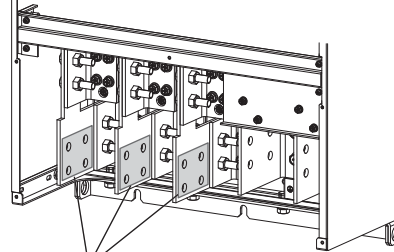
- When wiring cables to the main circuit conductor (R/L1, S/L2, T/L3) of the converter unit, use the bolts (nuts) for main circuit wiring, which are provided on the front side of the conductor.

FR-CC2-H315K, H355K



Connect the cables here.

FR-CC2-H400K to H500K



Connect the cables here.



3.3 Wiring fundamentals

3.3.1 Cable size

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

The following table indicates a selection example for the wiring length of 20m (when input power supply is 440V based on the rated current for 150% overload for 1 minute).

Converter model FR-CC2-H□	Terminal Screw Size *4	Tightening Torque [Nm]	Crimping Terminal	Cable Sizes					
				HIV, etc. [mm ²] *1			AWG/MCM *2	PVC, etc. [mm ²] *3	
				R/L1, S/L2, T/L3	R/L1, S/L2, T/L3	P/+, N/-	Earth Cable Gauge	R/L1, S/L2, T/L3	R/L1, S/L2, T/L3
315K	M12 (M10)	46	150-12	2×150	2×150	100	2×300	2×150	150
355K	M12 (M10)	46	C2-200	2×200	2×200	100	2×350	2×185	2×95
400K	M12 (M10)	46	C2-200	2×200	2×200	100	2×400	2×185	2×95
450K	M12 (M10)	46	C2-250	2×250	2×250	100	2×500	2×240	2×120
500K	M12 (M10)	46	C2-200	3×200	3×200	2×100	2×500	2×240	2×120

*1 The recommended cable size is that of the LMFC cable (heat resistant flexible cross-linked polyethylene insulated cable) with continuous maximum permissible temperature of 90°C. Assumes that the surrounding air temperature is 50°C or less and wiring is performed in an enclosure.

*2 The recommended cable size is that of THHN cable with continuous maximum permissible temperature of 90°C. Assumes that the surrounding air temperature is 40°C or less and wiring is performed in an enclosure. (Selection example for use mainly in the United States.)

*3 The recommended cable size is that of XLPE cable with continuous maximum permissible temperature of 90°C. Assumes that the surrounding air temperature is 40°C or less and wiring is performed in an enclosure. (Selection example for use mainly in Europe.)

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

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

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

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.

CAUTION

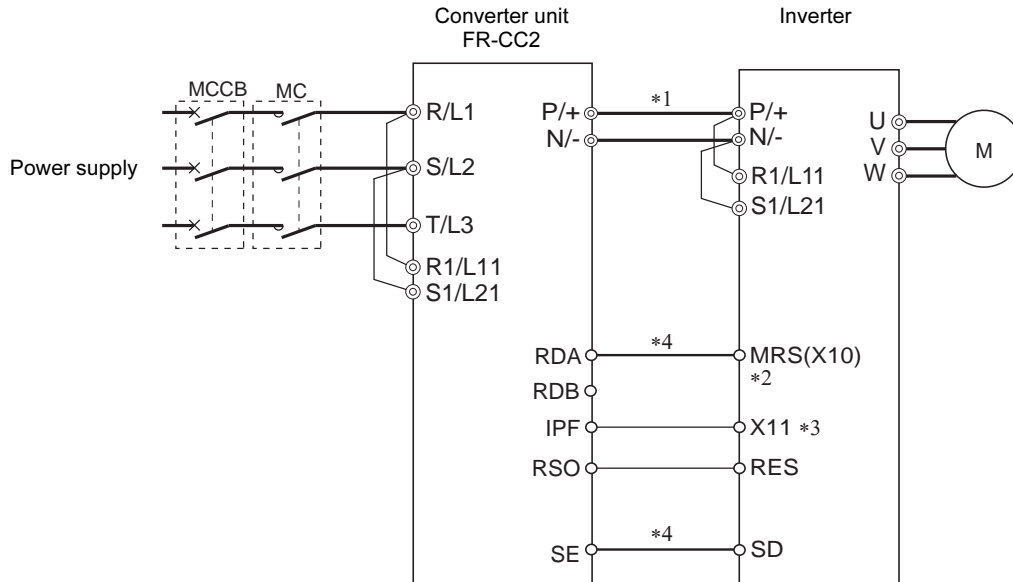
- Tighten the terminal screw to the specified torque.
A screw that has been tightened too loosely can cause a short circuit or malfunction.
A screw that has been tightened too tightly can cause a short circuit or malfunction due to the unit breakage.
- Use crimping terminals with insulation sleeve to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

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

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

Wiring Length	
Across the terminals P and P and the terminals N and N	Other signal cables
≤ 50m	≤ 30m

- For the cable gauge of the cable across the main circuit terminals P/+ and N/- (P and P, N and N), refer to *page 8*.



*1 Do not install an MCCB across the terminals P/+ and N/- (across terminals P and P/+ or across N and N/-). Connecting the opposite polarity of terminals N/- and P/+ will damage the inverter.

*2 For the terminal used for the X10 signal input, set "10" in any of Pr.178 to Pr.189 (input terminal function selection) to assign the function.

*3 For the terminal used for the X11 signal input, set "11" in any of Pr.178 to Pr.189 (input terminal function selection) to assign the function. For RS-485 or any other communication where the start command is only transmitted once, use the X11 signal to save the operation mode at the time of an instantaneous power failure.

*4 Always connect the terminal RDA of the converter unit and the terminal MRS (X10) of the inverter, and the terminal SE of the converter unit and the terminal SD (sink logic) of the inverter. Not connecting these terminals may damage the converter unit.

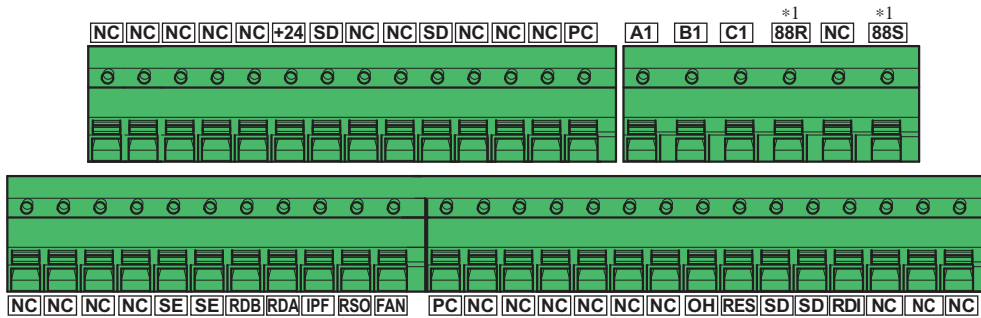
3.3.3 Cable size of the control circuit power supply (terminal R1/L11, S1/L21)

- Terminal screw size: M4
- Cable size: 0.75mm² to 2mm²
- Tightening torque: 1.5Nm



3.4 Control circuit terminals

3.4.1 Terminal layout



*1 For manufacturer setting. Do not use.

CAUTION

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

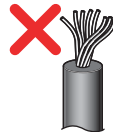
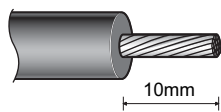
3.4.2 Wiring method

- Power supply connection

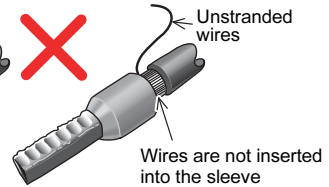
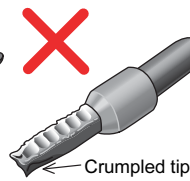
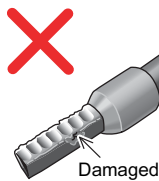
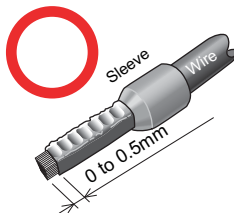
For the control circuit wiring, strip off the sheath of a cable, and use it with a blade terminal. For a single wire, strip off the sheath of the wire and apply directly. Insert the blade terminal or the single wire into a socket of the terminal.

- Strip off the sheath for the below length. If the length of the sheath peeled is too long, a short circuit may occur with neighbouring wires. If the length is too short, wires might come off. Wire the stripped cable after twisting it to prevent it from becoming loose. In addition, do not solder it.

Cable sheath stripping length



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



- Blade terminals commercially available (as of February 2012)

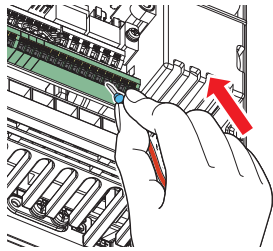
Cable gauge (mm ²)	Blade terminal model			Manufacturer	Crimping tool name
	With insulation sleeve	Without insulation sleeve	For UL wire *2		
0.3	AI 0,5-10WH	—	—	Phoenix Contact Co., Ltd.	CRIMPFOX 6
0.5	AI 0,5-10WH	—	AI 0,5-10WH-GB		
0.75	AI 0,75-10GY	A 0,75-10	AI 0,75-10GY-GB		
1	AI 1-10RD	A 1-10	AI 1-10RD/1000GB		
1.25, 1.5	AI 1,5-10BK	A 1,5-10	AI 1,5-10BK/1000GB *3		
0.75 (for two wires)	AI-TWIN 2x0,75-10GY	—	—		

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

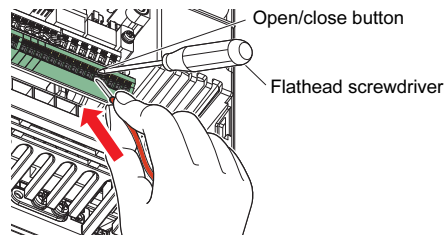
*3 Applicable for the terminals A1, B1, and C1 only.

Cable gauge (mm ²)	Blade terminal product number	Insulation product number	Manufacturer	Crimping tool product number
0.3 to 0.75	BT 0.75-11	VC 0.75	NICHIFU Co.,Ltd.	NH 69

- (3) Insert the wires into a socket.

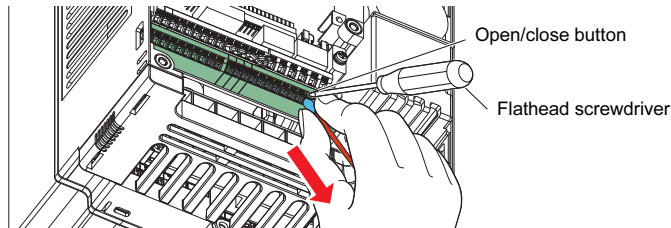


When using a single wire or stranded wires without a blade terminal, push the open/close button all the way down with a flathead screwdriver, and insert the wire.



• Wire removal

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



CAUTION

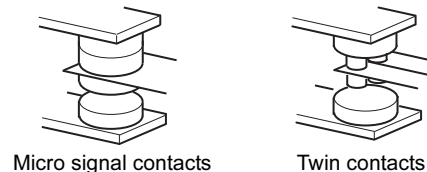
- When using stranded wires without a blade terminal, twist enough to avoid short circuit with a nearby terminals or wires.
- During wiring, pulling out the wire forcefully without pushing the open/close button all the way down may damage the terminal block.
- Use a small flathead screwdriver (tip thickness: 0.4 mm, tip width: 2.5 mm). If a flathead screwdriver with a narrow tip is used, terminal block may be damaged.
Commercially available products (as of February 2012).

Name	Model	Manufacturer
Driver	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.

3.4.3 Wiring precautions

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





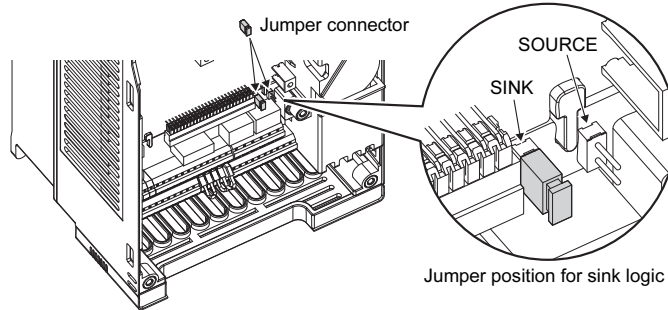
3.4.4 Control logic (sink/source) change

Change the control logic of input signals as necessary.

To change the control logic, change the jumper connector position on the control circuit board. Connect the jumper connector to the connector pin of the desired control logic.

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

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



CAUTION

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

3.4.5 When supplying 24 V external power to the control circuit

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

During the 24 V external power supply operation, the ALARM lamp of the accessory cover flickers. When the operation panel (FR-DU08) is installed, "EV" flickers.

♦ Applied 24 V external power specification

Item	Rated specification
Input voltage	23 to 25.5VDC
Input current	≤ 1.4A

3.5 Compatible inverters

The table below shows the inverter models compatible with the FR-CC2 converter units.

Motor capacity [kW] *1	Converter unit FR-CC2-H□	Inverter												
		SLD (superlight duty)			LD (light duty)			ND (normal duty, initial value)			HD (heavy duty)			
		Model FR-A842-□	Rated current [A]		Model FR-A842-□	Rated current [A]		Model FR-A842-□	Rated current [A]		Model FR-A842-□	Rated current [A]		
280	315K	—	—	—	—	—	—	—	—	—	—	315K	07700	547
315	315K	—	—	—	—	—	—	315K	07700	610	—	355K	08660	610
355	355K	—	—	—	315K	07700	683	355K	08660	683	—	400K	09620	683
400	400K	315K	07700	770	355K	08660	770	400K	09620	770	—	450K	10940	770
450	450K	355K	08660	866	400K	09620	866	450K	10940	866	—	500K	12120	866
500	500K	400K	09620	962	450K	10940	962	500K	12120	962	—	—	—	—

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

4 PRECAUTIONS FOR USE OF THE CONVERTER UNIT

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

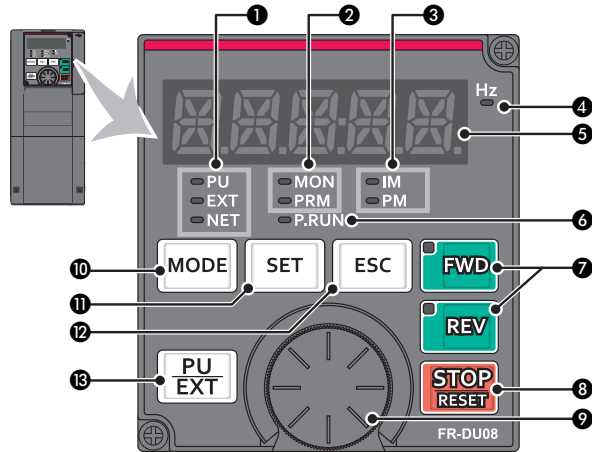
Before starting operation, always recheck the following items:

- Use crimping terminals with insulation sleeve to wire the power supply and the inverter.
- After wiring, wire offcuts must not be left in the converter unit.
Wire offcuts can cause an alarm, failure or malfunction. Always keep the converter unit clean. When drilling mounting holes in a control box etc., take care not to allow chips and other foreign matter to enter the converter unit.
- Use cables of the appropriate size to make a voltage drop of 2% maximum.
Refer to *page 8* for the recommended cable size.
- The overall wiring length should be within the prescribed length.
Especially for long distance wiring, the fast-response current limit function may be reduced or the equipment connected to the converter unit's output side may malfunction or become faulty under the influence of a charging current due to the stray capacity of the wiring. Therefore, note the overall wiring length. (Refer to *page 9*)
- Electromagnetic wave interference
The input/output (main circuit) of the converter unit includes high frequency components, which may interfere with the communication devices (such as AM radios) used near the converter unit. In this case, activate the EMC filter (turn ON the EMC filter ON/OFF connector) to minimize interference. (Refer to the Instruction Manual.)
- Before starting wiring or other work after the product is operated, 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.
- If "EV" is displayed on the operation panel, turn OFF the 24 V external power supply before performing wiring.
- Do not use the converter unit input side magnetic contactor (MC) to start/stop the inverter.
Since repeated inrush currents at power ON will shorten the life of the inverter and the converter unit (switching life is about 1,000,000 times), frequent starts and stops of the MC must be avoided.
Always use the start signal (ON/OFF of STF and STR signals) to start/stop the inverter.
- Do not apply a voltage higher than the permissible voltage to the converter unit I/O signal circuits.
Contact to the converter unit I/O signal circuits or opposite polarity may damage the I/O devices. Check the wiring beforehand.
- Converter unit's input side magnetic contactor (MC)
On the converter unit's input side, connect an MC for the following purposes. (Refer to the Instruction Manual.)
 - To release the converter unit from the power supply when a fault occurs or when the drive is not functioning (e.g. emergency stop operation).
 - To prevent any accident due to an automatic restart at restoration of power after an inverter stop made by a power failure.
 - To separate the converter unit from the power supply to ensure safe maintenance and inspection work.If using an MC for emergency stop during operation, select an MC regarding the converter unit input side current as JEM1038-AC-3 class rated current.
- Make sure that the specifications and rating match the system requirements.
- Connect the converter unit and the inverter correctly.
 - Make sure that the terminal P/+ of the converter unit and the terminal P/+ of the inverter, and the terminal N/- of the converter unit and the terminal N/- of the inverter are correctly connected.
Connecting the opposite polarity of terminals N/- and P/+ will damage the inverter.
Also, do not install an MCCB across the terminals P/+ and N/- (across terminals P and P/+ or across N and N/-).
 - Always connect the terminal RDA of the converter unit and the terminal MRS (X10) of the inverter, and the terminal SE of the converter unit and the terminal SD (terminal PC for source logic) of the inverter.
Not connecting these terminals may damage the converter unit.

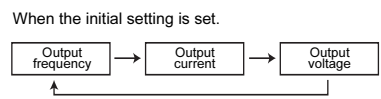
5 DRIVE THE MOTOR

5.1 Operation panel (FR-DU08)

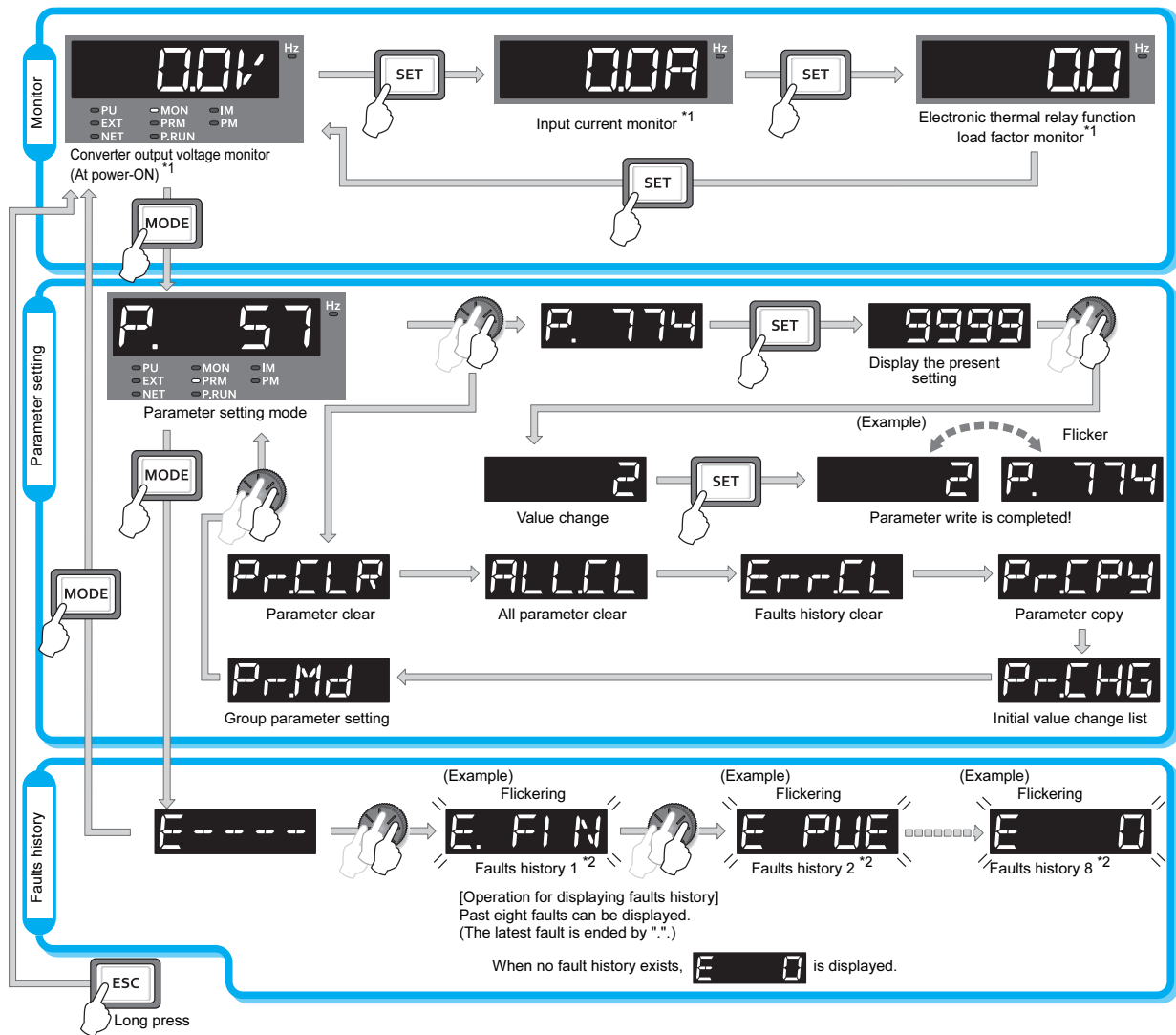
5.1.1 Components of the operation panel (FR-DU08)



No.	Component	Name	Description
①	<ul style="list-style-type: none"> ○ PU ○ EXT ○ NET 	—	Not used
②	<ul style="list-style-type: none"> ○ MON ○ PRM 	Operation panel status indicator	MON: Lit to indicate the monitoring mode. Quickly flickers twice intermittently while the protective function is activated. Slowly flickers in the display-OFF mode. PRM: Lit to indicate the parameter setting mode.
③	<ul style="list-style-type: none"> ○ IM ○ PM 	—	Not used
④	Hz	—	Not used
⑤		Monitor (5-digit LED)	Shows the monitored status, parameter number, etc. (Using Pr. 774 to Pr. 776, the monitored item can be changed.)
⑥	○ P.RUN	—	Not used
⑦	 	—	Not used
⑧		STOP/RESET key	Resets the converter unit when the protection function is activated.
⑨		Setting dial	The setting dial is used to change the parameter settings. Press the setting dial to perform the following operations: <ul style="list-style-type: none"> • To display a monitored item set in Pr. 992 • To display a fault history number in the faults history mode
⑩		MODE key	Switches to different modes. Holding this key for 2 seconds locks the operation. The key lock is invalid when Pr. 161="0 (initial setting)". (Refer to the Instruction Manual.)
⑪		SET key	Enters each setting. If pressed during operation, the monitored item changes. (Using Pr. 774–Pr. 776, the monitored item can be changed.)
⑫		ESC key	Goes back to the previous display. Holding this key for a longer time changes the mode back to the monitor mode.
⑬		—	Not used



5.1.2 Basic operation of the operation panel (factory setting)



*1 Monitored items can be changed. (Refer to the FR-CC2 Instruction Manual.)

*2 For the details of faults history, refer to the FR-CC2 Instruction Manual.



5.2 Parameter list

Set the necessary parameters to meet the load and operational specifications. Parameter setting, change and check can be performed from the operation panel (FR-DU08).

Parameter	Name	Setting Range	Initial Value	Parameter	Name	Setting Range	Initial Value
57	Restart selection	0, 9999	9999	190	RDB terminal function selection	2, 8, 11, 25, 26, 64, 68, 90, 94, 95, 98, 99, 102, 108, 111, 125, 126, 164, 168, 190, 194, 195, 198, 199, 206, 207, 209, 306, 307, 309, 9999	111
65	Retry selection	0 to 4	0	191	RDA terminal function selection		11
67	Number of retries at fault occurrence	0 to 10, 101 to 110	0	192	IPF terminal function selection		2
68	Retry waiting time	0.1 to 600s	1s	193	RSO terminal function selection		209
69	Retry count display erase	0	0	194	FAN terminal function selection		25
75	Reset selection/ disconnected PU detection/Reset limit	0, 1, 14 to 17, 114 to 117	14	195	ABC1 terminal function selection	99	
77	Parameter write selection	1, 2	2	255	Life alarm status display	(0 to 15)	0
117	PU communication station number	0 to 31	0	256	Inrush current limit circuit life display	(0 to 100%)	100%
118	PU communication speed	48, 96, 192, 384, 576, 768, 1152	192	257	Control circuit capacitor life display	(0 to 100%)	100%
119	PU communication stop bit length / data length	0, 1, 10	1	268	Monitor decimal digits selection	0, 1, 9999	9999
120	PU communication parity check	0 to 2	2	269	Parameter for manufacturer setting. Do not set.		
121	Number of PU communication retries	0 to 10, 9999	1	290	Monitor negative output selection	0, 2, 4, 6	0
122	PU communication check time interval	0, 0.1 to 999.8s, 9999	9999	296	Password lock level	0 to 3, 5, 6, 100 to 103, 105, 106, 9999	9999
123	PU communication waiting time setting	0 to 150ms, 9999	9999	297	Password lock/unlock	(0 to 5), 1000 to 9998, 9999	9999
124	PU communication CR/LF selection	0 to 2	1	331	RS-485 communication station number	0 to 31 (0 to 247)	0
161	Key lock operation selection	0, 10	0	332	RS-485 communication speed	3, 6, 12, 24, 48, 96, 192, 384, 576, 768, 1152	96
168	Parameter for manufacturer setting.			333	RS-485 communication stop bit length/data length	0, 1, 10, 11	1
169	Do not set.			334	RS-485 communication parity check selection	0 to 2	2
170	Watt-hour meter clear	0, 10, 9999	9999				
178	RDI terminal function selection	7, 62, 9999	9999				
187	OH terminal function selection		7				
189	RES terminal function selection		62				

Parameter	Name	Setting Range	Initial Value
335	RS-485 communication retry count	0 to 10, 9999	1
336	RS-485 communication check time interval	0 to 999.8s, 9999	0s
337	RS-485 communication waiting time setting	0 to 150ms, 9999	9999
341	RS-485 communication CR/LF selection	0 to 2	1
342	Communication EEPROM write selection	0, 1	0
343	Communication error count	—	0
503	Maintenance timer 1	0 (1 to 9998)	0
504	Maintenance timer 1 warning output set time	0 to 9998, 9999	9999
539	Modbus-RTU communication check time interval	0 to 999.8s, 9999	9999
549	Protocol selection	0, 1	0
563	Energization time carrying-over times	(0 to 65535)	0
598	Undervoltage level	350 to 430V, 9999	9999
663	Control circuit temperature signal output level	0 to 100 °C	0 °C
686	Maintenance timer 2	0 (1 to 9998)	0
687	Maintenance timer 2 warning output set time	0 to 9998, 9999	9999
688	Maintenance timer 3	0 (1 to 9998)	0
689	Maintenance timer 3 warning output set time	0 to 9998, 9999	9999

Parameter	Name	Setting Range	Initial Value
774	Operation panel monitor selection 1	2, 8, 13, 20, 25, 43, 44, 55, 62, 98, 9999	9999
775	Operation panel monitor selection 2		9999
776	Operation panel monitor selection 3		9999
872	Input phase loss protection selection	0, 1	0
876	OH input selection	0 to 2	0
888	Free parameter 1	0 to 9999	9999
889	Free parameter 2	0 to 9999	9999
891	Cumulative power monitor digit shifted times	0, 4, 9999	9999
990	PU buzzer control	0, 1	1
992	Operation panel setting dial push monitor selection	2, 8, 13, 20, 25, 43, 44, 55, 62, 98	8
997	Fault initiation	0 to 255, 9999	9999
1006	Clock (year)	2000 to 2099	2000
1007	Clock (month, day)	1/1 to 12/31	101
1008	Clock (hour, minute)	0:00 to 23:59	0
1048	Display-off waiting time	0 to 60min	0min
Pr.CLR	Parameter clear	(0,) 1	0
ALL.CL	All parameter clear	(0,) 1	0
Err.CL	Fault history clear	(0,) 1	0
Pr.CPY	Parameter copy	(0,) 1 to 3	0
Pr.CHG	Initial value change list	—	0
Pr.Md	Group parameter setting	(0,) 1, 2	0

6 TROUBLESHOOTING

When a fault occurs in the converter unit, the protective function activates, and the PU display automatically changes to one of the fault or alarm indications listed on *page 19*.

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

- Retention of alarm output signal.....When the magnetic contactor (MC) provided on the input side of the converter unit is opened at the activation of the protective function, the converter unit's control power will be shut off and the alarm output will not be held.
- Alarm display.....When the protective function is activated, the operation panel display automatically switches to the fault or alarm indication.
- Resetting methodWhen a protective function is activated, the inverter output is kept stopped. Unless reset, the converter unit (inverter) cannot restart. (Refer to *page 18*.)
- When the protective functions were activated, take an appropriate corrective action, then reset the converter unit (inverter), and resume the operation. Not doing so may lead to a converter unit (an inverter) fault and damage.

Converter unit fault or alarm indications are roughly divided as below:

- Error Message
A message regarding operational fault and setting fault by the operation panel (FR-DU08) is displayed. The inverter does not shut off output.
- Warning
The inverter does not shut off output even when a warning is displayed. However, failure to take appropriate measures will lead to a fault.
- Alarm
The inverter does not shut off output. You can also output an alarm signal (LF) by making parameter setting.
- Fault
When the protective function is activated, the inverter output is shut off and a fault signal (ALM) is output.

NOTES

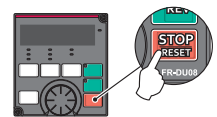
- For the details of fault displays and other malfunctions, also refer to the Instruction Manual.
- Past eight faults can be displayed using the setting dial. (Refer to *page 15*.)

6.1 Reset Method of Protective Function

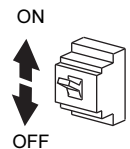
The converter unit can be reset by performing any of the following operations. Note that the internal thermal integrated value of the electronic thermal relay function and the number of retries are cleared (erased) by resetting the converter unit. Converter unit recovers about 1s after reset is cancelled.

Three different methods can be used to reset a converter unit:

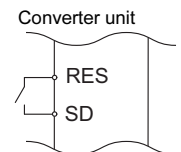
- Using the operation panel, press the STOP/RESET key to reset the converter unit .
(This may only be performed when a fault occurs.)



- Switch OFF the power once, then switch it ON again after the indicator of the operation panel turns OFF.



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



CAUTION

OFF status of the inverter start signal must be confirmed before resetting the converter unit fault. Resetting converter unit fault with the inverter start signal ON restarts the inverter suddenly. This may cause injury.

6.2 List of alarm display

Operation Panel Indication		Name	Data code	
Error message	E-----	E-----	Faults history	—
	HOLD	HOLD	Operation panel lock	—
	LOCd	LOCD	Password locked	—
	Er 1	Er1	Parameter write error	—
	rE1 to rE4	rE1 to rE4	Copy operation error	—
	Err.	Err.	Error	—
Warning	TH	TH	Electronic thermal relay function pre-alarm	—
	MT1 to MT3	MT1 to MT3	Maintenance timer 1 to 3	—
	EV	EV	24 V external power supply operation	—
Alarm	FN	FN	Fan alarm	—
Fault	E. OCF	E.OCT	Overcurrent trip	16 (H10)
	E. OVF	E.OVT	Overvoltage trip	32 (H20)
	E. THC	E.THC	Converter overload trip (electronic thermal relay function)	48 (H30)
	E. FIN	E.FIN	Heatsink overheat	64 (H40)
	E. IPF	E.IPF	Instantaneous power failure	80 (H50)
	E. UVT	E.UVT	Undervoltage	81 (H51)
	E. ILF	E.ILF	Input phase loss	82 (H52)

Operation Panel Indication		Name	Data code
E. OHT	E.OHT	External thermal relay operation	144 (H90)
E. PE	E.PE	Parameter storage device fault	176 (HB0)
E. PUE	E.PUE	PU disconnection	177 (HB1)
E. RET	E.RET	Retry count excess	178 (HB2)
E. PE2	E.PE2	Parameter storage device fault	179 (HB3)
E. CPU	E.CPU	CPU fault	192 (HC0)
E. CTE	E.CTE	Operation panel power supply short circuit/RS-485 terminal power supply short circuit	193 (HC1)
E. P24	E.P24	24V DC power fault	194 (HC2)
E. IOH	E.IOH	Inrush current limit circuit fault	197 (HC5)
E. SER	E.SER	Communication fault (inverter)	198 (HC6)
E. PBT	E.PBT	Internal circuit fault	202 (HCA)
E. 1	E. 1	Option fault	241 (HF1)
E. 5 to E. 7	E. 5 to E. 7	CPU fault	245–247 (HF5–HF7)
E. 13	E.13	Internal circuit fault	253 (HFD)

7 SPECIFICATIONS

7.1 Converter unit rating

Model FR-CC2-H□		315K	355K	400K	450K	500K
Applicable motor capacity [kW]		315	355	400	450	500
Output	Overload current rating ^{*1}	150% for 60s, 200% for 3s				
	Rated voltage ^{*2}	430 to 780 V DC ^{*5}				
Power supply	Rated input AC voltage/frequency	Three-phase 380 to 500 V 50Hz/60Hz				
	Permissible AC voltage fluctuation	Three-phase 323 to 550 V 50Hz/60Hz				
	Permissible frequency fluctuation	±5%				
	Rated input current [A]	610	683	770	866	962
	Power supply capacity [kVA] ^{*3}	465	521	587	660	733
Protective structure (IEC 60529) ^{*4}		Open type (IP00)				
Cooling system		Forced air cooling				
DC reactor		Built-in				
Weight [kg]		210	213	282	285	288

^{*1} The % value of the overload current rating indicated is the ratio of the overload current to the inverter's rated output current. For repeated duty, allow time for the converter unit and the inverter to return to or below the temperatures under 100% load.

^{*2} The converter unit output voltage varies according to the input power supply voltage and the load. The maximum point of the voltage waveform at the converter unit output side is approximately the power supply voltage multiplied by $\sqrt{2}$.

^{*3} The power supply capacity is the value when at the rated output current. It varies by the impedance at the power supply side (including those of the input reactor and cables).

^{*4} FR-DU08: IP40 (except for the PU connector section)

^{*5} The permissible voltage imbalance ratio is 3% or less.

(Imbalance ratio = (highest voltage between lines – average voltage between three lines) / average voltage between three lines × 100)

A APPENDIX

A.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
Name: Mitsubishi Electric Europe B.V.
Address: Gothaer Straße 8, 40880 Ratingen, Germany

NOTE

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

A.1.1 EMC Directive

We declare that this converter unit conforms with the EMC Directive and affix the CE marking on the converter unit.

- EMC Directive: 2004/108/EC
- Standard(s): EN61800-3:2004 (Second environment / PDS Category "C3")
- This converter unit is not intended to be used on a low-voltage public network which supplies domestic premises.
- Radio frequency interference is expected if used on such a network.
- The installer shall provide a guide for installation and use, including recommended mitigation devices.

NOTES

- First environment
Environment including residential buildings. Includes buildings directly connected without a transformer to the low voltage power supply network which supplies power to residential buildings.
- Second environment
Environment including all buildings except buildings directly connected without a transformer to the low voltage power supply network which supplies power to residential buildings.

NOTES

Set the EMC filter valid and install the converter unit and perform wiring according to the following instructions:

- The converter unit is equipped with a built-in EMC filter. Set the EMC filter valid.
(For details, refer to the Instruction Manual.)
- Connect the inverter and the converter unit to an earthed power supply.
- Install a motor and a control cable according to the EMC Installation Guidelines (BCN-A21041-204).
- Confirm that the final integrated system with the inverter and the converter unit conforms with the EMC Directive.



A.1.2 Low Voltage Directive

We have self-confirmed our converter units as products compliant to the Low Voltage Directive (conforming standard EN 61800-5-1) and place the CE mark on the converter unit.

Outline of instructions

- Do not use an earth leakage current breaker as an electric shock protector without connecting the equipment to the earth. Connect the equipment to the earth securely.
- Wire the earth 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 Appendix C TABLE 5.
- Use a tinned (plating should not include zinc) crimping 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 whose size is indicated on *page 8*.
- Use the moulded case circuit breaker and magnetic contactor which conform to the EN or IEC Standard.
- This product can cause a DC current in the protective earthing conductor. Where a residual current-operated protective (RCD) or monitoring (RCM) device is used for protection in case of direct or indirect contact, only an RCD or RCM of Type B is allowed on the supply side of this product.
- Use the converter unit under the conditions of overvoltage category II (usable regardless of the earth condition of the power supply), overvoltage category III (usable with the earthed-neutral system power supply, 400V class only) and pollution degree 2 or lower specified in IEC664.
 - To use the converter unit under the conditions of pollution degree 2, install it in the enclosure of IP 2X or higher.
 - To use the converter unit under the conditions of pollution degree 3, install it in the enclosure of IP54 or higher.
- On the input and output of the inverter and the converter unit, use cables of the type and size set forth in EN60204 Appendix C.
- The operating capacity of the relay outputs (terminal symbols A1, B1, C1) should be 30VDC, 0.3A. (Relay outputs are basically isolated from the inverter internal circuit and the converter unit.)
- Control circuit terminals on *page 4* are safely isolated from the main circuit.
- Environment

	During Operation	In Storage	During Transportation
Surrounding air temperature	-10 to +40°C	-20 to +65°C	-20 to +65°C
Ambient humidity	95% RH or less	95% RH or less	95% RH or less
Maximum altitude	2500m	2500m	10000m

Wiring protection

For installation Class T, Class J, Class CC, or Class L fuse must be provided.

FR-CC2-H□	315K	355K	400K	450K	500K
Rated fuse voltage [V]	500V or more				
Fuse Maximum allowable rating [A] ^{*1}	1100	1200	1350	1500	1800

^{*1} Maximum allowable rating by US National Electrical Code. Exact size must be chosen for each installation.

A.1.3 Short circuit ratings

Suitable for use in a circuit capable of delivering not more than 100kA rms symmetrical amperes, 550V or 600V maximum.

A.1.4 Machinery directive

The frequency inverter and the converter unit themselves are not a machine in the spirit of the EU machinery directive. The start up of the final integrated system with the inverter and the converter unit in a machine is prohibited so long until it has been confirmed that the entire machine complies with the provisions of Directive 98/37/EC (from 29.12.2009 Machinery Directive 2006/42/EC).

A.2 Instructions for UL and cUL

(Conforming standard UL 508C, CSA C22.2 No.14)

A.2.1 General precautions

⚠ WARNING

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.

A.2.2 Installation

All types of the converter unit have been approved as products for use in enclosure.

Design an enclosure so that the surrounding air temperature, humidity and atmosphere of the converter unit satisfy the specifications (refer to *page 2*.)

Wiring protection

For installation in the United States, Class T, Class J, Class CC, or Class L fuse must be provided in accordance with the National Electrical Code and any applicable provincial codes (refer to the table on *page 22*).

For installation in Canada, Class T, Class J, Class CC, or Class L fuse must be provided in accordance with the Canada Electrical Code and any applicable provincial codes (refer to the table on *page 22*).

A.2.3 Wiring of the power supply and motor

For wiring the input (R/L1, S/L2, T/L3) terminals of the converter unit and output (U, V, W) terminals of the inverter, use the UL-listed copper wires (rated at 75°C) and round crimping terminals. Crimp the crimping terminals with the crimping tool recommended by the terminal maker.

A.2.4 Short circuit ratings

Suitable for use in a circuit capable of delivering not more than 100kA rms symmetrical amperes, 550V or 600V maximum.

HEADQUARTERS		EUROPEAN REPRESENTATIVES		EUROPEAN REPRESENTATIVES		EURASIAN REPRESENTATIVES	
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