


Thank you for purchasing our FRENIC-Ace series of inverters.  
The purpose of this instruction manual is to provide handling information, setting up and operating of the FRENIC-Ace series of inverters.  
Do not use this product until you have full knowledge of the product, safety information and instructions from this Instruction Manual and Related documents.

**[Related Documents]**  
Instruction Manual (Detailed Version) INR-S147-173□-E  
User's Manual 2447-E-0043□  
RS-485 Communication User's Manual 2447-E-0099

Instruction manual QR code



This manual can be downloaded in PDF form from QR code in right figure.

https://www.fujielectric.com/products/ac\_drives\_inverter/ace/download/pr

**Fuji Electric Co., Ltd.**

Please feel free to send your comments regarding any errors or omissions you may have found, or any suggestions you may have for generally improving the manual. In no event will Fuji Electric Co., Ltd. be liable for any direct or indirect damages resulting from the application of the information in this manual.

First Edition, October 2020 **INR-S147-2364-E**

**CAUTION**

Thank you for purchasing our FRENIC-Ace series of inverters.

- This product is designed to drive induction motor and three-phase permanent magnet synchronous motor. Read through this instruction manual and be familiar with the handling procedure for correct use.
- Improper handling might result in incorrect operation, a short life, or even a failure of this product as well as the motor.
- Deliver this manual to the end user of the product in a safe place until this product is discarded.
- For instructions on how to use an optional device, refer to the instruction and installation manuals for that optional device.
- Drawings in this manual may be illustrated without covers or safety shields for explanation of detail parts. Restore the covers and shields in the original state and observe the description in the manual before starting operation.

**WARNING**

**Application**

- FRENIC-Ace is designed to drive a three-phase induction motor. Do not use it for single-phase motors or for other purposes.
- Fire or an accident could occur.
- FRENIC-Ace may not be used for a life-support system or other purposes directly related to the human safety.
- Though FRENIC-Ace is manufactured under strict quality control, install safety devices for applications where serious accidents or material losses are foreseen in relation to the failure of it.

**An accident could occur.**

- Install the inverter on a nonflammable material such as metal.
- Otherwise fire could occur.
- Do not place flammable material nearby.
- Doing so could cause fire.
- Inverters FRN008E2□-4□ or above, whose protective structure is IP00, involve a possibility that a human body may touch the live conductors of the main circuit terminal block. Inverters to which an optional DC reactor is connected also involve the same. Install such inverters in an inaccessible place.
- Otherwise, electric shock or injuries could occur.

**Wiring**

- If zero-phase current (earth leakage current) detection device such as a ground-fault relay is installed in the upstream power supply line, in order to avoid the entire power supply system's shutdown undesirable to factory operation, install a residual-current-protected protective device (RCD) or residual-current circuit breaker (RCCB) individually to inverters to break the individual inverter power supply lines only.
- When wiring the inverter to the power source, insert a recommended molded case circuit breaker (MCCB) or residual-current-protected protective device (RCD) or residual-current circuit breaker (RCCB) (with overcurrent protection) in the path of each pair of power lines to inverters. Use the recommended devices within the recommended current capacity.
- Use wires in the specified size.
- Tighten terminals with specified torque.
- When there is more than one combination of an inverter and motor, do not use a multicore cable for the purpose of handling their wirings together.
- Do not connect a surge killer to the inverter's output (secondary) circuit.
- Be sure to connect an optional DC reactor (DCR) when the capacity of the power supply transformer exceeds 500 kVA and is 10 times or more the inverter rated capacity.
- Otherwise, a fire could occur.
- Ground the inverter in compliance with the national or local electric code.
- Be sure to ground the inverter's grounding terminals G.
- Otherwise, an electric shock or injuries could occur.
- Qualified electricians should carry out wiring.
- Be sure to perform wiring after turning the power OFF.
- Otherwise, an electric shock could occur.
- Be sure to perform wiring after installing the inverter unit.
- Otherwise, an electric shock could occur.
- Ensure that the number of input phases and the rated voltage of the product match the number of phases and the voltage of the AC power supply to which the product is to be connected.
- Otherwise, a fire or an accident could occur.
- Do not connect the power supply wires to output terminals (U, V, and W).
- When connecting a DC braking resistor (DBR), never connect it to terminals other than terminals P(+) and DB.
- Doing so could cause fire or an accident.
- In general, sheaths of the control signal wires are not specifically designed to withstand a high voltage (i.e., reinforced insulation is not applied). Therefore, if a control signal wire comes into direct contact of the main circuit, the insulation of the wire sheath might break down, which would expose the signal wire to a high voltage of the main circuit. Make sure that the control signal wires will not come into contact with live conductors of the main circuit.
- Doing so could cause an accident or an electric shock.
- Before changing the switches of the control circuit terminal symbol plate, turn OFF the power and wait at least five minutes for inverters FRN011E2□-2□ / FRN007E2□-4□ / FRN001E2□-7□ or below, or at least ten minutes for inverters FRN008E2□-4□ or above. Make sure that the LED monitor and charging lamp are turned OFF. Further, use a multimeter or a similar instrument that the DC link bus voltage between the terminals P(+) and N(-) has dropped to the safe level (+25 VDC or below).
- Otherwise, an electric shock could occur.

**Operation**

- Be sure to mount the front cover before turning the power ON. Do not remove the cover when the inverter power is ON.
- Otherwise, an electric shock could occur.
- Do not operate switches with wet hands.
- Doing so could cause electric shock.
- If the auto-reset function has been selected, the inverter may automatically restart and drive the motor depending on the cause of tripping. Design the machinery or equipment so that human safety is ensured at the time of restarting.
- Otherwise, an accident could occur.
- If the stall prevention function (current limiter), automatic deceleration (anti-regenerative control), or overload prevention control has been selected, the inverter may operate with acceleration/deceleration or frequency different from the commanded ones. Design the machine so that safety is ensured even in such cases.
- The (STOP) key on the keypad is effective only when the keypad operation is enabled with function code F02 (= 0, 2 or 3). When the keypad operation is disabled, prepare an emergency stop safety operation.
- Switching the run command source from keypad (local) to external equipment (remote) by turning ON the "Enable communications link" command LE disables the (STOP) key. To enable the (STOP) key for an emergency stop, select the STOP key priority with function code H96 (= 1 or 3).
- If any of the protective functions have been activated, first remove the cause. Then, after checking that the all run commands are set to OFF, release the alarm. If the alarm is released while any run command is set to ON, the inverter may supply the power to the motor, running the motor.
- Otherwise, an accident could occur.
- If you enable the "Restart mode after momentary power failure" (Function code F14 = 3), then the inverter automatically restarts running the motor when the power is recovered.
- Design the machinery or equipment so that human safety is ensured after restarting.
- If the user configures the inverter codes wrongly without completely understanding the User's Manual, the motor may rotate with a torque or at a speed not permitted for the machine.
- Starting auto-braking involves motor rotation. Sufficiently check that motor rotation brings no danger beforehand.
- An accident or injuries could occur.
- Even if the inverter has interrupted power to the motor, if the voltage is applied to the main circuit input terminals L1/R, L2/S, L3/T, L1/L, and L2/N, voltage may be output to inverter output terminals U, V, and W.
- Even if the motor is stopped due to DC braking or preliminary excitation, voltage is applied to inverter output terminals U, V, and W.
- An electric shock may occur.
- The inverter can easily cause high-speed operation. When changing the speed setting, carefully check the specifications of motors or equipment beforehand.
- Otherwise, injuries could occur.

**Maintenance and inspection, and parts replacement**

- Before proceeding to the maintenance or inspection jobs, turn OFF the power and wait at least five minutes for inverters FRN011E2□-2□ / FRN007E2□-4□ / FRN001E2□-7□ or below, or at least ten minutes for inverters FRN008E2□-4□ or above. Make sure that the LED monitor and charging lamp are turned OFF. Further, make sure, using a multimeter or a similar instrument, that the DC link bus voltage between the terminals P(+) and N(-) has dropped to the safe level (+25 VDC or below).
- Otherwise, an electric shock could occur.
- Always carry out the daily and periodic inspections described in the instruction/user's manual. Use of the inverter for long periods of time without carrying out regular inspections could result in malfunction or damage, and an accident or fire could occur.
- It is recommended that periodic inspections be carried out every one to two years, however, they should be carried out more frequently depending on the usage conditions.
- It is recommended that parts for periodic replacement be replaced in accordance with the standard replacement frequency indicated in the user's manual. Use of the product for long periods of time without replacing the terminals, modifying the function code settings may cause a sudden motor start or an abrupt change in speed.
- Contact outputs (3A/B/C) use relays, and may remain ON, OFF, or undetermined when their lifetime is reached. In the interests of safety, equip the inverter with an external protective function.
- Otherwise, an accident or fire could occur.
- Maintenance, inspection, and parts replacement should be made only by qualified persons.
- Take off the watch, rings and other metallic objects before starting work.
- Use insulated tools.
- Otherwise, an electric shock or injuries could occur.
- Never modify the inverter.
- Doing so could cause an electric shock or injuries.

**CAUTION**

**Disposal**

- Treat the inverter as an industrial waste when disposing of it.
- Otherwise injuries could occur.

**Storage**

- In case of storing this product for certain period of time, review the environmental conditions and follow the guidance described in Instruction Manual (Detailed Version).

**Chapter 1 BEFORE USING THE INVERTER**

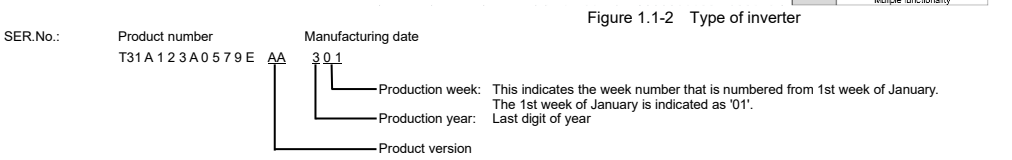
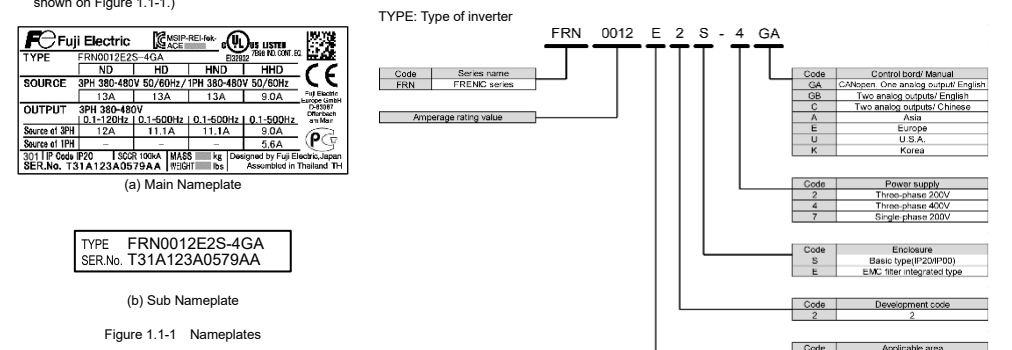
**1.1 Acceptance Inspection**

Unpack the package and check the following.

(1) An inverter and the following accessories are contained in the package.  
Accessories  
- DC reactor (for M4-mode inverters of FRN013E2□-4□ or above, HD/HND-mode inverters of FRN018E2□-4□ or above, and HD-mode inverters of FRN020E2□-4□ or above) (Not included with the FRN\*\*\*E2□-4□ (china model))  
- Keypad near cover (with three screws for securing the keypad)  
- Instruction manual  
- CD-ROM (containing the FRENIC-Ace User's Manual)  
- Wiring guide (for FRN012E2□-4□ or below, FRN002E2□-2□ or below, FRN011E2□-7□ or below)  
- Core (FRN008E2□-2□ or below, FRN003E2□-7□ or below)  
- Core (FRN008E2□-2□ or below, FRN003E2□-7□ or below)  
- Core (FRN008E2□-2□ or below, FRN003E2□-7□ or below)

(2) The inverter has not been damaged during transportation—there should be no dents or parts missing.

(3) The inverter is the type you ordered. You can check the type and specifications on the main nameplate. (The main and sub nameplates are attached to the inverter as shown in Figure 1.1-1.)



**Chapter 2 INSTALLATION AND WIRING**

**2.1 Usage environment**

Install the inverter in an environment that satisfies the requirements listed in Table 2.1-1.

Item	Specifications
Site location	Indoors
Ambient temperature	Standard (Open Type) +10 to +50°C (14 to 122°F) (HD/HND spec.) (Note 1), -10 to +40°C (14 to 104°F) (HD/ND spec.) HEM/AL Type 1 +10 to +50°C (14 to 104°F) (HD/HND spec.), -10 to +30°C (14 to 86°F) (HD/ND spec.)
Relative humidity	5 to 95% RH (No condensation)
Atmosphere	The inverter must not be exposed to dust, direct sunlight, corrosive gases, flammable gases, oil mist, vapor or water drops. Pollution degree 2 (IEC60964-1) (Note 2)
Altitude	1,000 m (3,300 ft) max. (Note 3)
Atmospheric pressure	85 to 105 kPa
Vibration	FRN011E2□-2□ or below, FRN020E2□-4□ or below, FRN001E2□-7□ or below FRN024E2□-4□ or above 3 mm (Max. amplitude), 2 to less than 9 Hz 2 m/s <sup>2</sup> 9 to less than 20 Hz 2 m/s <sup>2</sup> 20 to less than 55 Hz 1 m/s <sup>2</sup> 55 to less than 200 Hz

(Note 1) When inverters are mounted side-by-side without any clearance between them (FRN001E2□-7□ / FRN011E2□-2□ / FRN007E2□-4□ or below), the ambient temperature should be within the range from -10 to +40°C.

(Note 2) Do not install the inverter in an environment where it may be exposed to lint, cotton waste or moist dust or dirt which will clog the heat sink of the inverter. If the inverter is to be used in such an environment, install it in a dustproof panel of your system.

(Note 3) If you use the inverter in an altitude above 1,000 m (3,300 ft), you should apply an output current derating factor as listed in Table 2.1-2.

Altitude	Output current derating factor
1,000 m or lower (3,300 ft or lower)	1.00
1,000 to 1,500 m (3,300 to 4,900 ft)	0.97
1,500 to 2,000 m (4,900 to 6,600 ft)	0.95
2,000 to 2,500 m (6,600 to 8,200 ft)	0.91
2,500 to 3,000 m (8,200 to 9,800 ft)	0.88

**2.2 Installation**

**2.2.1 Installation Surface**

Please install the inverter on non-combustible matter such as metals. Also, do not mount it upside down or horizontally.

Install on non-combustible matter such as metals.

**Risk of fire exists**

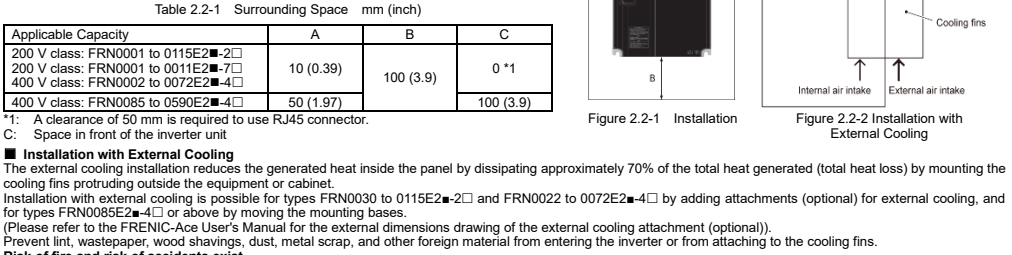
**2.2.2 Surrounding Space**

Secure the space shown in Figure 2.2-1 and Table 2.2-1. When enclosing FRENIC-Ace in cabinets, be sure to provide adequate ventilation to the cabinet, as the surrounding temperature may rise.

Do not contain it in small enclosures with low heat dissipation capacity.

**Installation of Multiple Inverters**

When installing 2 or more units in the same equipment or cabinet, generally mount them to the side of each other, not above each other. When the inverters are mounted above each other, attach partitioning boards to prevent that the heat dissipated from the lower inverter affects the upper inverter. For types FRN007E2□-4□, FRN011E2□-2□, FRN011E2□-7□ or below and for ambient temperature below 40°C only, the units can be installed side by side without any spacing between them. (30°C or lower for ND and HD.)



Applicable Capacity	A	B	C
200 V class: FRN001 to 011E2□-2□ 200 V class: FRN001 to 011E2□-7□ 400 V class: FRN002 to 012E2□-4□	10 (0.39)	100 (3.9)	0*1
400 V class: FRN008 to 090E2□-4□	50 (1.97)		100 (3.9)

\*1: A clearance of 50 mm is required to use RJ45 connector.

**Installation with External Cooling**

The external cooling installation reduces the generated heat inside the panel by dissipating approximately 70% of the total heat generated (total heat cooling) by mounting the cooling fins protruding outside the equipment or cabinet. This is possible for types FRN0030 to 011E2□-2□ and FRN0022 to 007E2□-4□ by adding attachments (optional) for external cooling, and for types FRN008E2□-4□ or above by moving the mounting bases.

(Please refer to the FRENIC-Ace User's Manual for the external dimensions drawing of the external cooling attachment (optional).)

Prevent lint, wastepaper, wood shavings, dust, metal scrap, and other foreign material from entering the inverter or from attaching to the cooling fins.

**Risk of fire and risk of accidents exist**

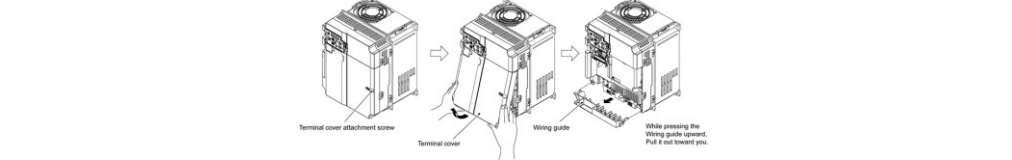
**2.2.3 Removal and attachment of the front cover terminal cover and wiring guide**

Always remove the RS-485 communication cable from the RJ-45 connector before removing the front cover.

**Risk of fire and risk of accidents exist**

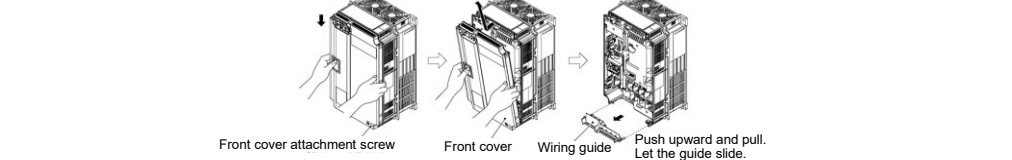
(1) Types FRN002E2□-2□ / FRN001E2□-7□ or below

- Loosen the screws of the terminal cover. To remove the terminal cover, put your finger in the dimple of the terminal cover and then pull it up toward you.
- Put out the wiring guide toward you.
- After routing the wires, attach the wiring guide and the terminal cover reversing the steps above.



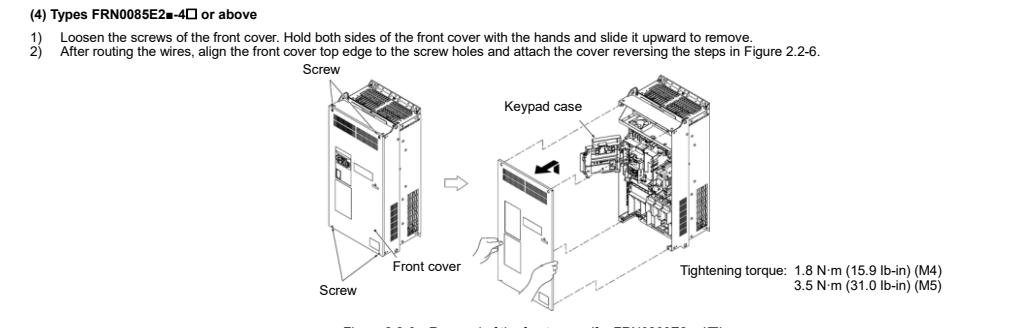
(2) Types FRN0030E2□-2□ / FRN011E2□-2□ / FRN002E2□-4□ to FRN0044 E2□-4□

- Loosen the screws of the terminal cover. To remove the terminal cover, put your finger in the dimple of the terminal cover and then pull it up toward you.
- Put out the wiring guide toward you.
- After routing the wires, attach the wiring guide and the terminal cover reversing the steps above.



(3) Types FRN008E2□-2□ / FRN011E2□-2□ / FRN007E2□-4□ / FRN006E2□-4□

- Loosen the screws of the front cover. Hold both sides of the front cover with the hands, slide the cover downward, and pull. Then remove it to the upward direction.
- Push the wiring guide upward and pull. Let the wiring guide slide and remove it.
- After routing the wires, attach the wiring guide and the front cover reversing the steps above.



**2.2.4 Terminal arrangement and screw specifications**

**2.2.4.1 Arrangement of the main circuit terminals**

The specifications for the screws used in the main circuit wiring and the wire sizes are shown below. Exercise caution as the terminal position varies depending on inverter capacity. In the diagram in 2.2.4.2 Terminal layout diagram (main circuit terminal), the two ground terminals G are not differentiated for the input side (primary side) and the output side (secondary side). Also, use crimped terminals with insulating sleeves compatible for main circuit or terminal terminals. The recommended wire sizes are shown depending on cabinet temperature and wire type.

Power System	Inverter type	See item 2.2.4.2	Screw specifications					
			Main circuit	Grounding	Auxiliary power input for control (R0, T0)	Auxiliary power input for fan (R1, T1)		
			Screw size (driver size)	Tightening torque N·m (ft·lb)	Screw size (driver size)	Tightening torque N·m (ft·lb)	Screw size	Tightening torque N·m (ft·lb)
Three-phase 200 V	FRN001E2□-2□	Fig. a	M3.5	0.8 (7.1)	M3.5	1.2 (10.6)	-	-
	FRN002E2□-2□		M4	1.2 (10.6)	M4	1.8 (15.9)	-	-
	FRN003E2□-2□		M5	3.0 (26.6)	M5	3.0 (26.6)	-	-
	FRN004E2□-2□		M6 (No. 3)	5.8 (51.3)	M6 (No. 3)	5.8 (51.3)	-	-
	FRN005E2□-2□		M6 (No. 3)	5.8 (51.3)	M6 (No. 3)	5.8 (51.3)	M3.5	1.2
	FRN006E2□-2□		M4	1.2 (10.6)	M4	1.8 (15.9)	-	-
	FRN007E2□-2□		M5	3.0 (26.6)	M5	3.0 (26.6)	-	-
	FRN008E2□-2□		M6 (No. 3)	5.8 (51.3)	M6 (No. 3)	5.8 (51.3)	-	-
	FRN009E2□-2□		M6 (No. 3)	5.8 (51.3)	M6 (No. 3)	5.8 (51.3)	M3.5	1.2
	FRN010E2□-2□		M6 (No. 3)	5.8 (51.3)	M6 (No. 3)	5.8 (51.3)	M3.5	1.2
Three-phase 200 V	FRN001E2□-2□	Fig. a	M3.5	0.8 (7.1)	M3.5	1.2 (10.6)	-	-
	FRN002E2□-2□		M4	1.2 (10.6)	M4	1.8 (15.9)	-	-
	FRN003E2□-2□		M5	3.0 (26.6)	M5	3.0 (26.6)	-	-
	FRN004E2□-2□		M6 (No. 3)	5.8 (51.3)	M6 (No. 3)	5.8 (51.3)	-	-
	FRN005E2□-2□		M6 (No. 3)	5.8 (51.3)	M6 (No. 3)	5.8 (51.3)	M3.5	1.2
	FRN006E2□-2□		M4	1.2 (10.6)	M4	1.8 (15.9)	-	-
	FRN007E2□-2□		M5	3.0 (26.6)	M5	3.0 (26.6)	-	-
	FRN008E2□-2□		M6 (No. 3)	5.8 (51.3)	M6 (No. 3)	5.8 (51.3)	-	-
	FRN009E2□-2□		M6 (No. 3)	5.8 (51.3)	M6 (No. 3)	5.8 (51.3)	M3.5	1.2
	FRN010E2□-2□		M6 (No. 3)	5.8 (51.3)	M6 (No. 3)	5.8 (51.3)	M3.5	1.2
Three-phase 400 V	FRN001E2□-2□	Fig. a	M3.5	0.8 (7.1)	M3.5	1.2 (10.6)	-	-
	FRN002E2□-2□		M4	1.2 (10.6)	M4	1.8 (15.9)	-	-
	FRN003E2□-2□		M5	3.0 (26.6)	M5	3.0 (26.6)	-	-
	FRN004E2□-2□		M6 (No. 3)	5.8 (51.3)	M6 (No. 3)	5.8 (51.3)	-	-
	FRN005E2□-2□		M6 (No. 3)	5.8 (51.3)	M6 (No. 3)	5.8 (51.3)	M3.5	1.2
	FRN006E2□-2□		M4	1.2 (10.6)	M4	1.8 (15.9)	-	-
	FRN007E2□-2□		M5	3.0 (26.6)	M5	3.0 (26.6)	-	-
	FRN008E2□-2□		M6 (No. 3)	5.8 (51.3)	M6 (No. 3)	5.8 (51.3)	-	-
	FRN009E2□-2□		M6 (No. 3)	5.8 (51.3)	M6 (No. 3)	5.8 (51.3)	M3.5	1.2
	FRN010E2□-2□		M6 (No. 3)	5.8 (51.3)	M6 (No. 3)	5.8 (51.3)	M3.5	1.2
Single-phase 200 V	FRN001E2□-2□	Fig. g	M3.5	0.8 (7.1)	M3.5	1.2 (10.6)	-	-
	FRN002E2□-2□		M4	1.2 (10.6)	M4	1.8 (15.9)	-	-
	FRN003E2□-2□		M5	3.0 (26.6)	M5	3.0 (26.6)	-	-
	FRN004E2□-2□		M6 (No. 3)	5.8 (51.3)	M6 (No. 3)	5.8 (51.3)	-	-
	FRN005E2□-2□		M6 (No. 3)	5.8 (51.3)	M6 (No. 3)	5.8 (51.3)	M3.5	1.2
	FRN006E2□-2□		M4	1.2 (10.6)	M4	1.8 (15.9)	-	-
	FRN007E2□-2□		M5	3.0 (26.6)	M5	3.0 (26.6)	-	-
	FRN008E2□-2□		M6 (No. 3)	5.8 (51.3)	M6 (No. 3)	5.8 (51.3)	-	-
	FRN009E2□-2□		M6 (No. 3)	5.8 (51.3)	M6 (No. 3)	5.8 (51.3)	M3.5	1.2
	FRN010E2□-2□		M6 (No. 3)	5.8 (51.3)	M6 (No. 3)	5.8 (51.3)	M3.5	1.2
Single-phase 200 V	FRN001E2□-2□	Fig. g	M3.5	0.8 (7.1)	M3.5	1.2 (10.6)	-	-
	FRN002E2□-2□		M4	1.2 (10.6)	M4	1.8 (15.9)	-	-
	FRN003E2□-2□		M5	3.0 (26.6)	M5	3.0 (26.6)	-	-
	FRN004E2□-2□		M6 (No. 3)	5.8 (51.3)	M6 (No. 3)	5.8 (51.3)	-	-
	FRN005E2□-2□		M6 (No. 3)	5.8 (51.3)	M6 (No. 3)	5.8 (51.3)	M3.5	1.2
	FRN006E2□-2□		M4	1.2 (10.6)	M4	1.8 (15.9)	-	-
	FRN007E2□-2□		M5	3.0 (26.6)	M5	3.0 (26.6)	-	-
	FRN008E2□-2□		M6 (No. 3)	5.8 (51.3)	M6 (No. 3)	5.8 (51.3)	-	-
	FRN009E2□-2□		M6 (No. 3)	5.8 (51.3)	M6 (No. 3)	5.8 (51.3)	M3.5	1.2
	FRN010E2□-2□		M6 (No. 3)	5.8 (51.3)	M6 (No. 3)	5.8 (51.3)	M3.5	1.2

**2.2.4.2 Terminal layout diagram (main circuit terminal)**

The following terminals will have high voltage when power is ON.  
Main circuit: L1/R, L2/S, L3/T, L1/L, L2/N, L1/L, L2/N, P(+), N(-), DB, U, V, W, R0, T0, R1, T1  
Insulation level: Basic insulation (overvoltage category III, degree of contamination 2)  
Main circuit: Casing  
Main circuit: Control circuit  
Risk of electric shock exists

