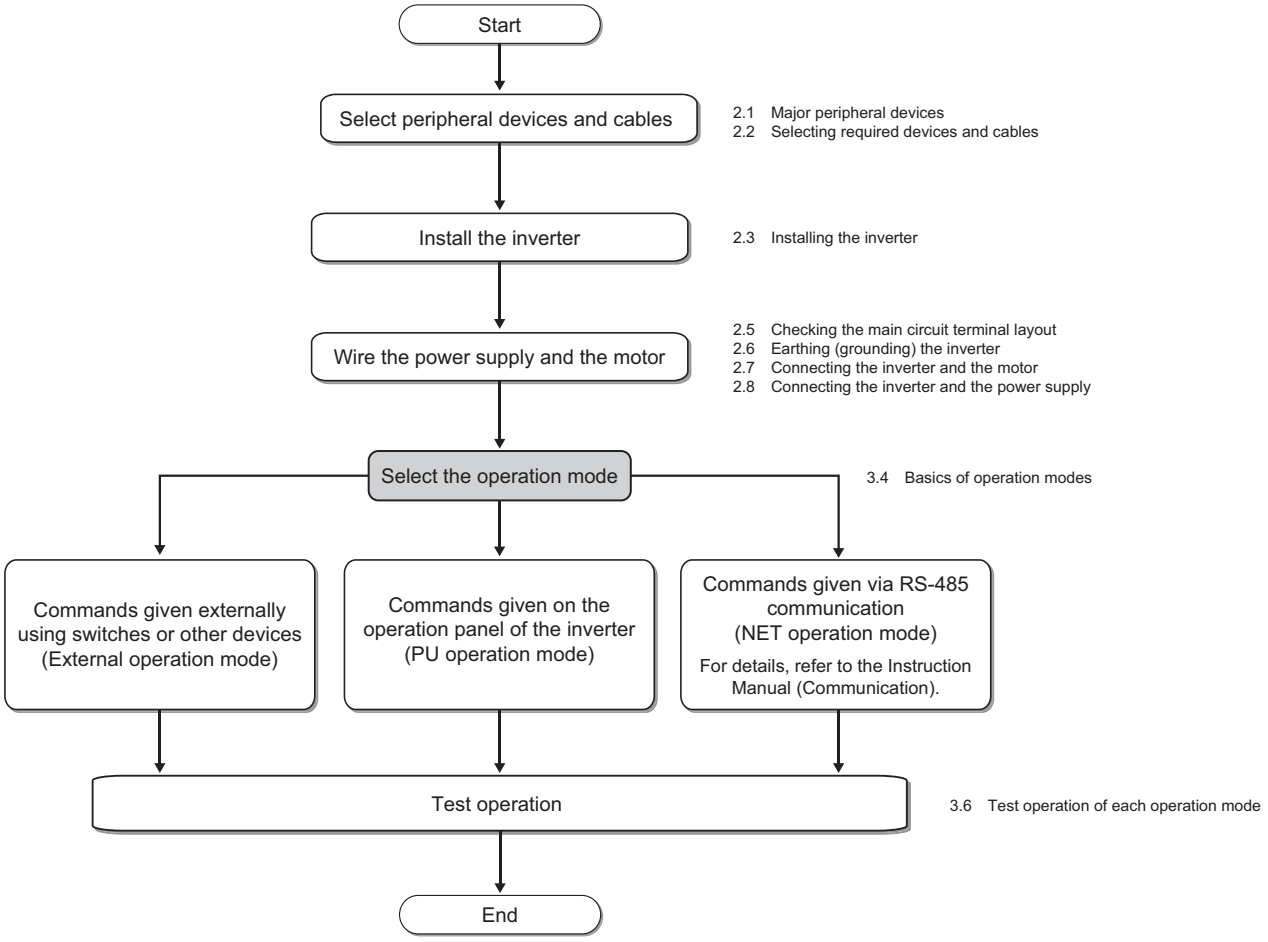
MITSUBISHI ELECTRIC

INVERTER

FR-D800
Instruction Manual (Startup) (Standard model)

Compact & easy-to-use inverter

Simple operation steps



1 Introduction

1.1 Descriptions in this Instruction Manual

This Instruction Manual describes the basic flow for installation, wiring, settings, and test operation of the inverter. For details on the functions and specifications, refer to other FR-D800 Instruction Manuals (Connection, Function, Communication, Maintenance).

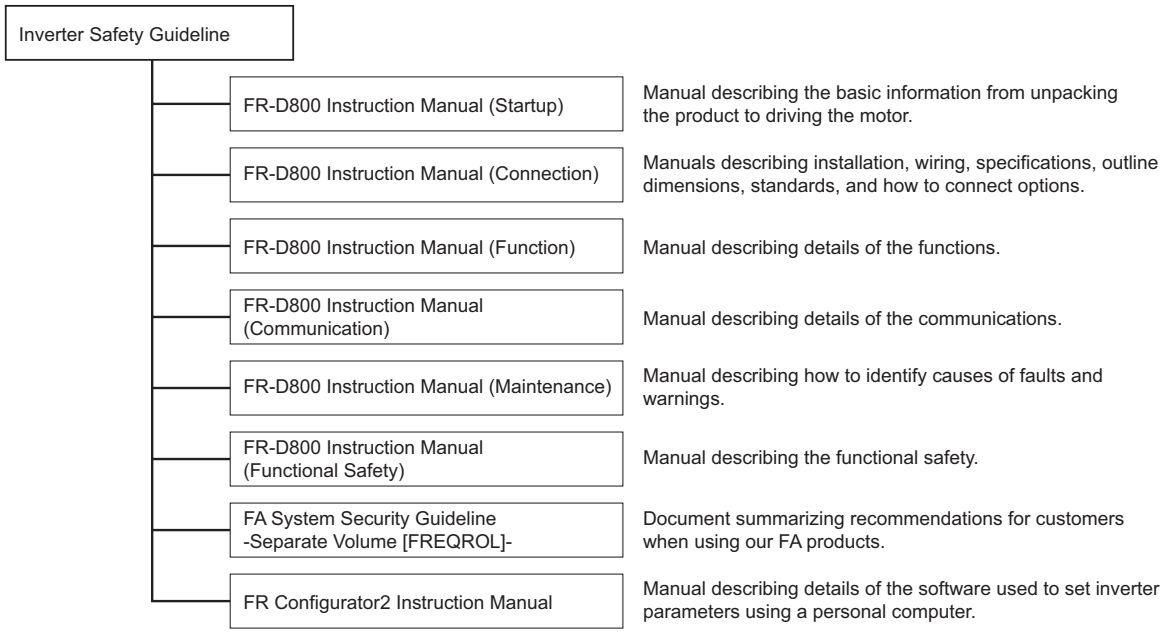
1.2 Related manuals

When using this inverter for the first time, prepare the following manuals as required and use the inverter safely. The latest version of e-Manual Viewer and the latest PDF manuals can be downloaded from the Mitsubishi Electric FA Global Website.
https://www.MitsubishiElectric.com/app/fa/download/search.do?kisyu=/inv&mode=manual

Point

- e-Manual refers to the Mitsubishi FA electronic book manuals that can be browsed using a dedicated tool.
- Required information can be cross-searched in multiple manuals. Pages that users often browse can be bookmarked.

Manuals related to the FR-D800 inverter are shown in the following table.

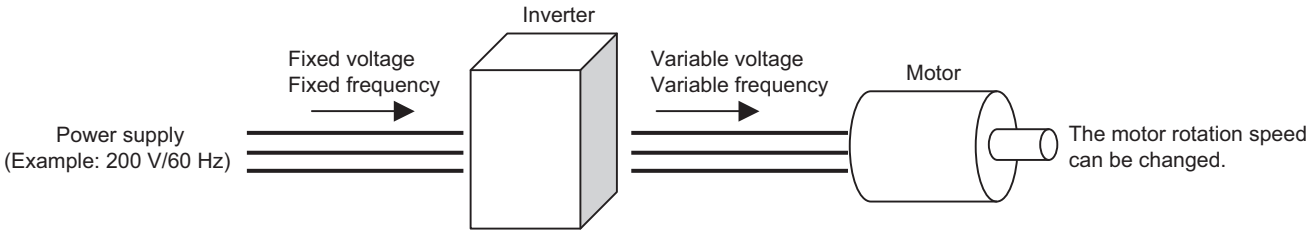


Name	Manual number
FR-D800 Inverter Safety Guideline	IB-0601019
FR-D800 Instruction Manual (Connection)	IB-0601029ENG
FR-D800 Instruction Manual (Function)	IB-0601034ENG
FR-D800 Instruction Manual (Communication)	IB-0601039ENG
FR-D800 Instruction Manual (Maintenance)	IB-0601044ENG
FR-D800 Instruction Manual (Functional Safety)	BCN-A23498-007(E)
FA System Security Guideline -Separate Volume [FREQROL]-	BCN-C22005-1054
FR Configurator2 Instruction Manual	IB-0600516ENG

1.3 What is an inverter?

1.3.1 What is an inverter?

An inverter is a device that can change the motor rotation speed freely and easily.
The power supply (AC) at factories and houses is fixed according to the country and area, such as 200 V/60 Hz, 200 V/50 Hz, 100 V/60 Hz, and 100 V/50 Hz. With the fixed voltage and frequency obtained from the power supply, the motor can be rotated only at a single speed. However, with an inverter which freely changes the voltage and frequency, the motor can be rotated at different speeds.
Thus, inverters are used in various applications, for example to control fan's air volume and conveyor speed, exhibiting their ability to freely change motor's speed. Inverters can drive three-phase induction motors, IPM motors, and PM motors.



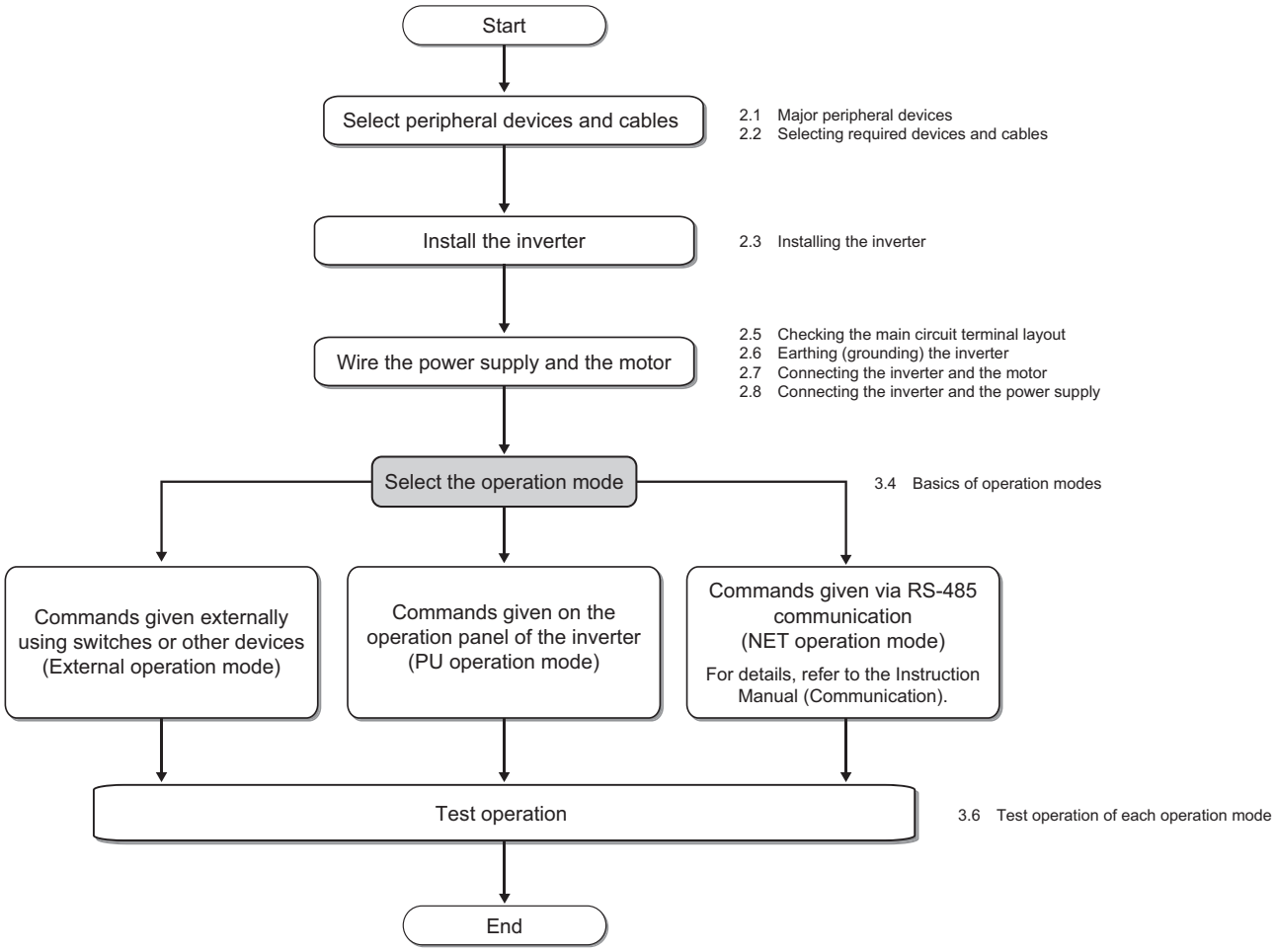
1.3.2 Advantages of using inverters

Using inverters provides the following advantages.

- The motor speed can be changed freely. Existing motors are also applicable.
- Adjusting the motor speed by the inverter's rotation speed control can lead to energy savings.
- A motor can rotate at constant speed without being affected by the power supply frequency.
- Productivity can be improved by changing the motor rotation speed according to the application.
- The starting current of the motor can be reduced, allowing the motor to start and stop smoothly.
- Factory automation system, such as automatic operation and synchronized operation with multiple machines, can be introduced easily.

1.4 Operation steps

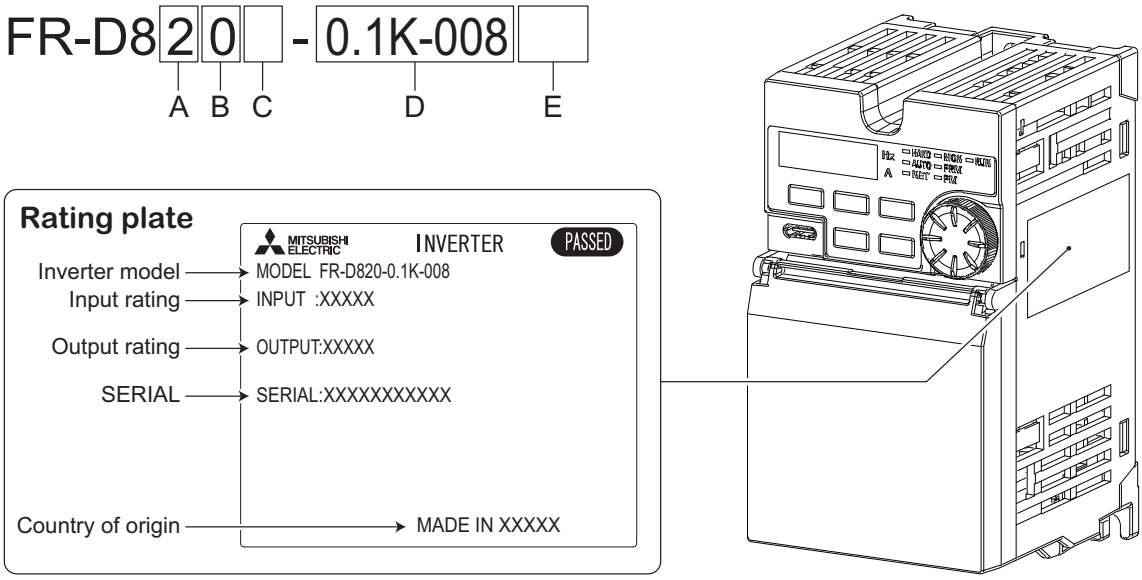
This flow chart describes the basic steps required to perform the test operation of the inverter. Follow the following operation steps to perform the test operation.



1.5 How to read the model name

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

◆ Inverter model



- A: The voltage class is shown.

Symbol	Voltage class
1	100 V class
2	200 V class
4	400 V class

- B: The protective structure is shown.

Symbol	Protective structure
0	Open type (IP20)

- C: The number of phases of the power source is shown.

Symbol	Description
None	Three-phase input
S	Single-phase input
W	Single-phase input (double voltage output)

- D: The applicable motor capacity and the inverter rated current are shown.

Symbol	Description
Example) 200 V class 0.1K-008 to 7.5K-318	Applicable motor capacity (ND) (kW) - Inverter rated current (ND) (A)*1

*1 The term ND in parentheses represents the ND rating. Two types of ratings, ND and SLD, are available for the FR-D800 series. For details, refer to the Instruction Manual (Function).

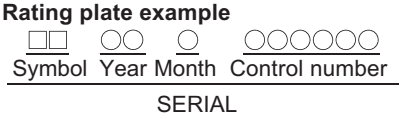
- E: Availability of circuit board coating is shown.

Symbol	Circuit board coating*2
None	Without coating
-60	With coating

*2 Conforming to IEC 60721-3-3:1994 3C2/3S2

◆ How to read the SERIAL number

Rating plate example



The SERIAL consists of two symbols, three characters indicating the production year and month, and six characters indicating the control number.
The last two digits of the production year are indicated as the Year, and the Month is indicated by 1 to 9, X (October), Y (November), or Z (December).

◆ Specification differences by the country of origin

The rated frequency (initial setting) and the control logic (initial status) of the input signal differ depending on the country of origin.

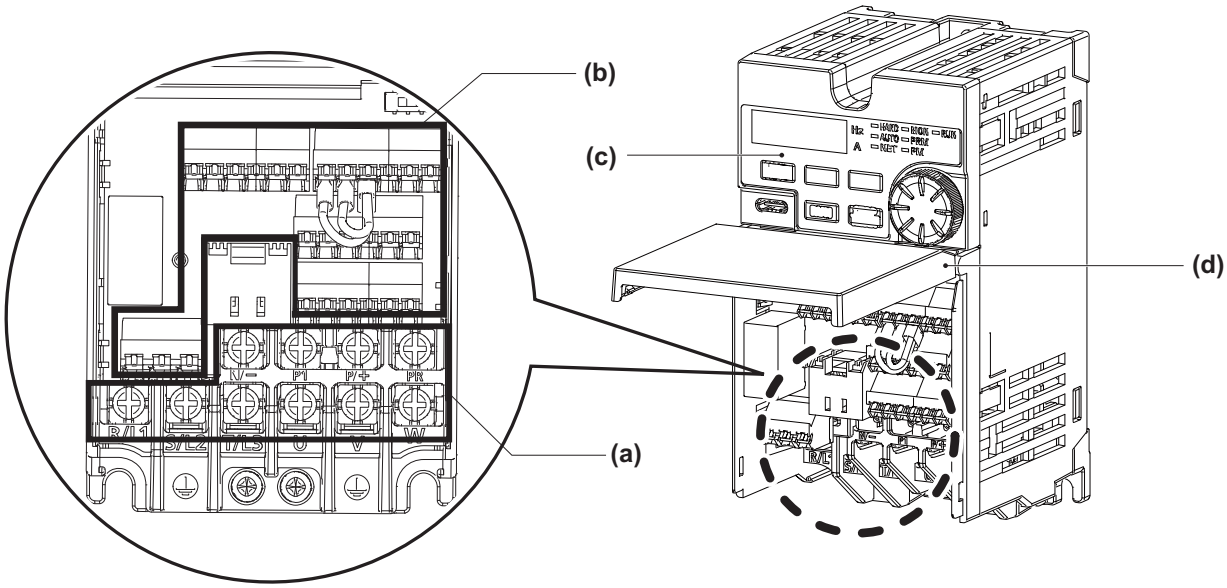
For the country of origin, refer to the rating plate (page 7).

Country of origin	Parameter initial value group	Rated frequency (initial setting)	Control logic	
			Input signal (initial status)	Safety stop signal
MADE IN JAPAN	Group 1 (Gr.1)	60 Hz	Sink logic	Source logic (fixed)
MADE IN CHINA	Group 2 (Gr.2)	50 Hz	Source logic	

1.6 Component names

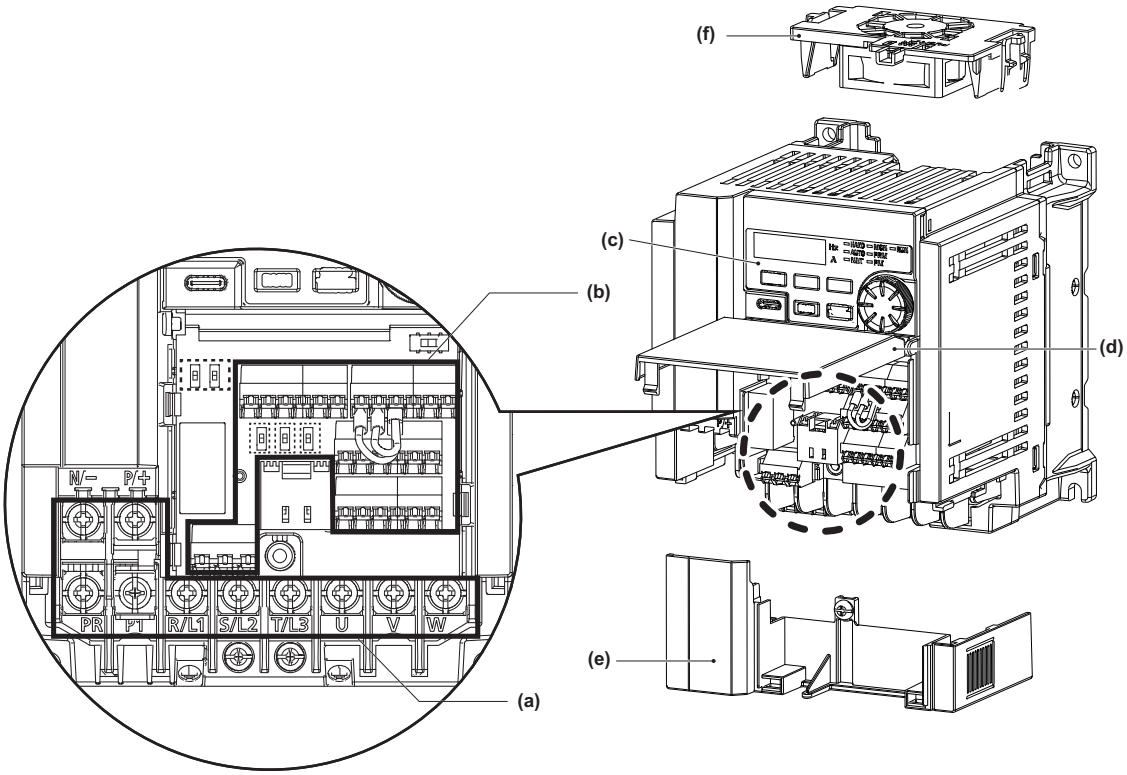
Component names are as follows.

◆ Example) FR-D820-0.1K-008



Symbol	Name	Description
(a)	Main circuit terminal block	Used for wiring of power supply cables and motor cables.
(b)	Control circuit terminal block	Used for the External operation.
(c)	Operation panel	Panel on the front of the inverter used to perform operations. Use the setting dial and keys to operate the inverter, switch the operation mode, and set parameters.
(d)	Front cover	Flip up this cover for wiring.

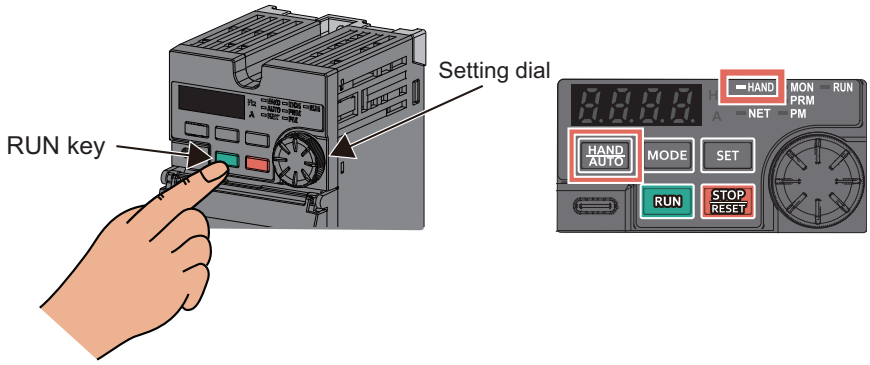
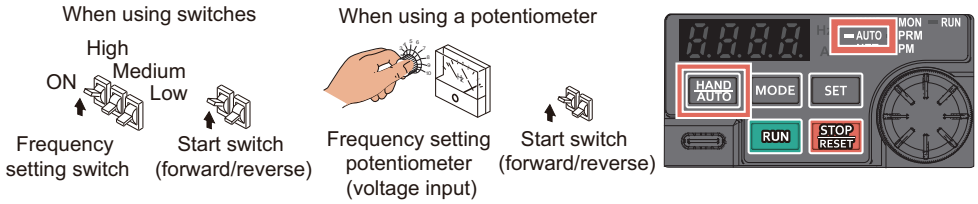
◆ Example) FR-D820-2.2K-100



Symbol	Name	Description
(a)	Main circuit terminal block	Used for wiring of power supply cables and motor cables.
(b)	Control circuit terminal block	Used for the External operation.
(c)	Operation panel	Panel on the front of the inverter used to perform operations. Use the setting dial and keys to operate the inverter, switch the operation mode, and set parameters.
(d)	Front cover	Flip up this cover for wiring.
(e)	Comb-shaped wiring cover	Remove this cover before wiring.
(f)	Cooling fan*1	Cools the inverter. (Provided with the FR-D820-2.2K-100 or higher, FR-D840-2.2K-050 or higher, FR-D820S-2.2K-100 or higher.)

*1 For the FR-D820-2.2K-100, the FR-D820-3.7K-165, the FR-D840-2.2K-050, the FR-D840-3.7K-081, and the FR-D820S-2.2K-100, the fan unit is provided (the fan and its cover are integrated). For details, refer to the Instruction Manual (Connection).

1.7 Terms

Term	Description
Start command	A command (signal) that determines which direction the motor is rotated. Basically, the following methods are available to input a start command. Operation panel: Give a start command on the operation panel. External switch: Give a start command using the switches connected to the inverter terminal block.
Frequency command	A command that determines the frequency when the motor is operated. Basically, the following methods are available to input a frequency command. Operation panel: Give a frequency command on the operation panel. External switch: Pre-set operation speeds with parameters and switch among the speeds using contact terminals. Analog input: Give a frequency command via terminal 2 (voltage input) or terminal 4 (current input).*1
PU operation mode	The inverter is controlled using keys on the operation panel of the inverter. Set the frequency (speed) with the setting dial, and start the operation with the RUN key. (In the initial setting, the motor rotates in the forward direction.) Use the HAND/AUTO key on the operation panel to switch the operation mode. (In the initial status, the inverter is in the External operation mode.) When the inverter is in the PU operation mode, the HAND LED on the operation panel is ON. 
External operation mode	The inverter is controlled by signals input from an external device to its control circuit terminals. External devices used include switches or a potentiometer. Use the HAND/AUTO key on the operation panel to switch the operation mode. (In the initial status, the inverter is in the External operation mode.) When the inverter is in the External operation mode, the AUTO LED on the operation panel is ON. 
Parameter (Pr.)	Set parameters as necessary to use functions of the inverter. Use the operation panel of the inverter to set parameters.

*1 For information on the analog input, refer to the Instruction Manual (Function).

Point

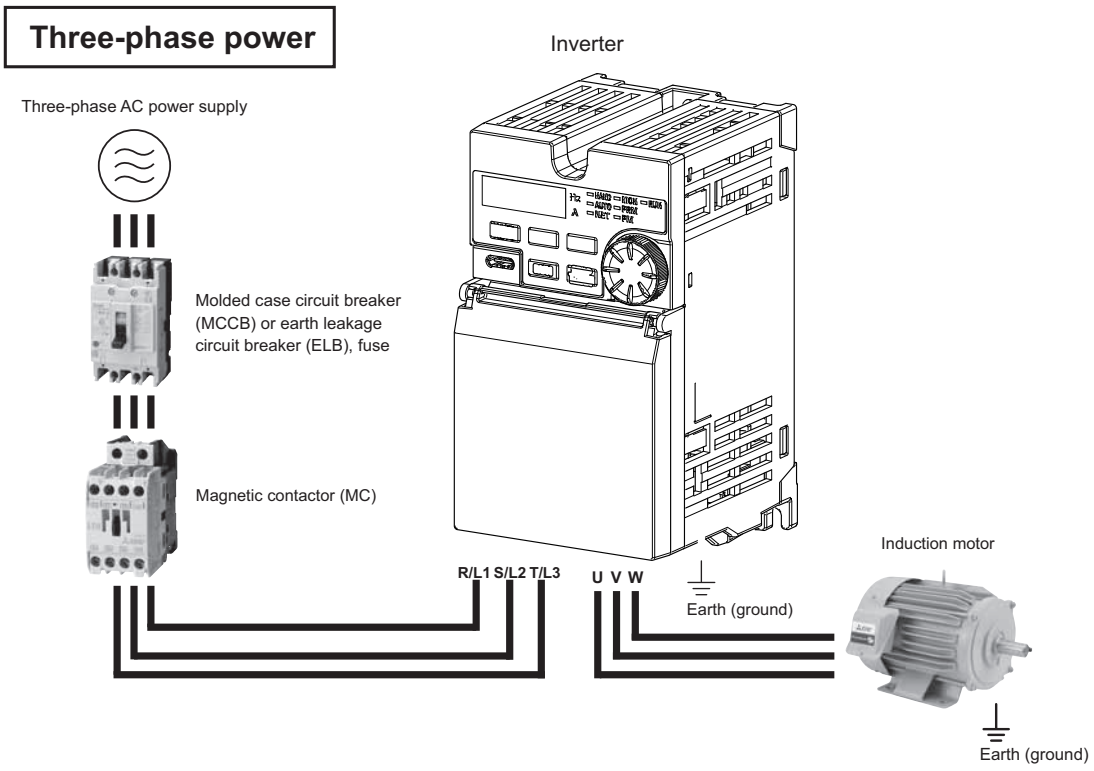
- The inverter setup software FR Configurator2 can be used to set parameters.
  FR Configurator2 is a support tool for the inverter operations from setup to maintenance, providing a comfortable inverter operating environment. For details, refer to the Instruction Manual of FR Configurator2.

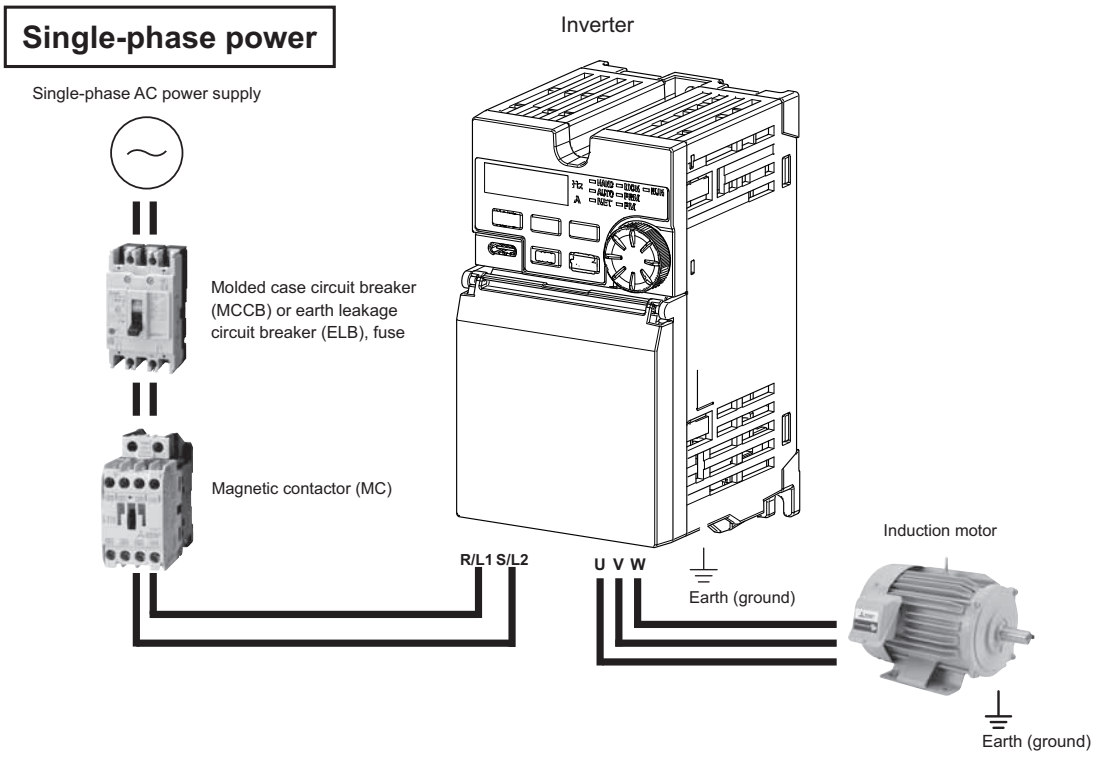
2 Installation and main circuit wiring

To drive a motor, connect the power supply cables and the motor cables to the main circuit terminals of this product. Always read the instructions before use.

2.1 Major peripheral devices

The following diagrams show major peripheral devices and terminals to be connected.





2.2 Selecting required devices and cables

To drive a motor, stable power must be supplied to the inverter.
Check the model of the inverter, and select devices and cables according to the capacity.

Item	Description	Refer to page
Molded case circuit breaker (MCCB) / earth leakage circuit breaker (ELB)	Must be selected carefully since an inrush current flows in the inverter at power ON.	page 13
Magnetic contactor	Install this to ensure safety. Do not use this to start and stop the inverter. Doing so will shorten the life of the inverter.	page 14
Cable of appropriate size	Select cables of recommended size to ensure that the voltage drop will be 2% or less. If the wiring distance is long between the inverter and motor, the voltage drop in the main circuit will cause the motor torque to decrease especially at a low speed.	page 15

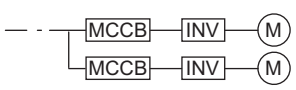
◆ Selecting a molded case circuit breaker / earth leakage circuit breaker

A molded case circuit breaker (MCCB) is used to prevent distribution lines on the power supply side of the inverter from being damaged due to overload and short-circuit currents. If an overcurrent occurs, the breaker automatically shuts off the power supply to prevent damage to the system and devices. This is a matrix showing the rated current of the molded case circuit breaker (MCCB) or earth leakage circuit breaker (ELB) (NF or NV type) according to the selected inverter and rating.

Voltage	Inverter model	Rated current (ND rating)
Three-phase 200 V class	FR-D820-0.1K-008	5 A
	FR-D820-0.2K-014	5 A
	FR-D820-0.4K-025	5 A
	FR-D820-0.75K-042	10 A
	FR-D820-1.5K-070	15 A
	FR-D820-2.2K-100	20 A
	FR-D820-3.7K-165	30 A
	FR-D820-5.5K-238	50 A
	FR-D820-7.5K-318	60 A
Three-phase 400 V class	FR-D840-0.4K-012	5 A
	FR-D840-0.75K-022	5 A
	FR-D840-1.5K-037	10 A
	FR-D840-2.2K-050	15 A
	FR-D840-3.7K-081	20 A
	FR-D840-5.5K-120	30 A
	FR-D840-7.5K-163	30 A
Single-phase 200 V class	FR-D820S-0.1K-008	5 A
	FR-D820S-0.2K-014	5 A
	FR-D820S-0.4K-025	10 A
	FR-D820S-0.75K-042	15 A
	FR-D820S-1.5K-070	20 A
	FR-D820S-2.2K-100	40 A
Single-phase 100 V class	FR-D810W-0.1K-008	10 A
	FR-D810W-0.2K-014	10 A
	FR-D810W-0.4K-025	15 A
	FR-D810W-0.75K-042	30 A

NOTE

- Select an MCCB according to the power supply capacity.
- Install one MCCB per inverter.



- For selection when operating the inverter with the SLD rating or when connecting a reactor, refer to the Instruction Manual (Connection).

- For the use in the United States or Canada, refer to "Instructions for UL and cUL" in the document enclosed with the product and select appropriate fuses.
- When the inverter capacity is larger than the motor capacity, select the MCCB and the magnetic contactor according to the inverter model, and select cables according to the motor output.
- Incorrect selection may cause an inrush current at power ON, resulting in output shutoff by the breaker. Cables are to be selected according to the motor output as the output current varies depending on the motor output. When the motor output is small, the output current is also small. Therefore, select cables according to the motor output. However, output shutoff by the MCCB may be disabled if the difference between the inverter capacity and the motor capacity is too large.
- When the breaker installed on the inverter input side is shut off, check for the wiring fault (such as short circuit), damage to internal parts of the inverter, etc. The cause of the output shutoff must be identified and removed before turning ON the power of the breaker.

◆ Selecting a magnetic contactor on the input side

A magnetic contactor is used when the inverter needs to be disconnected from the power supply at an inverter's fault occurrence, for maintenance and inspection, or other reasons.
This is a matrix showing the model name of the magnetic contactor to be installed at the inverter's input line according to the selected inverter and rating.

Voltage	Inverter model	Magnetic contactor (ND rating)
Three-phase 200 V class	FR-D820-0.1K-008	S-T10
	FR-D820-0.2K-014	S-T10
	FR-D820-0.4K-025	S-T10
	FR-D820-0.75K-042	S-T10
	FR-D820-1.5K-070	S-T10
	FR-D820-2.2K-100	S-T10
	FR-D820-3.7K-165	S-T21
	FR-D820-5.5K-238	S-T35
	FR-D820-7.5K-318	S-T35
Three-phase 400 V class	FR-D840-0.4K-012	S-T10
	FR-D840-0.75K-022	S-T10
	FR-D840-1.5K-037	S-T10
	FR-D840-2.2K-050	S-T10
	FR-D840-3.7K-081	S-T10
	FR-D840-5.5K-120	S-T21
	FR-D840-7.5K-163	S-T21
Single-phase 200 V class	FR-D820S-0.1K-008	S-T10
	FR-D820S-0.2K-014	S-T10
	FR-D820S-0.4K-025	S-T10
	FR-D820S-0.75K-042	S-T10
	FR-D820S-1.5K-070	S-T10
	FR-D820S-2.2K-100	S-T21
Single-phase 100 V class	FR-D810W-0.1K-008	S-T10
	FR-D810W-0.2K-014	S-T10
	FR-D810W-0.4K-025	S-T10
	FR-D810W-0.75K-042	S-T10

NOTE

- The matrix shows the magnetic contactor selected according to the standards of Japan Electrical Manufacturers' Association (JEM standards) for AC-1 class. The electrical durability of magnetic contactor is 500,000 times. When the MC is used for emergency stops during motor driving, the electrical durability is 25 times. If using the MC for emergency stop during motor driving, select the MC for the inverter input current according to the rated current against JEM 1038 standards for AC-3 class. When installing an MC on the inverter output side to switch to the commercial-power supply operation while running a general-purpose motor, select the MC for the rated motor current according to the rated current against JEM 1038 standards for AC-3 class.

- When the inverter capacity is larger than the motor capacity, select the MCCB and the magnetic contactor according to the inverter model, and select cables according to the motor output.
- For selection when operating the inverter with the SLD rating or when connecting a reactor, refer to the Instruction Manual (Connection).
- Incorrect selection may cause an inrush current at power ON, resulting in output shutoff by the breaker. Cables are to be selected according to the motor output as the output current varies depending on the motor output. When the motor output is small, the output current is also small. Therefore, select cables according to the motor output. However, output shutoff by the MCCB may be disabled if the difference between the inverter capacity and the motor capacity is too large.
- When the breaker installed on the inverter input side is shut off, check for the wiring fault (such as short circuit), damage to internal parts of the inverter, etc. The cause of the output shutoff must be identified and removed before turning ON the power of the breaker.

◆ Selecting cables

Selecting an appropriate cable gauge can minimize the power loss caused by the resistance of the cable. If an inappropriate cable is selected, the cable cannot be installed in the terminal block, or it may overheat and cause damage or fire. Select cables of recommended size to ensure that the voltage drop will be 2% or less. If the wiring distance is long between the inverter and motor, the voltage drop in the main circuit will cause the motor torque to decrease especially at a low speed. The following tables show appropriate cable gauges for the inverter at ND rating.

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

Applicable inverter model FR-D820-[]	Terminal screw size*4	Tightening torque N·m	Crimp terminal		Cable gauge								
					HIV cables, etc. (mm^2)*1				AWG/MCM*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	P/+, P1	Earthing (grounding) cable	R/L1, S/L2, T/L3	U, V, W	R/L1, S/L2, T/L3	U, V, W	Earthing (grounding) cable
0.1K-008 to 0.75K-042	M3.5	1.2	2-3.5	2-3.5	2	2	2	2	14	14	2.5	2.5	2.5
1.5K-070, 2.2K-100	M4 (M3.5)	1.5	2-4	2-4	2	2	2	2	14	14	2.5	2.5	2.5
3.7K-165	M4 (M3.5)	1.5	5.5-4	5.5-4	3.5	3.5	3.5	3.5	12	12	4	4	4
5.5K-238	M5	2.5	5.5-5	5.5-5	5.5	5.5	5.5	5.5	10	10	6	6	6
7.5K-318	M5	2.5	14-5	8-5	14	8	8	5.5	6	8	16	10	6

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

Applicable inverter model FR-D840-[]	Terminal screw size*4	Tightening torque N·m	Crimp terminal		Cable gauge								
					HIV cables, etc. (mm^2)*1				AWG/MCM*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	P/+, P1	Earthing (grounding) cable	R/L1, S/L2, T/L3	U, V, W	R/L1, S/L2, T/L3	U, V, W	Earthing (grounding) cable
0.4K-012 to 1.5K-037	M3.5	1.2	2-3.5	2-3.5	2	2	2	2	14	14	2.5	2.5	2.5
2.2K-050, 3.7K-081	M4 (M3.5)	1.5	2-4	2-4	2	2	2	2	14	14	2.5	2.5	2.5
5.5K-120	M4	1.5	5.5-4	2-4	3.5	2	3.5	3.5	12	14	4	2.5	4
7.5K-163	M4	1.5	5.5-4	5.5-4	3.5	3.5	3.5	3.5	12	12	4	4	4

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

Applicable inverter model FR-D820S-[]	Terminal screw size*4	Tightening torque N·m	Crimp terminal		Cable gauge								
					HIV cables, etc. (mm^2)*1				AWG/MCM*2		PVC cables, etc. (mm^2)*3		
			R/L1, S/L2	U, V, W	R/L1, S/L2	U, V, W	P/+, P1	Earthing (grounding) cable	R/L1, S/L2	U, V, W	R/L1, S/L2	U, V, W	Earthing (grounding) cable
0.1K-008 to 0.75K-042	M3.5	1.2	2-3.5	2-3.5	2	2	2	2	14	14	2.5	2.5	2.5
1.5K-070	M4 (M3.5)	1.5	2-4	2-4	2	2	2	2	14	14	2.5	2.5	2.5
2.2K-100	M4 (M3.5)	1.5	5.5-4	2-4	3.5	2	2	3.5	12	14	4	2.5	4

- Single-phase 100 V class (110 V input power supply)

Applicable inverter model FR-D810W-[]	Terminal screw size*4	Tightening torque N·m	Crimp terminal		Cable gauge								
					HIV cables, etc. (mm^2)*1				AWG/MCM*2		PVC cables, etc. (mm^2)*3		
			R/L1, S/L2	U, V, W	R/L1, S/L2	U, V, W	P/+, P1	Earthing (grounding) cable	R/L1, S/L2	U, V, W	R/L1, S/L2	U, V, W	Earthing (grounding) cable
0.1K-008 to 0.4K-025	M3.5	1.2	2-3.5	2-3.5	2	2	2	2	14	14	2.5	2.5	2.5
0.75K-042	M4 (M3.5)	1.5	5.5-4	2-4	3.5	2	2	2	12	14	4	2.5	2.5

*1 HIV cable (600 V grade heat-resistant PVC insulated wire) with a continuous maximum permissible temperature of 75°C. It assumes a surrounding air temperature of 50°C or lower and the wiring distance of 20 m or shorter.

*2 THHW cable with a continuous maximum permissible temperature of 75°C. It assumes a surrounding air temperature of 40°C or lower and the wiring distance of 20 m or shorter.
(For the use in the United States or Canada, refer to "8.2 Instructions for UL and cUL" in the document enclosed with the product.)

*3 PVC cable with a continuous maximum permissible temperature of 70°C. It assumes a surrounding air temperature of 40°C or lower and the wiring distance of 20 m or shorter.
(Selection example mainly for use in Europe.)

*4 The screw size for terminals R/L1, S/L2, T/L3, U, V, W, PR, P/+, N/-, and P1, and the earthing (grounding) terminal is shown. (For the single-phase 200 V power input models, the screw size for terminals R/L1, S/L2, U, V, W, PR, P/+, N/-, and P1, and the earthing (grounding) terminal is shown. For the single-phase 100 V power input models, the screw size for terminals R/L1, S/L2, U, V, W, PR, P/+, and N/-, and the earthing (grounding) terminal is shown.)
The screw size for the earthing (grounding) terminal on FR-D820-1.5K-070 to 3.7K-165, FR-D840-2.2K-050 to 3.7K-081, FR-D820S-1.5K-070, FR-D820S-2.2K-100, and FR-D810W-0.75K-042 is indicated in parentheses.

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

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

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

NOTE

- For selection when operating the inverter with the SLD rating or when connecting a reactor, refer to the Instruction Manual (Connection).

◆ Total wiring length

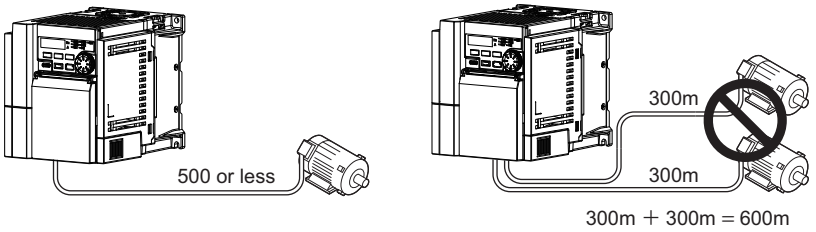
The total wiring length of the cables connecting the inverter and a motor is limited depending on the motor used. If the cable length is too long, the motor performance may deteriorate due to the shortage of the supplied power or ambient electromagnetic noise.

■ With induction motor

Connect one or more general-purpose motors within the total wiring length shown in the following table.

Cable type	Pr.72 setting (carrier frequency)	Voltage class	0.1K	0.2K	0.4K	0.75K	1.5K	2.2K	3.7K or higher
Unshielded	1 (1 kHz) or lower	100/200 V	200 m	200 m	300 m	500 m	500 m	500 m	500 m
		400 V	—	—	200 m	200 m	300 m	500 m	500 m
	2 (2 kHz) or higher	100/200 V	30 m	100 m	200 m	300 m	500 m	500 m	500 m
		400 V	—	—	30 m	100 m	200 m	300 m	500 m
Shielded	1 (1 kHz) or lower	100/200 V	50 m	50 m	75 m	100 m	100 m	100 m	100 m
		400 V	—	—	50 m	50 m	75 m	100 m	100 m
	2 (2 kHz) or higher	100/200 V	10 m	25 m	50 m	75 m	100 m	100 m	100 m
		400 V	—	—	10 m	25 m	50 m	75 m	100 m

Total wiring length (FR-D820-1.5K-070 or higher / FR-D840-3.7K-081 or higher) of unshielded cables



When driving a 400 V class motor by the inverter, surge voltages attributable to the wiring constants may occur at the motor terminals, deteriorating the insulation of the motor. In this case, take one of the following measure.

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

Wiring length 50 m or shorter	Wiring length 50 to 100 m	Wiring length longer than 100 m
14.5 kHz or lower	8 kHz or lower	2 kHz or lower

For details, refer to the Instruction Manual (Connection).

2.3 Installing the inverter

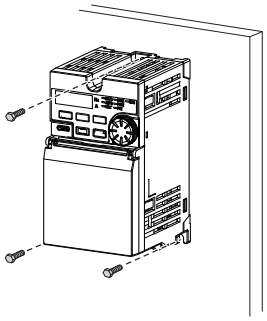
When installing the inverter on the enclosure surface, remove the comb-shaped wiring cover to fix the inverter.
For some models, the unpacked product can be installed without removing the comb-shaped wiring cover.

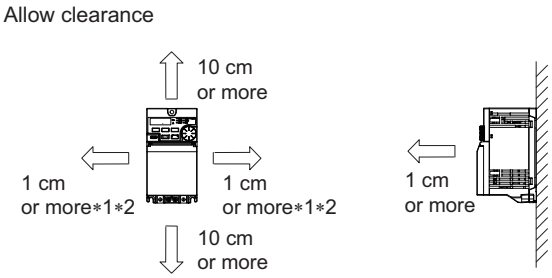
Voltage	Inverter model	Installation without removing the wiring cover
Three-phase 200 V class	FR-D820-0.1K-008	○
	FR-D820-0.2K-014	○
	FR-D820-0.4K-025	○
	FR-D820-0.75K-042	○
	FR-D820-1.5K-070	—
	FR-D820-2.2K-100	—
	FR-D820-3.7K-165	—
	FR-D820-5.5K-238	—
	FR-D820-7.5K-318	—
Three-phase 400 V class	FR-D840-0.4K-012	○
	FR-D840-0.75K-022	○
	FR-D840-1.5K-037	○
	FR-D840-2.2K-050	—
	FR-D840-3.7K-081	—
	FR-D840-5.5K-120	—
	FR-D840-7.5K-163	—

Voltage	Inverter model	Installation without removing the wiring cover
Single-phase 200 V class	FR-D820S-0.1K-008	○
	FR-D820S-0.2K-014	○
	FR-D820S-0.4K-025	○
	FR-D820S-0.75K-042	○
	FR-D820S-1.5K-070	—
	FR-D820S-2.2K-100	—
Single-phase 100 V class	FR-D810W-0.1K-008	○
	FR-D810W-0.2K-014	○
	FR-D810W-0.4K-025	○
	FR-D810W-0.75K-042	—

Observe the following precautions for installation.

- Install the inverter on a nonflammable and strong surface vertically.
- Install the inverter securely with screws. Leave enough clearances and take cooling measures.
- Avoid places where the inverter is subjected to direct sunlight, high temperature and high humidity.





*1 When using the inverters at the surrounding air temperature of 40°C or less, the inverters can be installed side-by-side (closely attached with 0 cm clearance).

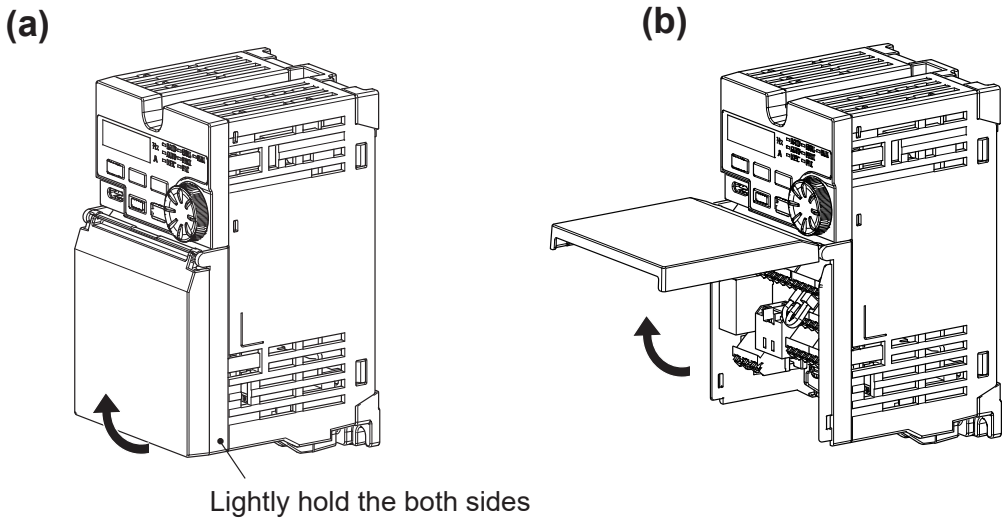
*2 5 cm or more for the FR-D820-5.5K-238 or higher and the FR-D840-5.5K-120 or higher.

For details, refer to the Instruction Manual (Connection).

2.4 Opening/closing of the front cover and removal/reinstallation of the comb-shaped wiring cover

◆ How to open the front cover (FR-D820-0.75K-042 or lower, FR-D840-1.5K-037 or lower, FR-D820S-0.75K-042 or lower, FR-D810W-0.4K-025 or lower)

- Example of FR-D820-0.1K-008

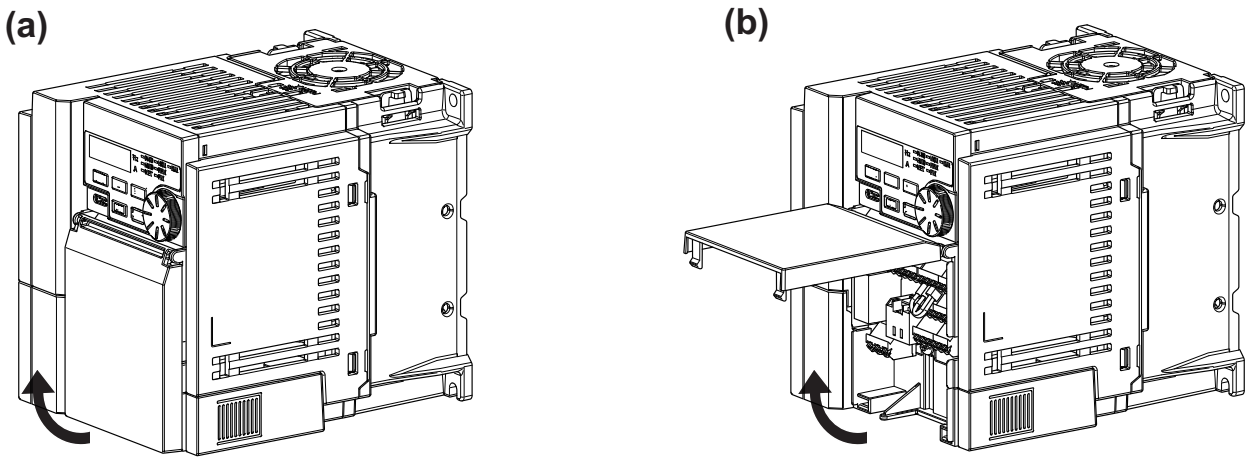


(a) While lightly holding the lower parts of the both sides of the inverter, pull open the front cover using its upper end as a support.
To open the front cover for side-by-side installation, refer to the Instruction Manual (Connection).

(b) The front cover can be held fully open.

◆ How to open the front cover (FR-D820-1.5K-070 or higher, FR-D840-2.2K-050 or higher, FR-D820S-1.5K-070 or higher, FR-D810W-0.75K-042)

- Example of FR-D820-1.5K-070

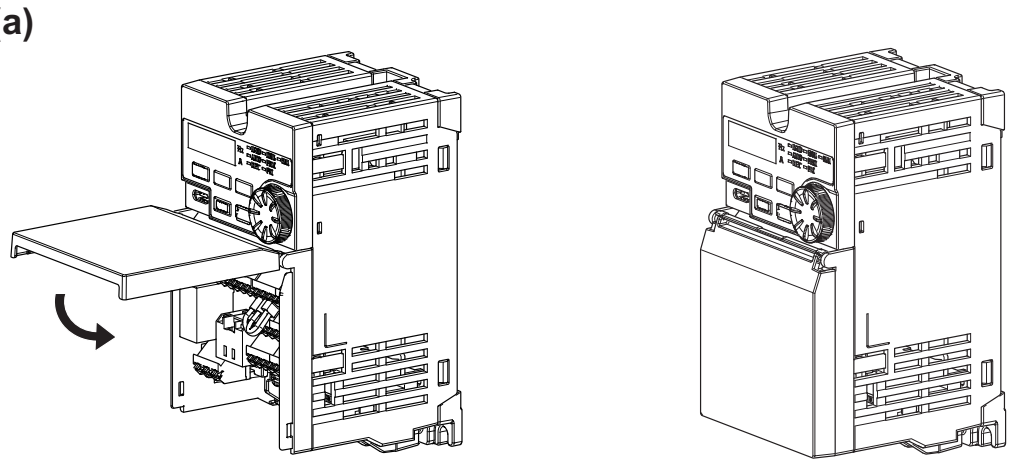


(a) Pull open the front cover using its upper end as a support.

(b) The front cover can be held fully open.

◆ How to close the front cover (FR-D820-0.75K-042 or lower, FR-D840-1.5K-037 or lower, FR-D820S-0.75K-042 or lower, FR-D810W-0.4K-025 or lower)

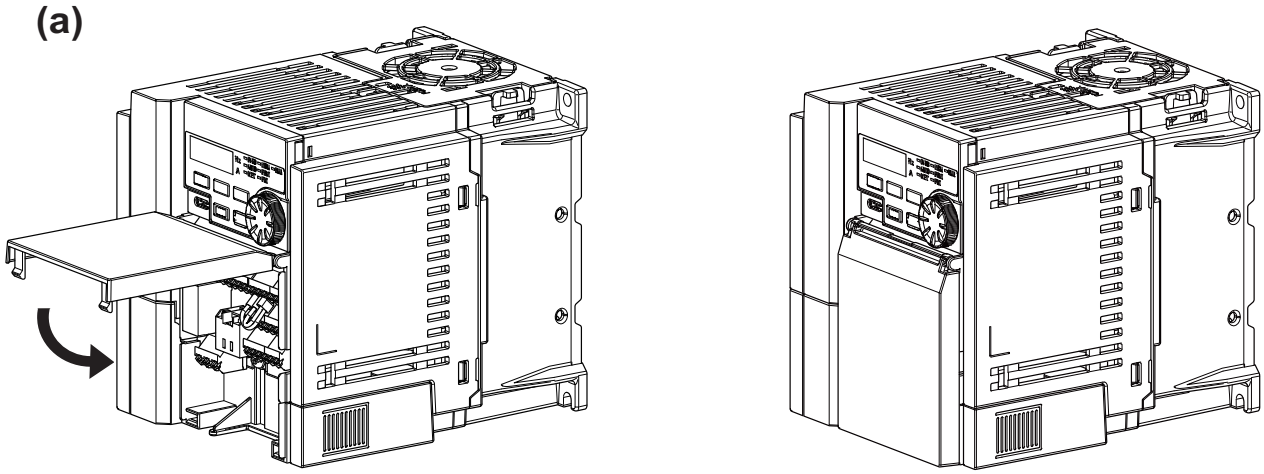
• Example of FR-D820-0.1K-008



(a) Push the front cover downward using its upper end as a support to close the cover.

◆ How to close the front cover (FR-D820-1.5K-070 or higher, FR-D840-2.2K-050 or higher, FR-D820S-1.5K-070 or higher, FR-D810W-0.75K-042)

• Example of FR-D820-1.5K-070

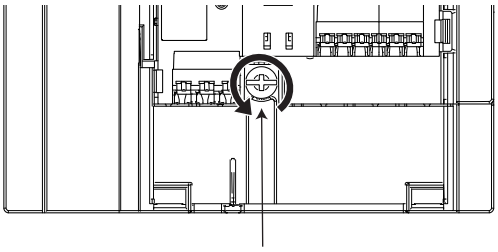


(a) Push the front cover downward using its upper end as a support to close the cover.

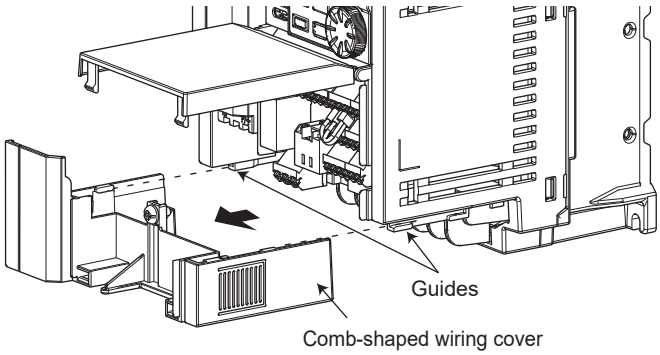
◆ Removal of the comb-shaped wiring cover (FR-D820-1.5K-070 to 3.7K-165, FR-D840-2.2K-050, FR-D840-3.7K-081, FR-D820S-1.5K-070, FR-D820S-2.2K-100, FR-D810W-0.75K-042)

- Example of FR-D820-1.5K-070

(a)



(b)



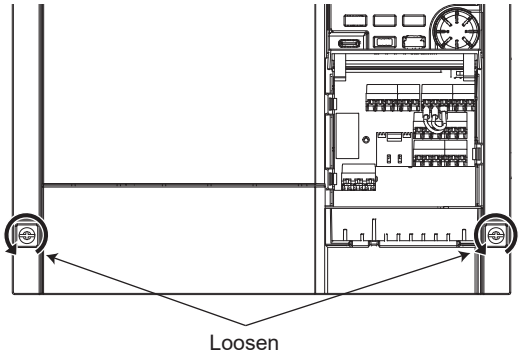
(a) Loosen the mounting screw of the comb-shaped wiring cover.

(b) Pull out the cover along the guides in the direction shown by the arrow in the figure above.

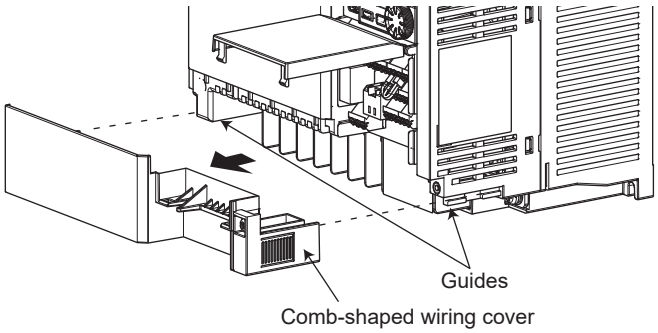
◆ Removal of the comb-shaped wiring cover (FR-D820-5.5K-238, FR-D820-7.5K-318, FR-D840-5.5K-120, FR-D840-7.5K-163)

- Example of FR-D820-5.5K-238

(a)



(b)

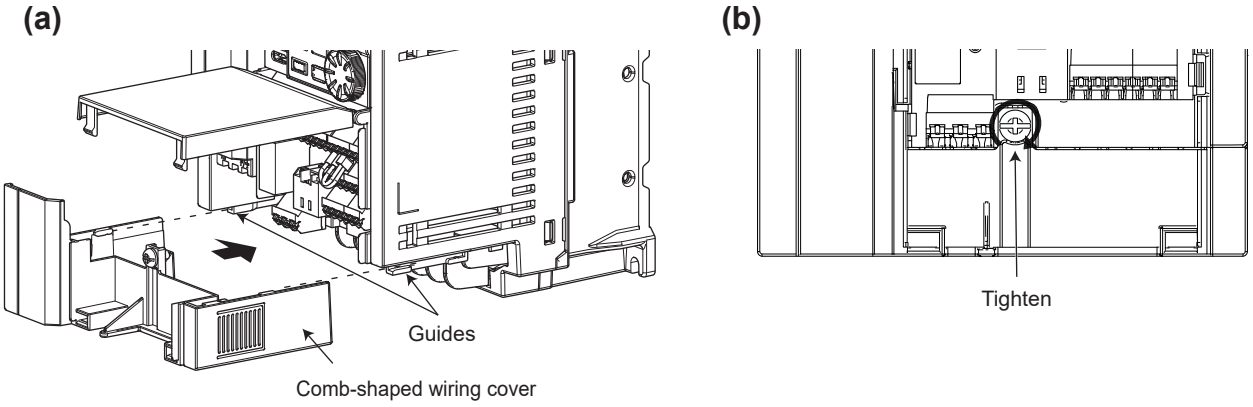


(a) Loosen the mounting screws of the comb-shaped wiring cover.

(b) Pull out the cover along the guides in the direction shown by the arrow in the figure above.

◆ Reinstallation of the comb-shaped wiring cover (FR-D820-1.5K-070 to 3.7K-165, FR-D840-2.2K-050, FR-D840-3.7K-081, FR-D820S-1.5K-070, FR-D820S-2.2K-100, FR-D810W-0.75K-042)

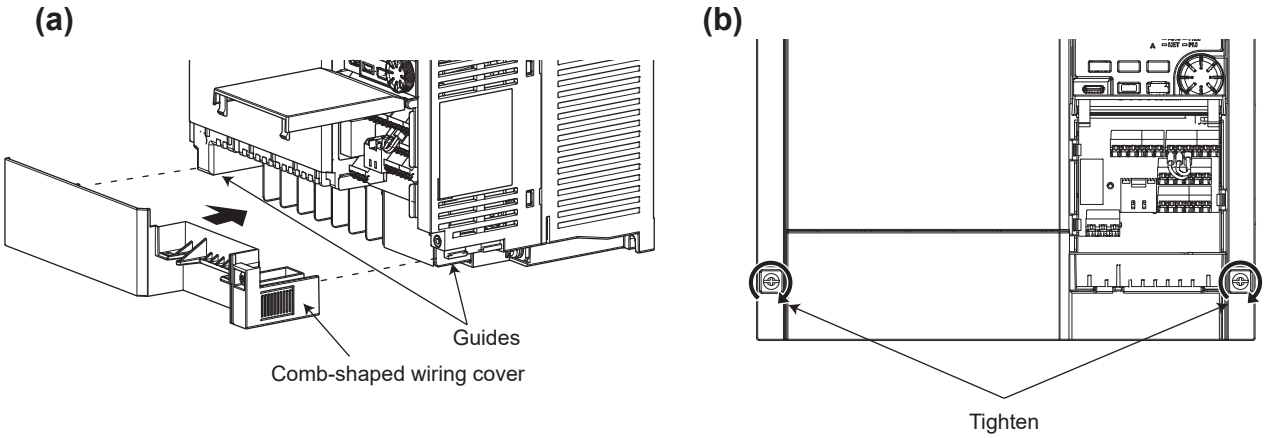
- Example of FR-D820-1.5K-070



(a) Fit the comb-shaped wiring cover to the inverter along the guides.
(b) Tighten the mounting screw of the cover. (Tightening torque: 0.6 to 0.8 N·m)

◆ Reinstallation of the comb-shaped wiring cover (FR-D820-5.5K-238, FR-D820-7.5K-318, FR-D840-5.5K-120, FR-D840-7.5K-163)

- Example of FR-D820-5.5K-238



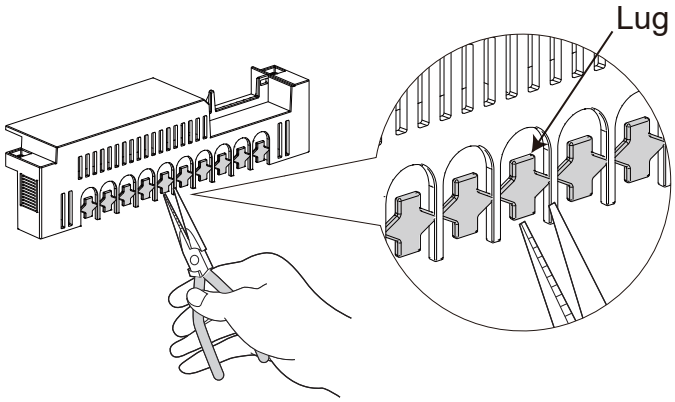
(a) Fit the comb-shaped wiring cover to the inverter along the guides.
(b) Tighten the mounting screws of the cover. (Tightening torque: 0.6 to 0.8 N·m)

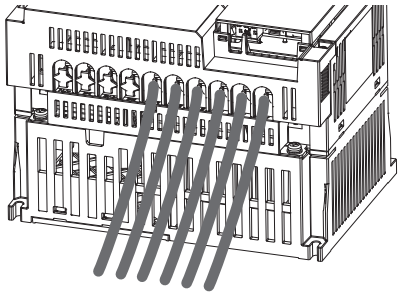
◆ Handling of the comb-shaped wiring cover

Cut off lugs of the comb-shaped wiring cover as required using tools such as needle-nose pliers. The comb-shaped wiring cover is provided for the FR-D820-1.5K-070 to 7.5K-318, FR-D840-2.2K-050 to 7.5K-163, FR-D820S-1.5K-070, FR-D820S-2.2K-100, and FR-D810W-0.75K-042.

NOTE

- Cut off the same number of lugs as wires.
  If parts where no wire is put through have been cut off (10 mm or more), protective structure (IEC 60529) becomes an open type (IP00).



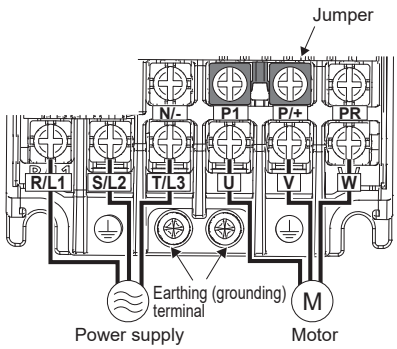


2.5 Checking the main circuit terminal layout

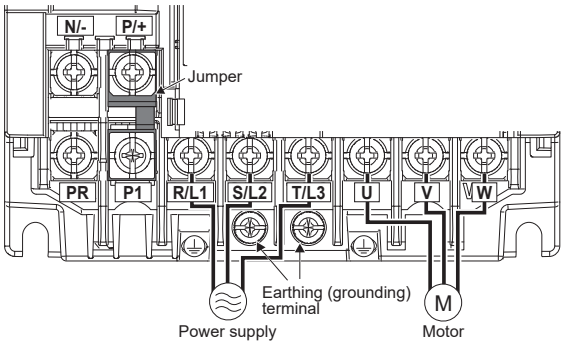
The following shows the main circuit terminal layout.

◆ Three-phase 200/400 V class

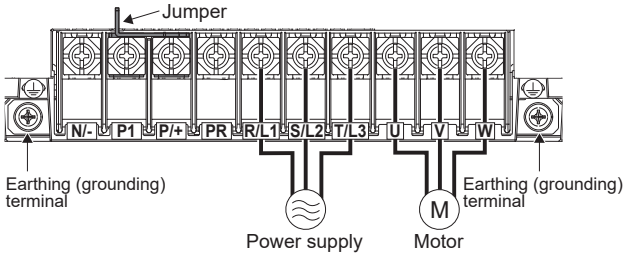
FR-D820-0.1K-008 to 0.75K-042
FR-D840-0.4K-012 to 1.5K-037



FR-D820-1.5K-070 to 3.7K-165
FR-D840-2.2K-050, FR-D840-3.7K-081

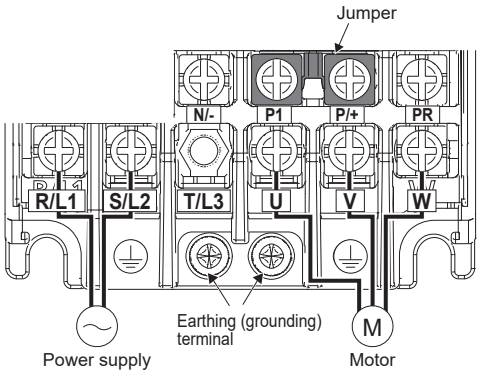


FR-D820-5.5K-238, FR-D820-7.5K-318
FR-D840-5.5K-120, FR-D840-7.5K-163

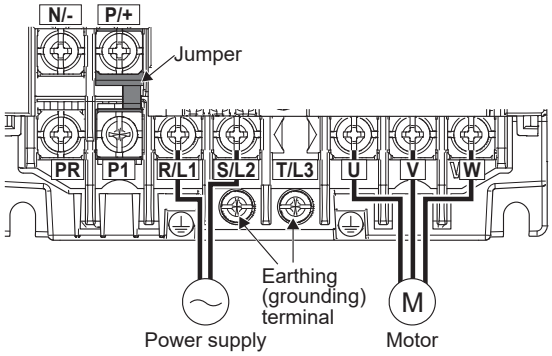


◆ Single-phase 200 V class

FR-D820S-0.1K-008 to 0.75K-042

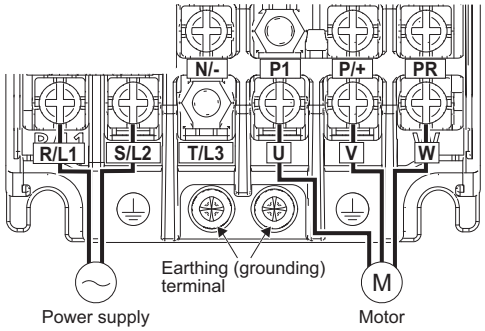


FR-D820S-1.5K-070, FR-D820S-2.2K-100

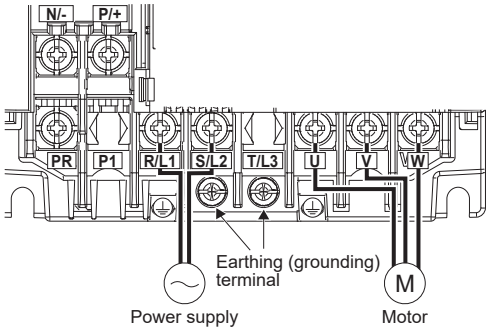


◆ Single-phase 100 V class

FR-D810W-0.1K-008 to 0.4K-025

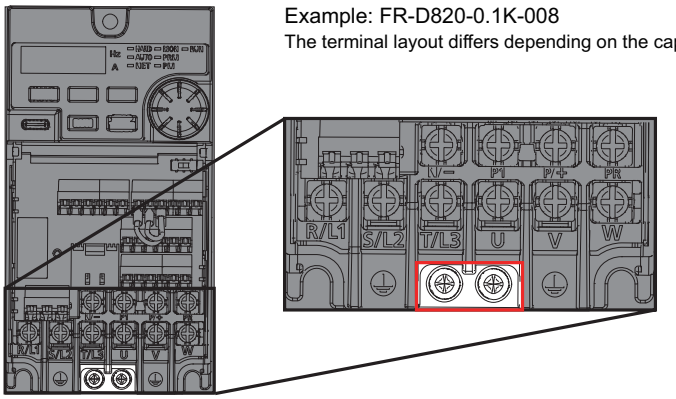


FR-D810W-0.75K-042



2.6 Earthing (grounding) the inverter

First, earth (ground) the inverter. Be sure to earth (ground) the motor and inverter.

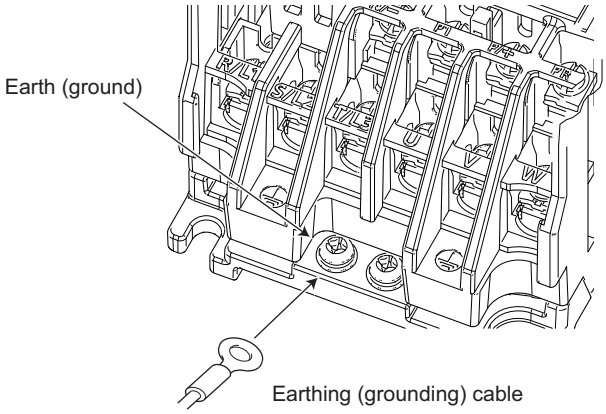


Example: FR-D820-0.1K-008
The terminal layout differs depending on the capacity.

Terminal symbol	Terminal name	Terminal function description
⏚	Earth (ground)	Be sure to earth (ground) the inverter.

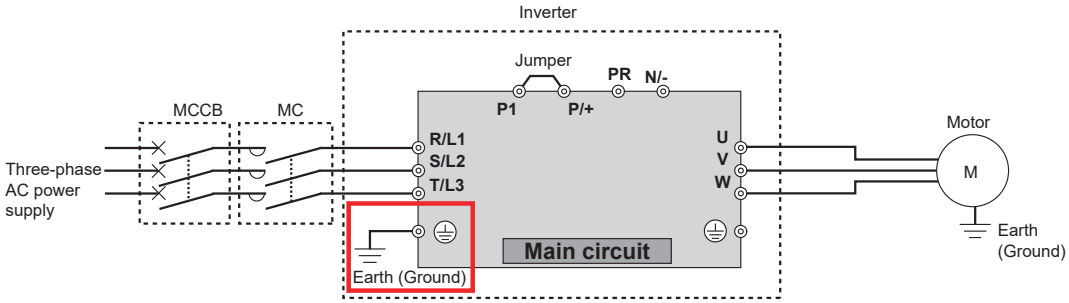
Follow the following procedure to connect the cable to the earth (ground) terminal ⏚.

1. Connect the selected cable to the earth (ground) terminal.



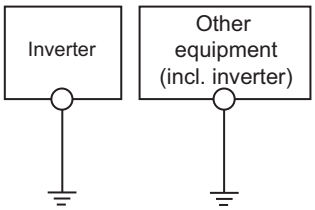
2. Connect the other end of the earthing (grounding) cable to the ground.
3. To wire the cables to the motor, proceed to the next procedure (page 27).

The above steps complete the following connection.

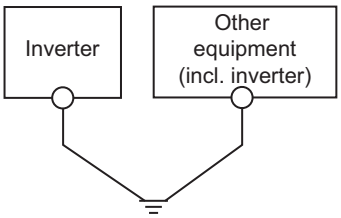


⚠CAUTION

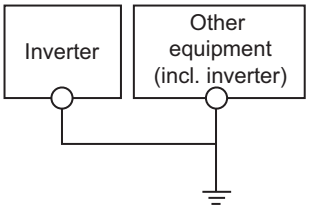
Make the separate earth (ground) connection (I) for the inverter from any other devices wherever possible.
Establishing adequate common (single-point) earth (ground) system (II) is allowed if the separate earth (ground) system (I) is not feasible.
Do not make inadequate common (single-point) earth (ground) connection (III). For details, refer to the Instruction Manual (Connection).



(I) Separate earthing (grounding): Good



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



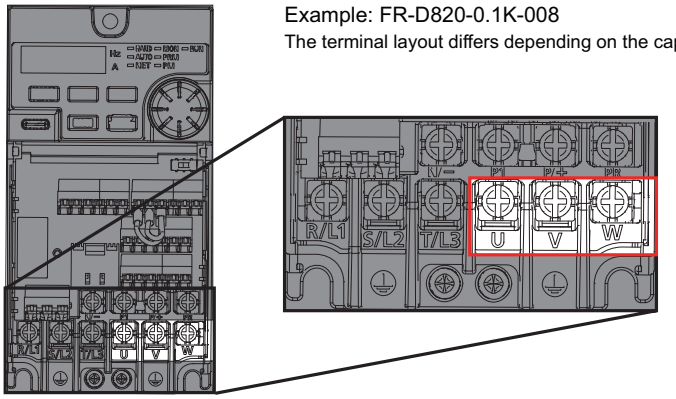
(III) Inadequate common (single-point) earthing (grounding): Bad

NOTE

- To be compliant with the EU Directive (Low Voltage Directive), refer to "Instructions for compliance with the EU Directives" in the document enclosed with the product.

2.7 Connecting the inverter and the motor

Connect the motor to the main circuit terminals U, V, and W of the inverter using the selected cable.

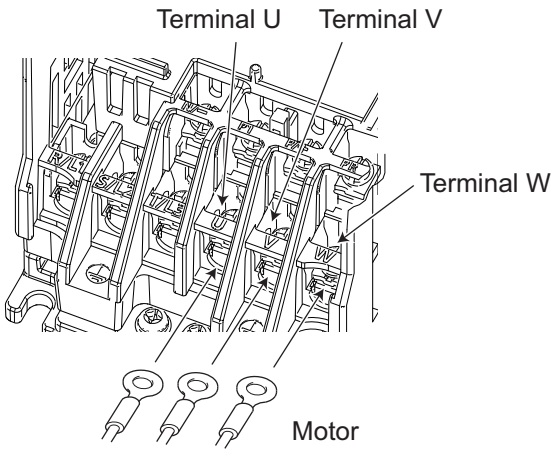


Example: FR-D820-0.1K-008
The terminal layout differs depending on the capacity.

Terminal symbol	Terminal name	Terminal function description
U, V, W	Inverter output	Connected to the motor.

Follow the following procedure to connect the motor to the main circuit terminals U, V, and W.

1. Remove the wiring instruction label.
2. Connect the selected cable to terminals U, V, and W.

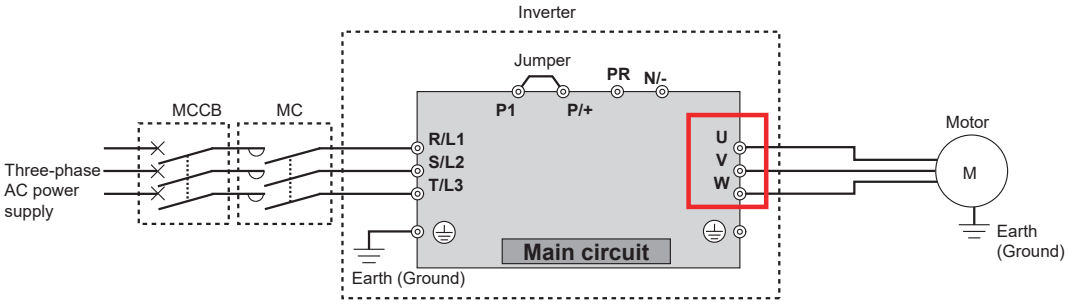


3. To wire the cables to the power supply, proceed to the next procedure (page 28).

NOTE

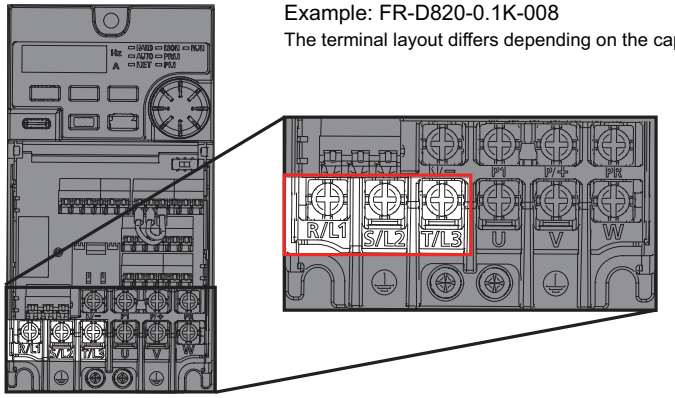
- Connect the motor to U, V, and W. Wire the motor to the inverter in the correct phase sequence. If the phase sequence between the motor and the inverter is incorrect, the motor may rotate in the reverse direction although the forward rotation command is input.

The above steps complete the following connection.



2.8 Connecting the inverter and the power supply

Connect the power supply to the main circuit terminals R/L1, S/L2, and T/L3 of the inverter using the selected cable.

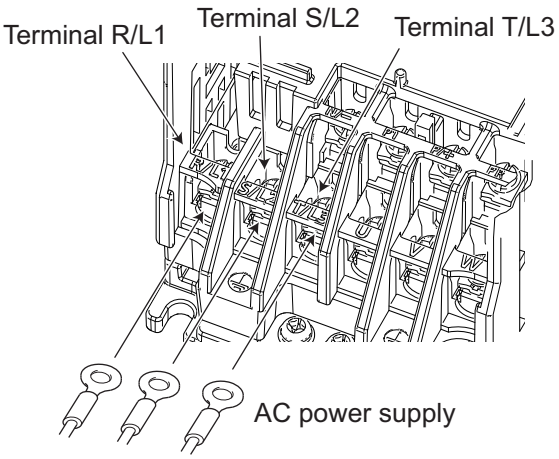


Example: FR-D820-0.1K-008
The terminal layout differs depending on the capacity.

Terminal symbol	Terminal name	Terminal function description
R/L1, S/L2, T/L3	AC power input	Connect these terminals to the commercial power supply.

Follow the following procedure to connect the power supply to the main circuit terminals R/L1, S/L2, and T/L3.

1. Connect the selected cables to terminals R/L1, S/L2, and T/L3.

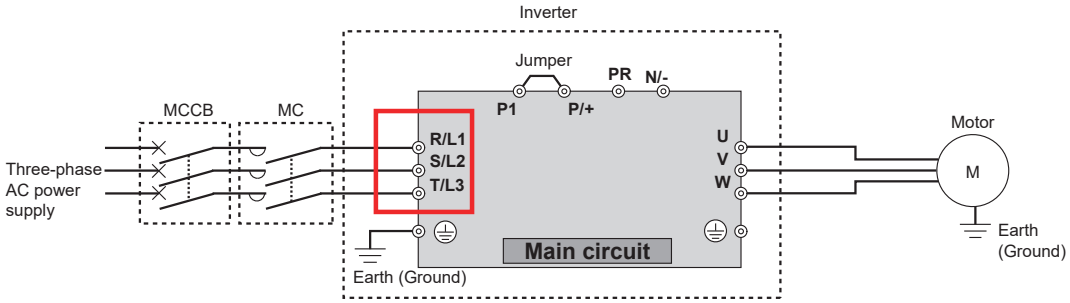


2. Close the front cover.

⚠CAUTION

• Make sure the power cables are connected to the R/L1, S/L2, and T/L3. (Phase need not be matched.) Never connect the power cable to the U, V, and W of the inverter. Doing so will damage the inverter.

The above steps complete the following connection.



Wiring of the main circuit is complete.

The next chapter describes the procedure to actually drive a motor with the inverter.

3 Driving a motor

This chapter describes how to drive a motor with the inverter.

3.1 Checklist before starting operation

Before power-ON, check the following points. For details on checkpoints and countermeasures, refer to "Checklist before starting operation" in the Instruction Manual (Connection).

Checkpoint	Countermeasure	Refer to page	Check by user
Crimp terminals are insulated.	Use crimp terminals with insulation sleeves to wire the power supply and the motor.	—	
The wiring between the power supply (terminals R/L1, S/L2, T/L3) and the motor (terminals U, V, W) is correct.	Application of power to the output terminals (U, V, W) of the inverter will damage the inverter. Never perform such wiring.	page 27, page 28	
No wire offcuts are left from the time of wiring.	Wire offcuts can cause a fault, failure, or malfunction. Always keep the inverter clean. When drilling mounting holes in an enclosure etc., take caution not to allow chips and other foreign matter to enter the inverter.	—	
The main circuit cable gauge is correctly selected.	Use an appropriate cable gauge to suppress the voltage drop to 2% or less. If the wiring distance is long between the inverter and motor, a voltage drop in the main circuit will cause the motor torque to decrease especially during the output of a low frequency.	page 15	
The total wiring length is within the specified length.	Keep the total wiring length within the specified length. In long distance wiring, charging currents due to stray capacitance in the wiring may degrade the fast-response current limit operation or cause the equipment on the inverter's output side to malfunction. Pay attention to the total wiring length.	page 17	
The inverter's output side has no short circuit or ground fault occurring.	A short circuit or ground fault on the inverter's output side may damage the inverter module. · Fully check the insulation resistance of the circuit prior to inverter operation since repeated short circuits caused by peripheral circuit inadequacy or an earth (ground) fault caused by wiring inadequacy or reduced motor insulation resistance may damage the inverter module. · Fully check the to-earth (ground) insulation and phase-to-phase insulation of the inverter's output side before power-ON. Especially for an old motor or use in hostile atmosphere, securely check the motor insulation resistance, etc.	—	

3.2 Basics of start commands

The start command is a command to start the motor operation.

Basically, the following methods are available to input a start command.

- Operation panel: Give a start command on the operation panel.
- External switch: Give a start command using the switches connected to the inverter terminal block.

3.3 Basics of frequency commands

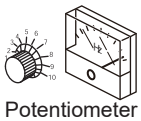
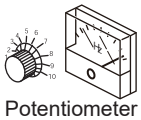
The frequency command is a command to set the frequency to operate the motor.

Basically, the following methods are available to input a frequency command.

- Operation panel: Give a frequency command on the operation panel.
- Multi-speed switch (external switch): Pre-set operation speeds with parameters and switch among the speeds using the contact terminals.
- Analog input: Give a frequency command via terminal 2 (voltage input) or terminal 4 (current input).

3.4 Basics of operation modes

The operation mode specifies the source of the start command and the frequency command for the inverter. Select the operation mode according to the combination of sources of the start command and the frequency command.
Basically, the following operation modes are available. This document describes the External operation mode and the PU operation mode. For the NET operation mode, refer to the Instruction Manual (Communication).

Start command	Frequency command	Operation mode	Pr.79 setting	Operating procedure
Use switches connected to external terminals.  Switch	Use switches or a potentiometer connected to external terminals.  Switch  Potentiometer	External operation mode	0 (initial value), 2[*1]	page 33
Use the operation panel.  Operation panel		PU operation mode	0 (initial value), 1[*2]	page 34
Use switches connected to external terminals.  Switch	Use the operation panel.  Operation panel	External/PU combined operation mode 1	3	page 35
Use the operation panel.  Operation panel	Use switches or a potentiometer connected to external terminals.  Switch  Potentiometer	External/PU combined operation mode 2	4	page 36
Use the RS-485 communication.  GOT  Programmable controller		NET operation mode	0 (initial value), 2	Refer to the Instruction Manual (Communication).

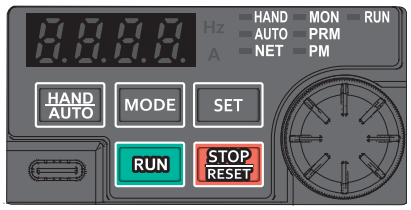
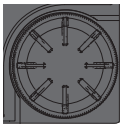
*1 To fix the operation mode to the External operation mode, set "2" in **Pr.79 Operation mode selection**.
*2 To fix the operation mode to the PU operation mode, set "1" in **Pr.79 Operation mode selection**.

For the setting procedure of the operation mode, refer to page 32.

3.5 Preparation before using each operation mode

3.5.1 Components of the operation panel

The following describes the names and functions of the operation panel keys.

	Appearance	Name	Description
		HAND/AUTO key	Switches between the PU operation mode and the External operation mode. HAND: PU operation mode AUTO: External operation mode
		MODE key	Switches the operation panel to a different mode. Press and hold the button to lock the operation.
		SET key	Confirms each selection. When this key is pressed in the monitor mode, the monitor item changes.
		RUN key	Start command The direction of motor rotation depends on the **Pr.40 RUN key rotation direction selection** setting. When **Pr.40** = "0 (initial value)", the motor starts forward rotation.
		STOP/ RESET key	Stops the operation commands. Used to reset the inverter when the protective function is activated.
		Setting dial	The setting dial of the Mitsubishi Electric inverters. Turn the setting dial to change the setting of frequency or parameter, etc.

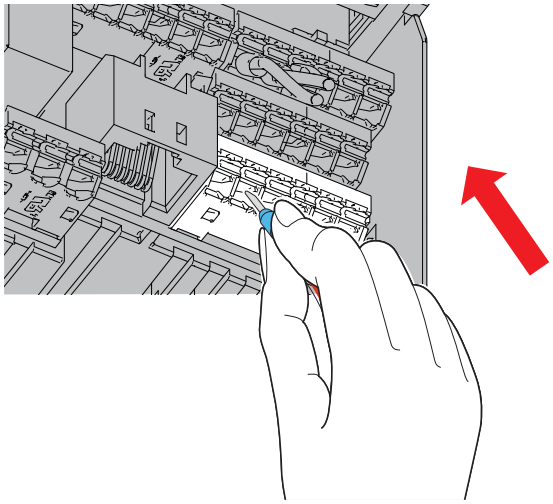
3.5.2 Digital characters and their corresponding printed equivalents

Digital characters displayed on the operation panel display are as follows.

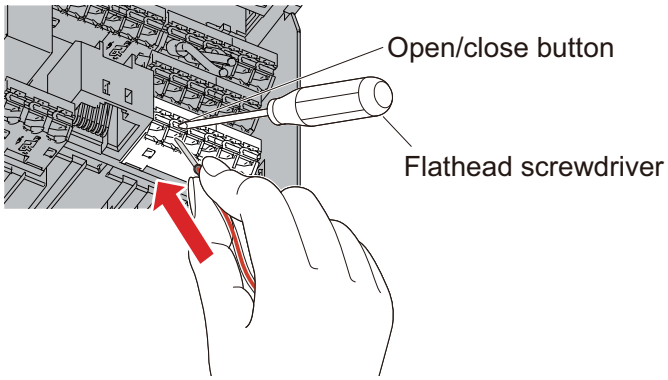
0	1	2	3	4	5	6	7	8	9	A	B	C
0	1	2	3	4	5	6	7	8	9	A	b	C
D	E	F	G	H	I	J	K	L	M	N	O	P
d	E	F	G	H	,	J	K	L	n	n	o	P
Q	R	S	T	U	V	W	X	Y	Z	-	_	
q	r	S	r	U	u	W	,	y	Z	-	_	

3.5.3 Wiring to external terminals

When wiring switches and a potentiometer, connect the wires to the terminals used in the following procedure.



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

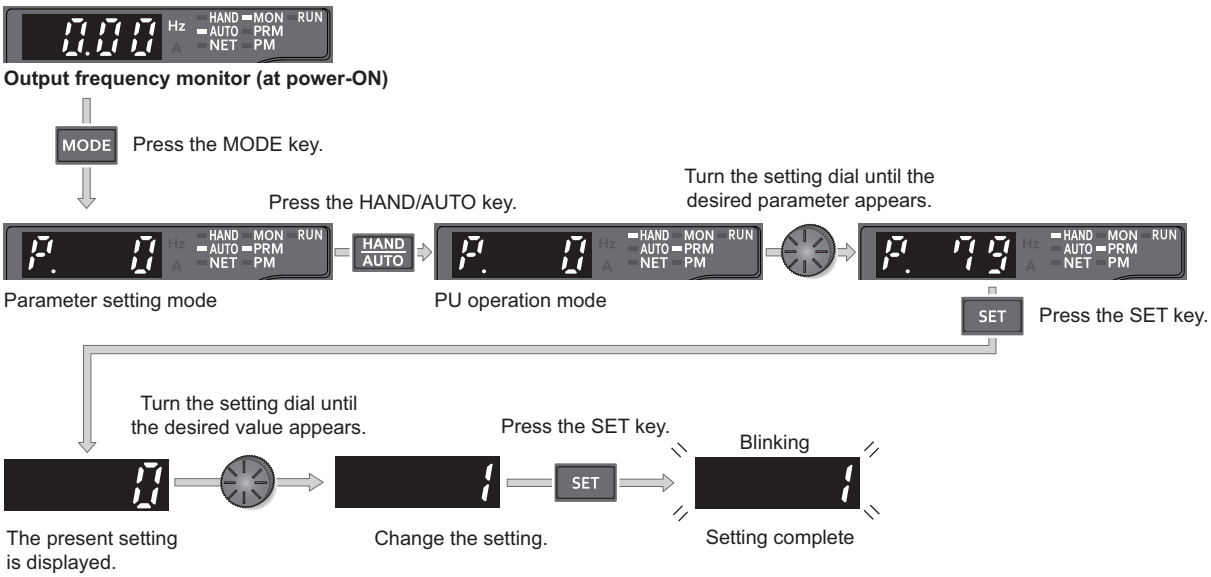


NOTE

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

3.5.4 Setting the operation mode

The following shows the procedure to set the operation mode on the operation panel.

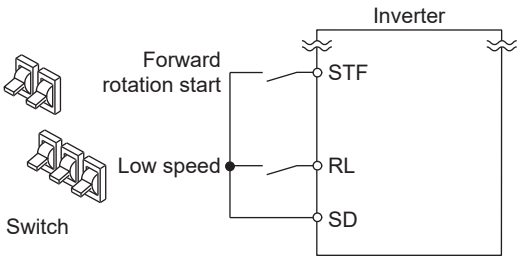


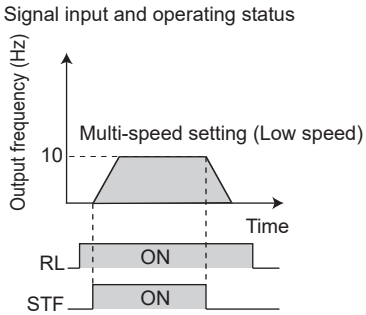
3.6 Test operation of each operation mode

3.6.1 External operation mode

Point

- Enable the External operation mode. (Set "0 (initial value) or 2" in **Pr.79 Operation mode selection**.)
  For wiring to control circuit terminals, refer to page 32.
- Turn ON the STF signal to give a start command.
- Turn ON the RL signal to give a frequency command.





The following shows the procedure to operate at a low speed (10 Hz).

Operating procedure

1. Turning ON the power of the inverter
   The operation panel is in the monitor mode.
2. Setting the frequency
   Turn ON the low-speed switch (RL signal).
3. Start → acceleration → constant speed
   Turn ON the start switch (STF signal). The frequency value on the monitor becomes 10.00 Hz ("10.00" appears on the monitor).
   The RUN LED turns ON.
4. Deceleration → stop
   Turn OFF the start switch (STF signal). The frequency value on the monitor becomes 0.00 Hz ("0.00" appears on the monitor), and the motor stops rotating. The RUN LED turns OFF.
   Turn OFF the low-speed switch (RL signal).
5. Test operation complete

NOTE

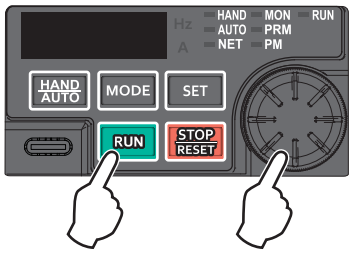
- The frequency when the RL signal is ON can be changed by the setting of **Pr.6 Multi-speed setting (low speed)**.

3.6.2 PU operation mode

Point

- Enable the PU operation mode. (Set "0 (initial value) or 1" in **Pr.79 Operation mode selection**.)
- Use the operation panel to give a start command and a frequency command.

Operation panel



The following shows the procedure to operate at 10 Hz.

Operating procedure

1. Turning ON the power of the inverter
The operation panel is in the monitor mode.

2. Changing the operation mode
Press the HAND/AUTO key to choose the PU operation mode. The HAND LED turns ON.

3. Setting the frequency
Turn the setting dial until the target frequency "10.00" (10.00 Hz) appears. The indication blinks for about 5 seconds.
While the value is blinking, press the SET key to enter the frequency. "F" and "10.00" are displayed alternately.
After about 3 seconds of alternate display, the indication returns to "0.00" (the indication of a monitored value).
(If the SET key is not pressed, the indication of the value returns to "0.00" (0.00 Hz) after about 5 seconds of blinking. In that case, turn the setting dial and set the frequency again.)

4. Start → acceleration → constant speed
Press the RUN key to start running. Forward rotation is performed when "0 (initial value)" is set in **Pr.40 RUN key rotation direction selection**.
The frequency value on the monitor becomes 10.00 Hz ("10.00" appears on the monitor).

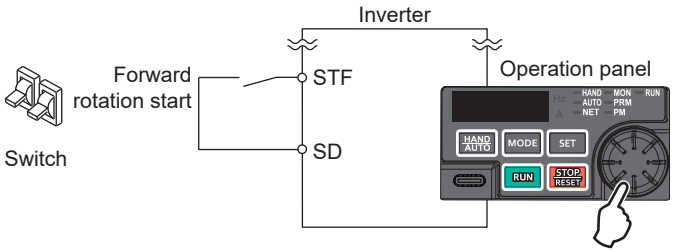
5. Deceleration → stop
Press the STOP/RESET key to stop. The frequency value on the monitor becomes 0.00 Hz ("0.00" appears on the monitor), and the motor stops rotating.

6. Test operation complete

3.6.3 External/PU combined operation mode 1

Point

- Enable the External/PU combined operation mode 1. (Set "3" in **Pr.79 Operation mode selection**.)
  For wiring to the control circuit terminals, refer to page 32.
- Turn ON the STF signal to give a start command.
- Use the setting dial on the operation panel to give a frequency command.



The following shows the procedure to operate at 10 Hz.

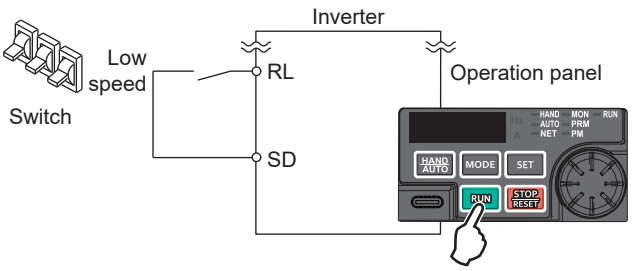
Operating procedure

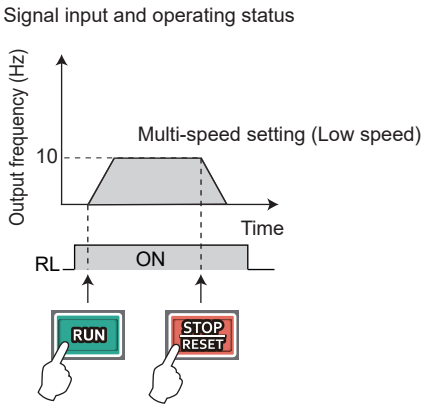
1. Turning ON the power of the inverter
   The operation panel is in the monitor mode.
2. Changing the operation mode
   Set "3" in **Pr.79 Operation mode selection**. The HAND LED and AUTO LED turn ON. (To change the setting, refer to page 32.)
3. Setting the frequency
   Turn the setting dial until the target frequency "10.00" (10.00 Hz) appears. The indication blinks for about 5 seconds.
   While the value is blinking, press the SET key to enter the frequency. "F" and "10.00" are displayed alternately.
   After about 3 seconds of alternate display, the indication returns to "0.00" (the indication of a monitored value).
   (If the SET key is not pressed, the indication of the value returns to "0.00" (0.00 Hz) after about 5 seconds of blinking. In that case, turn the setting dial and set the frequency again.)
4. Start → acceleration → constant speed
   Turn ON the start switch (STF signal). The frequency value on the monitor becomes 10.00 Hz ("10.00" appears on the monitor).
   The RUN LED turns ON.
5. Deceleration → stop
   Turn OFF the start switch (STF signal). The frequency value on the monitor becomes 0.00 Hz ("0.00" appears on the monitor), and the motor stops rotating.
   The RUN LED turns OFF.
6. Test operation complete

3.6.4 External/PU combined operation mode 2

Point

- Enable the External/PU combined operation mode 2. (Set "4" in **Pr.79 Operation mode selection**.) For wiring to the control circuit terminals, refer to page 32.
- Use the RUN key on the operation panel to give a start command.
- Turn ON the RL signal to give a frequency command.





The following shows the procedure to operate at a low speed (10 Hz).

Operating procedure

1. Turning ON the power of the inverter
   The operation panel is in the monitor mode.
2. Changing the operation mode
   Set "4" in **Pr.79 Operation mode selection**. The HAND LED and AUTO LED turn ON. (To change the setting, refer to page 32.)
3. Setting the frequency
   Turn ON the low-speed switch (RL signal).
4. Start → acceleration → constant speed
   Press the RUN key to start running. Forward rotation is performed when "0 (initial value)" is set in **Pr.40 RUN key rotation direction selection**.
   The frequency value on the monitor becomes 10.00 Hz ("10.00" appears on the monitor).
5. Deceleration → stop
   Press the STOP/RESET key to stop. The frequency value on the monitor becomes 0.00 Hz ("0.00" appears on the monitor), and the motor stops rotating. Turn OFF the low-speed switch (RL signal).
6. Test operation complete

NOTE

- The frequency when the RL signal is ON can be changed by the setting of **Pr.6 Multi-speed setting (low speed)**.

4 Parameters

4.1 Setting and changing parameters

◆ Setting and changing parameters

Ex.

Change the setting of **Pr.1 Maximum frequency** from 120 Hz (initial value) to 60 Hz.

Operation	Display
1. Turn ON the power. The operation panel is in the monitor mode.	
2. Press the MODE key to choose the parameter setting mode.	
3. Press the HAND/AUTO key to choose the PU operation mode.	
4. Turn the setting dial until **Pr.1** appears.	
5. Press the SET key to read the present set value. 120.0 Hz (initial value) appears.	
6. Turn the setting dial to change the value to 60.00 Hz.	
7. Press the SET key to confirm the setting.	 Parameter write complete

NOTE

- Er2 or Er4 is displayed. Why?

Er2 is displayed ..... Write error during operation
After stopping the operation, make parameter setting.

Er4 is displayed ..... Mode designation error
After setting the operation mode to the "PU operation mode", make parameter setting.
To enable the PU operation mode, follow the following steps.
· Press the HAND/AUTO key to choose the PU operation mode.
· Set "1" in **Pr.79**.

For details on error displays, refer to page 48.

- The number of digits displayed on the operation panel is four. When the parameter number is 4-digit, "Pr." and the parameter number are displayed alternately. When the parameter number is 5-digit, the upper 1 digit and the lower 4 digits of the parameter number are displayed alternately.

4.2 Explanation of frequently-used parameters

The following table lists the parameters frequently used during inverter operation. For other parameters, refer to the Instruction Manual (Function).

Purpose	Parameter to set		Refer to page
To set the starting torque manually	**Manual torque boost**	**Pr.0**	page 38
To limit the output frequency	**Maximum frequency**	**Pr.1**	page 39
To set V/F pattern	**Base frequency, base frequency voltage**	**Pr.3, Pr.19**	page 39
To control the frequency with combinations of terminals	**Multi-speed operation**	**Pr.4 to Pr.6**	page 40
To set the motor acceleration/deceleration time	**Acceleration/deceleration time**	**Pr.7, Pr.8, Pr.20**	page 40
To protect the motor from overheating	**Electronic thermal O/L relay**	**Pr.9**	page 42
To select the operation mode	**Operation mode selection**	**Pr.79**	page 43

4.2.1 Setting the starting torque manually (manual torque boost)

Under V/F control, voltage drop in the low-frequency range can be compensated, improving reduction of the motor torque in the low-speed range.

- Motor torque in the low-frequency range can be adjusted according to the load, increasing the motor torque at the start up.

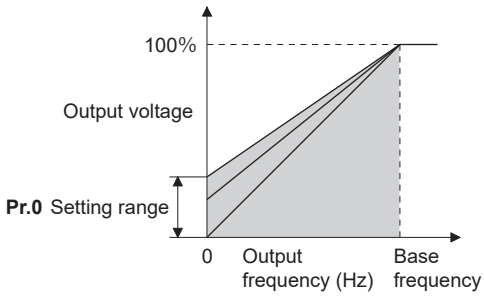
Pr.	Name	Initial value	Setting range	Description
0	Torque boost	3, 4, 6*1	0% to 30%	Set the output voltage at 0 Hz in %.

*1 The initial value differs depending on the inverter capacity. Refer to the following table.

Inverter	Initial value
FR-D820-0.75K-042 or lower FR-D840-0.75K-022 or lower FR-D820S-0.75K-042 or lower FR-D810W-0.75K-042 or lower	6%
FR-D820-1.5K-070 to FR-D820-3.7K-165 FR-D840-1.5K-037 to FR-D840-3.7K-081 FR-D820S-1.5K-070 or higher	4%
FR-D820-5.5K-238, FR-D820-7.5K-318 FR-D840-5.5K-120, FR-D840-7.5K-163	3%

◆ Starting torque adjustment

- Assuming **Pr.19 Base frequency voltage** is 100%, set the output voltage at 0 Hz to **Pr.0** in percentage.
- Perform the adjustment of the parameter little by little (approximately 0.5%), and confirm the status of the motor each time. The motor may overheat when the value is set too high. Do not use more than 10% as a guideline.



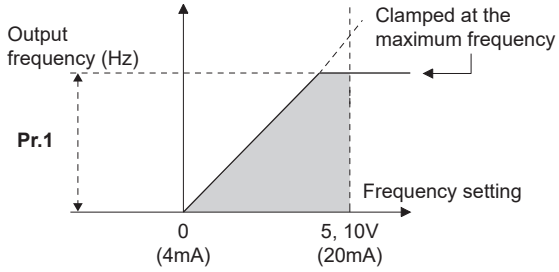
4.2.2 Limiting the output frequency (maximum frequency)

The motor speed can be limited by setting the upper limit of the output frequency.

Pr.	Name	Initial value	Setting range	Description
1	Maximum frequency	120 Hz	0 to 120 Hz	Set the upper limit of the output frequency.

◆ Setting the maximum frequency (Pr.1)

- Set **Pr.1 Maximum frequency** to the upper limit of the output frequency. If the value of the frequency command given is higher than the setting, the output frequency is clamped at the maximum frequency.



4.2.3 Setting the V/F pattern (base frequency, base frequency voltage)

Use this function to adjust the inverter outputs (voltage, frequency) to match with the motor rating under V/F control.

Pr.	Name	Initial value*1		Setting range	Description
		Gr.1	Gr.2		
3	Base frequency	60 Hz	50 Hz	0 to 590 Hz	Set the frequency at the rated motor torque. (50/60 Hz)
19	Base frequency voltage	9999	8888	0 to 1000 V	Set the base voltage.
				8888	95% of the power supply voltage (For a single-phase 100 V power input model, 95% of twice of the power supply voltage)
				9999	Same as the power supply voltage (For a single-phase 100 V power input model, twice of the power supply voltage)

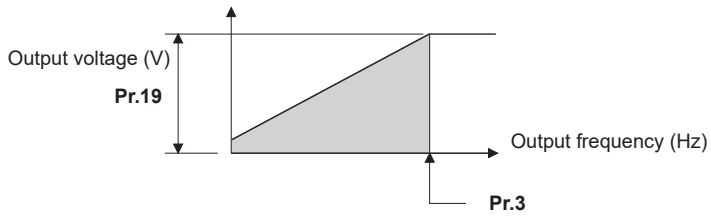
*1 Gr.1 and Gr.2 are the parameter initial value groups. The parameter initial value group differs depending on the country of origin. For the country of origin, refer to the rating plate (page 7). For the parameter initial value groups, refer to page 8.

◆ Base frequency setting (Pr.3)

- When operating a motor, set the rated frequency of the motor in **Pr.3 Base frequency**.
- When the frequency described on the motor rating plate is "50 Hz" only, make sure to set to 50 Hz. When it is set to 60 Hz, the voltage will drop too much, causing insufficient torque. As a result, the inverter output may be shut off due to overload.
- When using the Mitsubishi Electric constant torque motor, set **Pr.3** to 60 Hz.

◆ Setting of base frequency voltage (Pr.19)

- Use **Pr.19 Base frequency voltage** to set the base voltage (for example, rated motor voltage).
- When it is set lower than the power supply voltage (approximately twice of the power supply voltage for a single-phase 100 V power input model), maximum output voltage of the inverter will be the voltage set in **Pr.19**.



4.2.4 Controlling the frequency with combinations of terminals (multi-speed operation)

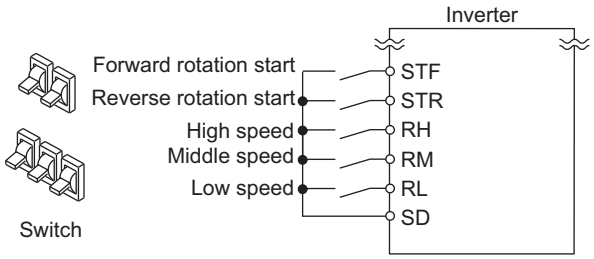
Turn ON or OFF the contact signals (RH, RM, and RL signals) to select the set frequency.

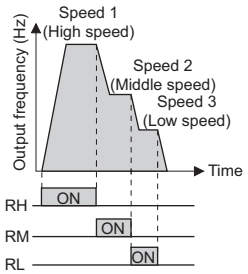
Pr.	Name	Initial value[*1]		Setting range	Description
		Gr.1	Gr.2		
4	Multi-speed setting (high speed)	60 Hz	50 Hz	0 to 590 Hz	Sets the frequency when RH is ON.
5	Multi-speed setting (middle speed)	30 Hz		0 to 590 Hz	Sets the frequency when RM is ON.
6	Multi-speed setting (low speed)	10 Hz		0 to 590 Hz	Sets the frequency when RL is ON.

*1 Gr.1 and Gr.2 are the parameter initial value groups. The parameter initial value group differs depending on the country of origin. For the country of origin, refer to the rating plate (page 7). For the parameter initial value groups, refer to page 8.

◆ Multi-speed setting (Pr.4 to Pr.6)

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





NOTE

- If two or more speed switches (signals) are simultaneously turned ON, priority is given to the switch (signal) for the lower speed. For example, when both the RH signal (**Pr.4**) and the RM signal (**Pr.5**) turn ON simultaneously, the RM signal (**Pr.5**) has the higher priority.

4.2.5 Setting the motor acceleration/deceleration time (acceleration/deceleration time)

The following parameters are used to set motor acceleration/deceleration time.
Set a larger value for a slower acceleration/deceleration, or a smaller value for a faster acceleration/deceleration.

Pr.	Name	Initial value[*1]		Setting range	Description
		Gr.1	Gr.2		
20	Acceleration/deceleration reference frequency	60 Hz	50 Hz	1 to 590 Hz	Set the frequency that is the basis of acceleration/deceleration time. As acceleration/deceleration time, set the time required to change the frequency from stop status (0 Hz) to the frequency set in **Pr.20** and vice versa.
7	Acceleration time	5 s[*2]		0 to 3600 s	Set the motor acceleration time (time required to change the frequency from stop status (0 Hz) to the frequency set in **Pr.20**).
		10 s[*3]			
8	Deceleration time	5 s[*2]		0 to 3600 s	Set the motor deceleration time (time required to change the frequency from the frequency set in **Pr.20** to stop status (0 Hz)).
		10 s[*3]			

*1 Gr.1 and Gr.2 are the parameter initial value groups. The parameter initial value group differs depending on the country of origin. For the country of origin, refer to the rating plate (page 7). For the parameter initial value groups, refer to page 8.

*2 Initial value for the FR-D820-3.7K-165 or lower, the FR-D840-3.7K-081 or lower, the FR-D820S-2.2K-100 or lower, and the FR-D810W-0.75K-042 or lower.

*3 Initial value for the FR-D820-5.5K-238 or higher and the FR-D840-5.5K-120 or higher.

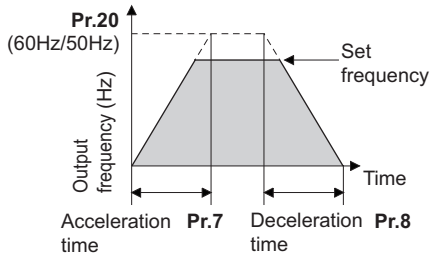
◆ Acceleration time setting (Pr.7, Pr.20)

- Use **Pr.7 Acceleration time** to set the acceleration time required to change the frequency to the frequency set in **Pr.20 Acceleration/deceleration reference frequency** from stop status.
- Set the acceleration time according to the following formula.

Acceleration time setting = **Pr.20** × Acceleration time from stop status to maximum frequency / (Maximum frequency - 0.5 Hz (starting frequency[*1]))

- For example, the following calculation is performed to find the setting value for **Pr.7** when increasing the output frequency to the maximum frequency of 50 Hz in 10 seconds with **Pr.20** = 60 Hz (initial value).

Pr.7 setting = 60 Hz × 10 s / (50 Hz - 0.5 Hz) ≈ 12.1 s



*1 The starting frequency can be changed by the setting of **Pr.13 Starting frequency**. (For details on **Pr.13**, refer to the Instruction Manual (Function).)

◆ Deceleration time setting (Pr.8, Pr.20)

- Use **Pr.8 Deceleration time** to set the deceleration time required to change the frequency to a stop status from the frequency set in **Pr.20 Acceleration/deceleration reference frequency**.
- Set the deceleration time according to the following formula.

Deceleration time setting = **Pr.20** × deceleration time from maximum frequency to stop / (maximum frequency - 3 Hz (DC injection brake operation frequency[*2]))

- For example, the following calculation is used to find the setting value for **Pr.8** when decreasing the output frequency from the maximum frequency of 50 Hz in 10 seconds with **Pr.20** = 120 Hz.

Pr.8 setting = 120 Hz × 10 s / (50 Hz - 3 Hz) ≈ 25.5 s

*2 The DC injection brake operation frequency can be changed by the setting of **Pr.10 DC injection brake operation frequency**. (For details on **Pr.10**, refer to the Instruction Manual (Function).)

NOTE

- The acceleration/deceleration reference frequency can be changed by the setting of **Pr.20 Acceleration/deceleration reference frequency**, and the starting frequency by the setting of **Pr.13 Starting frequency**. For details, refer to the Instruction Manual (Function).

4.2.6 Protecting the motor from overheating (electronic thermal O/L relay)

Set the current of the electronic thermal relay function to protect the motor from overheating. Such settings provide the optimum protective characteristic considering the low cooling capability of the motor during low-speed operation.

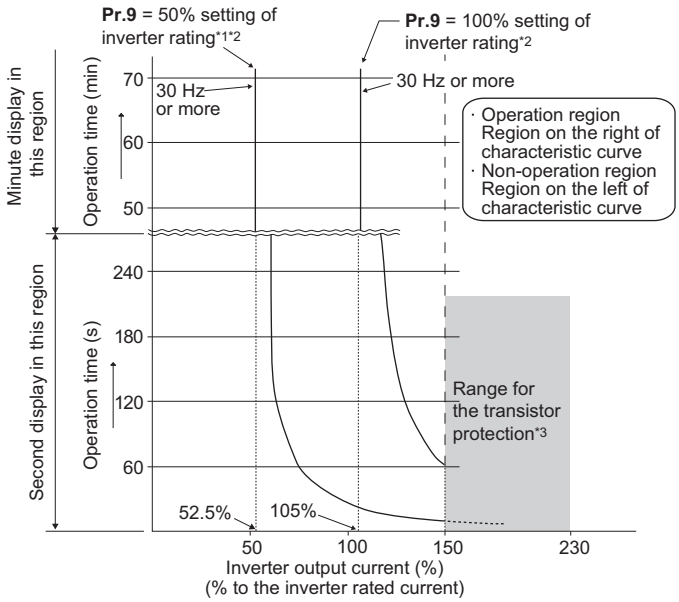
Pr.	Name	Initial value	Setting range	Description
9	Electronic thermal O/L relay	Inverter rated current*1	0 to 500 A	Set the rated motor current.

*1 The initial value for the FR-D820-0.75K-042 or lower, the FR-D840-0.75K-022 or lower, FR-D820S-0.75K-042 or lower, the FR-D810W-0.75K-042 or lower is set to the 85% of the inverter rated current.

◆ Electronic thermal O/L relay operation characteristic for induction motor (Pr.9)

- This function detects the overload (overheat) of the motor and shuts off the inverter output by stopping the operation of the transistor at the inverter output side.
- Set the rated current (A) of the motor in **Pr.9 Electronic thermal O/L relay**. (If the motor has both 50 Hz and 60 Hz ratings and **Pr.3 Base frequency** is set to 60 Hz, set to 1.1 times the 60 Hz rated motor current.)
- Set "0" in **Pr.9** to avoid activating the electronic thermal relay function; for example, when using an external thermal relay for the motor.
- When using the Mitsubishi Electric constant-torque motor SF-PR, set "70" in **Pr.71 Applied motor**. (This setting enables the 100% constant-torque characteristic in the low-speed range.)

When using the SF-PR



*1 When setting **Pr.9** to a value (current value) of 50% of the inverter rated current

*2 The % value denotes the percentage to the rated inverter current. It is not the percentage to the rated motor current.

*3 Transistor protection is activated depending on the temperature of the heat sink. The protection may be activated even with less than 150% depending on the operating conditions.

NOTE

- The internal accumulated heat value of the electronic thermal O/L relay is reset to the initial value by the inverter's power reset or reset signal input. Avoid unnecessary reset and power-OFF.
- When the difference between the inverter and motor capacities is large and the set value is small, the protective characteristics of the electronic thermal relay function will be deteriorated. Use an external thermal relay in such cases.
- A dedicated motor cannot be protected by an electronic thermal O/L relay. Use an external thermal relay.

4.2.7 Selecting the operation mode (operation mode selection)

Select the operation mode of the inverter.

The mode can be changed among operation using external signals (External operation mode), operation by the operation panel or parameter unit (PU operation mode), combined operation of PU operation and External operation (External/PU combined operation mode), and Network operation via RS-485 communication (NET operation mode). For the NET operation mode, refer to the Instruction Manual (Communication).

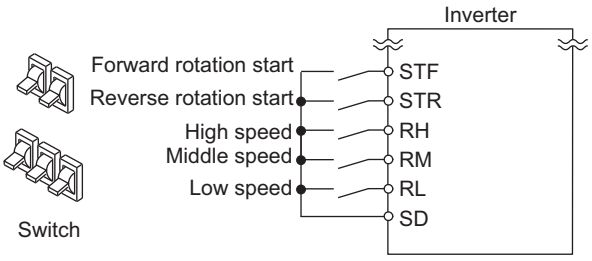
Pr.	Name	Initial value	Setting range	Description
79	Operation mode selection	0	0 to 4, 6, 7	Selects the operation mode.

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

Pr.79 setting	Description			LED indicator ■: OFF ▬: ON	Refer to page
0 (initial value)	EXT/PU selection of the operation mode. The inverter operation mode can be selected by pressing the HAND/AUTO key. At power ON, the inverter is in the External operation mode.			PU operation mode  External operation mode  NET operation mode  	page 44
1	**Operation mode** Fixed at PU operation mode.	**Frequency command** Sent from the operation panel.	**Start command** Input using the RUN key on the operation panel.	PU operation mode  	page 44
2	Fixed at External operation mode. However, the inverter operation mode can also be changed to the Network operation mode.	Sent using external signals (input via terminal 2 or 4, using the multi-speed setting function, etc.).	Sent using external signals (via terminal STF or STR).	External operation mode  NET operation mode  	page 44
3	External/PU combined operation mode 1	Sent from the operation panel or sent using external signals (input using the multi-speed setting function or via terminal 4).	Sent using external signals (via terminal STF or STR).	External/PU combined operation mode  	page 44
4	External/PU combined operation mode 2	Sent using external signals (input via terminal 2 or 4, using the multi-speed setting function, etc.).	Input using the RUN key on the operation panel.		page 44
6	Operation mode switchover during operation. Switching of PU, External, and NET operation modes can be performed during operation. For details, refer to the Instruction Manual (Function).			PU operation mode  External operation mode  NET operation mode  	—
7	External operation mode (PU operation interlock) X12 signal ON: Switchover to PU operation mode enabled (signal is OFF during External operation). X12 signal OFF: Switchover to PU operation mode disabled For details, refer to the Instruction Manual (Function).				—

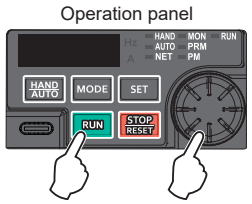
◆ External operation mode (Pr.79 = "0 (initial value) or 2")

- Select the External operation mode when the start command and the frequency command are applied from a frequency setting potentiometer, start switch, etc. which are externally connected to the control circuit terminals of the inverter.
- The voltage/current signal input via terminal 2 or 4 is also used as a frequency command. For details, refer to the Instruction Manual (Function).
- The operation is fixed at External operation mode by setting "2" in **Pr.79 Operation mode selection**.



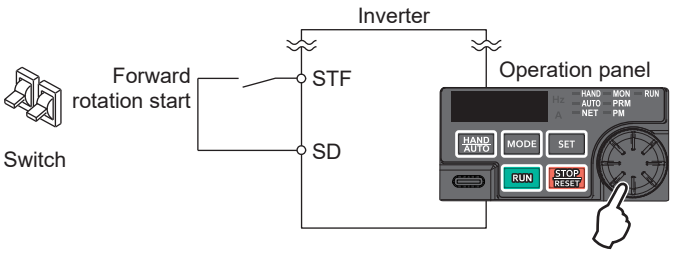
◆ PU operation mode (Pr.79 = "1")

- Select the PU operation mode when giving start and frequency commands by only the key operation on the operation panel.



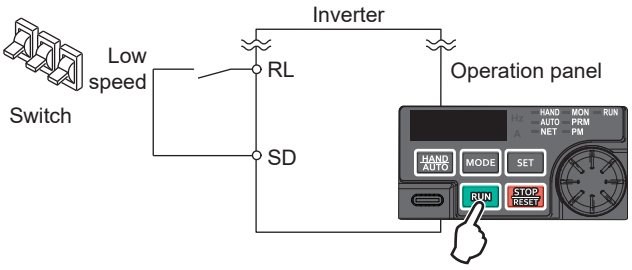
◆ PU/External combined operation mode 1 (Pr.79 = "3")

- Select the PU/External combined operation mode 1 when giving a frequency command from the operation panel and giving a start command with the external start switches.
- When the frequency commands are given using the external signals (multi-speed setting), they have a higher priority than the frequency commands given on the operation panel.



◆ PU/External combined operation mode 2 (Pr.79 = "4")

- Select the PU/External combined operation mode 2 when giving a frequency command using the external signals (multi-speed setting) and giving a start command by key operation on the operation panel.
- The voltage/current signal input via terminal 2 or 4 is also used as a frequency command. For details, refer to the Instruction Manual (Function).



5 Troubleshooting during test operation

5.1 Troubleshooting

The following sections describe some of the problems that are likely to occur during test operation and their countermeasures.
Refer to them for troubleshooting during operation.
For details and other possible causes and countermeasures, refer to the Instruction Manual (Maintenance).

5.1.1 Motor does not start

Check point	Possible cause	Countermeasure	Check by user
Main circuit	An appropriate power supply voltage is not applied. (The operation panel display is not operating.)	Power on a molded case circuit breaker (MCCB), an earth leakage circuit breaker (ELB), or a magnetic contactor (MC).	
		Check for the decreased input voltage, input phase loss, and wiring.	
	The motor is not connected properly.	Check the wiring between the inverter and the motor.	
Input signal	A start signal is not input.	Check the start command source, and input a start signal.	
	Both the forward and reverse rotation start signals (STF and STR) are input simultaneously.	Turn ON either one of the signals. When the STF and STR signals are turned ON simultaneously in the initial setting, a stop command is given.	
	Frequency command is zero. (The [RUN] LED indicator on the operation panel is blinking.)	Check the frequency command source and input a frequency command.	
	The switch setting for selecting sink logic or source logic is incorrect. (The [FWD] or [REV] LED indicator on the operation panel is blinking.)	Check that the control logic switch is set correctly. If it is not set correctly, the input signal is not recognized.	
	The STOP/RESET key was pressed. (The operation panel indication is "PS".)	During the External operation mode, check the method of restarting after the operation is stopped using the STOP/RESET key on the operation panel.	
Parameter setting	The **Pr.79 Operation mode selection** setting is incorrect.	Select the operation mode suitable for the input methods of the start command and frequency command.	
Load	Load is too heavy.	Reduce the load.	
	The shaft is locked.	Inspect the machine (motor).	

5.1.2 Motor or machine is making abnormal acoustic noise

Check point	Possible cause	Countermeasure	Check by user
Parameter setting	The motor noise increases due to activation of the carrier frequency automatic reduction function when the motor is driven overloaded.	Reduce the load. Disable the automatic reduction function by setting **Pr.260 PWM frequency automatic switchover** = "0". (As the load remains excessive, overload may cause a protective function E.THT.)	
Others	Mechanical looseness	Adjust machine/equipment so that there is no mechanical looseness.	
Motor	Operating with output phase loss	Check the motor wiring.	

5.1.3 Motor generates heat abnormally

Check point	Possible cause	Countermeasure	Check by user
Motor	The motor fan is not working. (Dust is accumulated.)	Clean the motor fan. Improve the environment.	
	Phase to phase insulation of the motor is insufficient.	Check the insulation of the motor.	
—	Motor current is too large.	Refer to "Motor current is too large" (page 47).	

5.1.4 Motor rotates in the opposite direction

Check point	Possible cause	Countermeasure	Check by user
Main circuit	The phase sequence of output terminals U, V and W is incorrect.	Connect the output side terminals (terminals U, V, and W) correctly.	
Input signal	The start signals (STF and STR signals) are connected improperly.	Check the connection. (STF: forward rotation, STR: reverse rotation)	
Parameter setting	The **Pr.40 RUN key rotation direction selection** setting is incorrect.	Change the parameter setting value to "0 (initial value)" to set forward rotation. For the parameter setting method, refer to page 37.	

5.1.5 Speed greatly differs from the setting

Check point	Possible cause	Countermeasure	Check by user
Input signal	The frequency setting signal is incorrect.	Measure the input signal level.	
Load	The stall prevention function is activated due to a heavy load.	Reduce the load.	
Parameter setting		Set **Pr.22 Stall prevention operation level (Torque limit level)** higher according to the load. (If **Pr.22** is set too high, an overcurrent trip (E.OC[]) is likely to occur.)	
Motor		Check the capacities of the inverter and the motor.	

5.1.6 Acceleration/deceleration is not smooth

Check point	Possible cause	Countermeasure	Check by user
Parameter setting	The acceleration/deceleration time is too short.	Increase the acceleration/deceleration time.	
	The torque boost (**Pr.0, Pr.46**) setting is not appropriate under V/F control, so the stall prevention function is activated.	Increase/decrease the **Pr.0 Torque boost** setting value by 0.5% increments so that stall prevention does not occur.	
Load	The stall prevention function is activated due to a heavy load.	Reduce the load.	
Parameter setting		Set **Pr.22 Stall prevention operation level (Torque limit level)** higher according to the load. (If **Pr.22** is set too high, an overcurrent trip (E.OC[]) is likely to occur.)	
Motor		Check the capacities of the inverter and the motor.	

5.1.7 Operation mode is not changed properly

Check point	Possible cause	Countermeasure	Check by user
Input signal	The start signal (STF or STR) is ON.	Check that the STF and STR signals are OFF. When either is ON, the operation mode cannot be changed.	
Parameter setting	The **Pr.79 Operation mode selection** setting is not appropriate.	When the **Pr.79** is set to "0 (initial value)", the operation mode is the External operation mode at power ON. To switch to the PU operation mode, press the HAND/AUTO key on the operation panel. At other settings (1 to 4, 6, 7), the operation mode is limited accordingly.	

5.1.8 Operation panel display is not operating

Check point	Possible cause	Countermeasure	Check by user
Main circuit Control circuit	The power is not input.	Input the power.	

5.1.9 The motor current is too large

Check point	Possible cause	Countermeasure	Check by user
Load	The stall prevention function is activated due to a heavy load.	Reduce the load.	
Parameter setting		Set **Pr.22 Stall prevention operation level (Torque limit level)** higher according to the load. (If **Pr.22** is set too high, an overcurrent trip (E.OC[]) is likely to occur.)	
Motor		Check the capacities of the inverter and the motor.	

5.1.10 Speed does not accelerate

Check point	Possible cause	Countermeasure	Check by user
Input signal	The start command or frequency command is chattering.	Check if the start command and the frequency command are correct.	
	The wiring length is too long for the analog frequency command, causing a voltage (current) drop.	Perform the bias and gain calibration for the analog input.	
	The input signal lines are affected by external EMI.	Take countermeasures against EMI, such as using shielded wires for input signal lines.	
Load	The stall prevention function is activated due to a heavy load.	Reduce the load.	
Parameter setting		Set **Pr.22 Stall prevention operation level (Torque limit level)** higher according to the load. (If **Pr.22** is set too high, an overcurrent trip (E.OC[]) is likely to occur.)	
Motor		Check the capacities of the inverter and the motor.	

5.1.11 Unable to write parameter setting

Check point	Possible cause	Countermeasure	Check by user
Input signal	Operation is being performed (the STF or STR signal is ON).	Stop the operation. When **Pr.77 Parameter write selection** = "0 (initial value)", writing is enabled only during a stop.	
Parameter setting	Parameter setting was attempted in External operation mode.	Choose the PU operation mode. Or, set **Pr.77 Parameter write selection** = "2" to enable parameter writing regardless of the operation mode.	

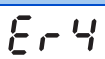
5.2 Fault displays

This section describes the fault displays that are likely to appear during test operation. For other fault displays, refer to the Instruction Manual (Maintenance).

◆ Write error during operation

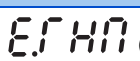
Item	Description
Operation panel indication	 (Er2)
Description	Parameter write was attempted during operation while **Pr.77 Parameter write selection** = "0 (initial value)".
Check point	• Check that the inverter is stopped. • Check that "0" is not set in **Pr.77 Parameter write selection**.
Corrective action	• After stopping the operation, make parameter setting. • When setting **Pr.77** = "2", parameter write is enabled during operation.
Reference manual	Instruction Manual (Function)

◆ Mode designation error

Item	Description
Operation panel indication	 (Er4)
Description	Parameter setting was attempted in the External operation mode while **Pr.77 Parameter write selection** = "0 (initial value)".
Check point	Check that the operation mode is the PU operation mode.
Corrective action	• After setting the operation mode to the "PU operation mode", make parameter setting. • When **Pr.77** = "2", parameter write is enabled regardless of the operation mode.
Reference manual	Instruction Manual (Function)

◆ Motor overload trip (electronic thermal relay function)

Resetting the inverter initializes the internal cumulative heat value of the electronic thermal relay function.

Item	Description
Operation panel indication	 (E.THM)
Description	The electronic thermal O/L relay function in the inverter detects motor overheat, which is caused by overload or reduced cooling capability during low-speed operation. When the cumulative heat value reaches 85% of the **Pr.9 Electronic thermal O/L relay** setting, pre-alarm (TH) is output. When the accumulated value reaches the specified value, the protection circuit is activated to stop the inverter output.
Check point	• Check the motor for the use under overload. • Check that the setting of **Pr.71 Applied motor** for motor selection is correct. • Check that the stall prevention operation setting is correct.
Corrective action	• Reduce the load. • Set **Pr.71 Applied motor** properly according to the motor to be used. • Set the stall prevention operation level accordingly.
Reference manual	Instruction Manual (Function)

◆ Stall prevention (overcurrent)

Item	Description	
Operation panel indication	oLC (OLC)	
Description	• When the output current of the inverter increases, the stall prevention (overcurrent) function is activated. • The following section explains about the stall prevention (overcurrent) function.	
	During acceleration	When the output current of the inverter exceeds the stall prevention level (**Pr.22 Stall prevention operation level**, etc.), this function stops the increase in frequency until the overload current decreases to prevent the inverter from resulting in overcurrent trip. When the overload current is reduced below stall prevention operation level, this function increases the frequency again.
	During constant-speed operation	When the output current of the inverter exceeds the stall prevention level (**Pr.22 Stall prevention operation level**, etc.), this function reduces frequency until the overload current decreases to prevent the inverter from resulting in overcurrent trip. When the overload current is reduced below stall prevention operation level, this function increases the frequency up to the set value.
	During deceleration	When the output current of the inverter exceeds the stall prevention level (**Pr.22 Stall prevention operation level**, etc.), this function stops the decrease in frequency until the overload current decreases to prevent the inverter from resulting in overcurrent trip. When the overload current is reduced below stall prevention operation level, this function decreases the frequency again.
Check point	• Check that the **Pr.0 Torque boost** setting is not too large. • The **Pr.7 Acceleration time and Pr.8 Deceleration time** settings may be too short. • Check that the load is not too heavy. • Check for any failures in peripheral devices. • Check that the **Pr.13 Starting frequency** setting is not too large. • Check that **Pr.22 Stall prevention operation level** is appropriate.	
Corrective action	• Gradually increase or decrease the **Pr.0 Torque boost** setting by 1% at a time and check the motor status. • Set a larger value in **Pr.7 Acceleration time or Pr.8 Deceleration time**. • Reduce the load. • The stall prevention operation current can be set in **Pr.22 Stall prevention operation level**.	
Reference manual	Instruction Manual (Function)	

◆ Overcurrent trip during acceleration

Item	Description
Operation panel indication	E.OC1 (E.OC1)
Description	When the inverter output current reaches or exceeds the specified value of the rated current during acceleration, the protection circuit is activated and the inverter output is shut off.
Check point	• Check for sudden speed acceleration. • Check for output short-circuit. • Check that the inverter capacity matches with the motor capacity. • Check that **Pr.22 Stall prevention operation level** is appropriate.
Corrective action	• Adjust **Pr.7 Acceleration time**. • If "E.OC1" always appears at start, disconnect the motor once and restart the inverter. If "E.OC1" still appears, contact your sales representative. • Check the wiring to make sure that output short circuit does not occur. • Choose inverter and motor capacities that match.
Reference manual	Instruction Manual (Function)

◆ Regenerative overvoltage trip during deceleration or stop

Item	Description
Operation panel indication	E.OV3 (E.OV3)
Description	If regenerative power causes the inverter's internal main circuit DC voltage to reach or exceed the specified value, the protective circuit is activated to stop the inverter output. The circuit may also be activated by a surge voltage produced in the power supply system.
Check point	• Check for sudden speed reduction. • Check if the stall prevention operation is frequently activated in an application with a large load inertia.
Corrective action	• Adjust **Pr.8 Deceleration time**. (Set the deceleration time which matches the moment of inertia of the load.) • Make the brake cycle longer. • Use a regenerative option such as a brake resistor and a brake unit as required.
Reference manual	Instruction Manual (Function)

MEMO

Revisions

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Model code	1AJ079

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