

# Inverter Basics (Operation) for the FR-800 series

This course will teach you how to configure a system using an inverter, how to use the operation panel, and how to operate the inverter, using the FR-A800 series inverter as an example.

**Introduction Purpose of the Course**

This course is intended for those who will build an inverter system using the FR-A800 series inverter for the first time. The course will teach you how to configure a system, how to use the operation panel, and how to operate the inverter under External and PU operation modes.



## Introduction Course Structure



The contents of this course are as follows.  
We recommend that you start from Chapter 1.

### Chapter 1 - Basics of the FR-A800 Series

This chapter explains the basic configuration, product features, product lineup, and component names and function of the FR-A800 series.

### Chapter 2 - Inverter System Configuration Procedure

This chapter explains the inverter system configuring procedure starting from the operation mode selection to the operation in External and PU operation mode.

### Chapter 3 - Selecting the Operation Mode

This chapter explains the roles of start and frequency commands and different operation modes.

### Chapter 4 - Installing and Wiring the Inverter and Motor

This chapter explains how to install and wire the inverter and motor.

### Chapter 5 - Setting Operation Mode and Parameters

This chapter explains how to use the operation panel to set operation modes and parameters.

### Chapter 6 - Operating the Inverter System

This chapter explains how to operate the inverter in PU and External operation modes.

### Chapter 7 - Responding to Errors During Operation

This chapter explains the fault display types, how to reset the protective function, how to check the faults history, and how to respond to a motor malfunction.

### Final Test

8 questions (39 items) passing grade: 60% or higher.

**Introduction** **How to Use This e-Learning Tool**

Go to the next page		Go to the next page.
Back to the previous page		Back to the previous page.
Move to the desired page		"Table of Contents" will be displayed, enabling you to navigate to the desired page.
Exit the learning		Exit the learning. Window such as "Contents" screen and the learning will be closed.

**Safety precautions**

When you learn by using actual products, please carefully read the safety precautions in the corresponding manuals.

## Chapter 1 Basics of the FR-A800 Series

This course will teach you how to configure an inverter system using the Mitsubishi general-purpose FR-A800 inverter (hereafter referred to as FR-A800) and a three-phase induction motor (hereafter referred to as motor).

The FR-A800 series inverter is one of the mainstream inverters.

With its high performance and high functionality, the FR-A800 series inverter offers a wide variety of lineup, and can be used for a wide range of applications.

This chapter explains the basic configuration, product features, product lineup, and component names and function of the FR-A800 series.

### 1.1 Basic Inverter System Configuration

### 1.2 Features of the FR-A800 Series

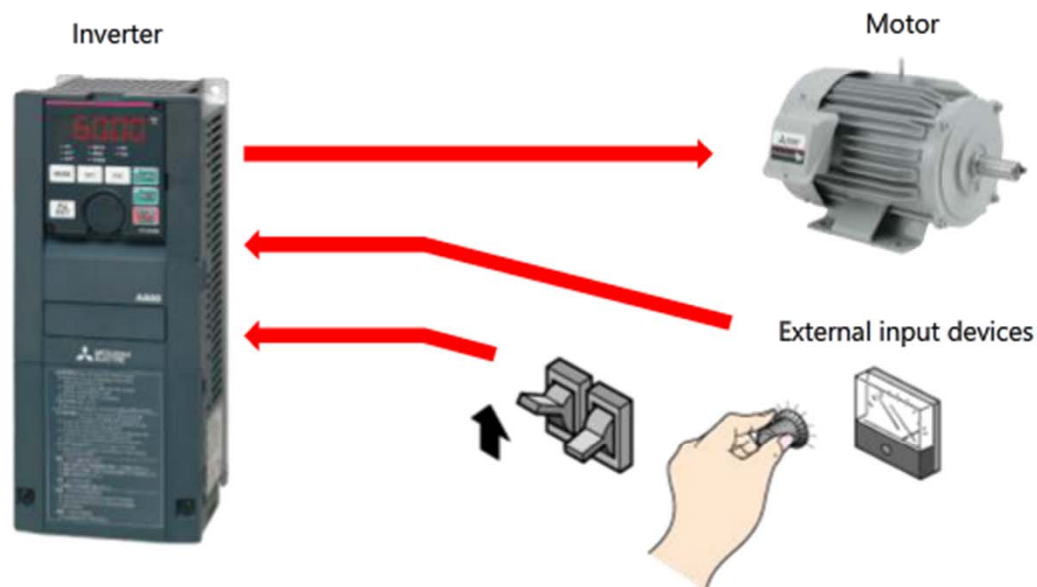
### 1.3 FR-A800 Series Lineup

### 1.4 Names and Functions of the FR-A800 Series

### 1.5 Summary of this Chapter

## 1.1 Basic Inverter System Configuration

Here is the basic inverter system configuration with the FR-A800 series inverter.



Device	Role
Inverter	Changes the motor speed by controlling the power supply frequency given to the motor.
Motor	The rotation speed changes according to the power supply frequency.
External input devices	Forward/reverse rotation start switch. Turns ON or OFF the forward or reverse rotation start command in the External operation mode.
	Frequency command device (potentiometer, etc.). Adjusts the motor speed (frequency command) in the External operation mode.

The FR-A800 series inverter has the following features.

■ **Leading drive performance**

The enhanced Real sensorless vector control and vector control serve the needs of all machinery types.

■ **Security & safety**

Rapid response is obtained when an unexpected trouble occurs.

■ **Easy setup & operation**

Fully equipped with a variety of simple functions and equipment to improve work efficiency.

■ **Eco-friendly factories**

Save energy while increasing factory production.

■ **System support**

Numerous functions and the extensive lineup of models are ready to support various systems.

■ **Environment adaptability**

The FR-A800 series complies with various standards and is usable in different scenes.

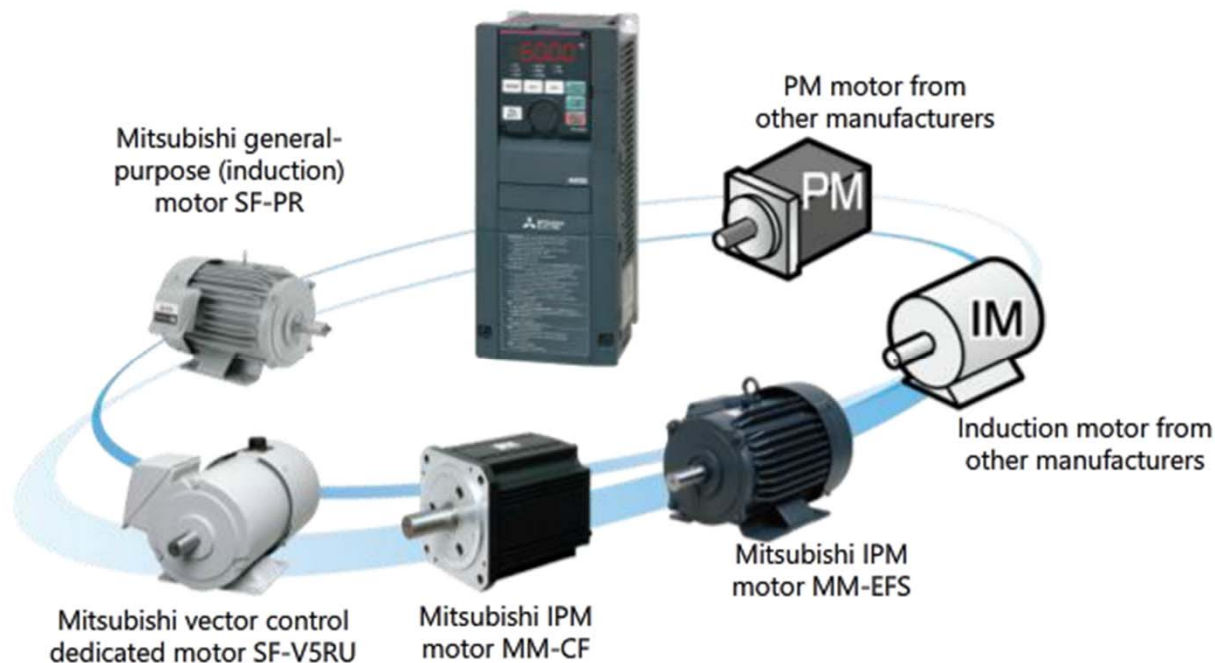
Some of main features are shown below.



## 1.2.1 Leading drive performance

### ■ Compatibility with various motors

Induction motors and PM motors (magnet motors) from various manufacturers can be used with the FR-A800 series inverter.



## 1.2.2

## For security & safety

### ■ High level system safety

Consciousness of safety is increasing in the market.

Since the FR-A800 series inverter is compliant with the safety standards, configuring a system with safety functions can be easily achieved.

- "Safety stop function\*" compliant with the international safety standard (PLd/SIL2)

\* Safety stop function: Shuts off the output of the inverter to the motor in case of emergency.



## 1.2.2 For security & safety

### ■ Quick troubleshooting

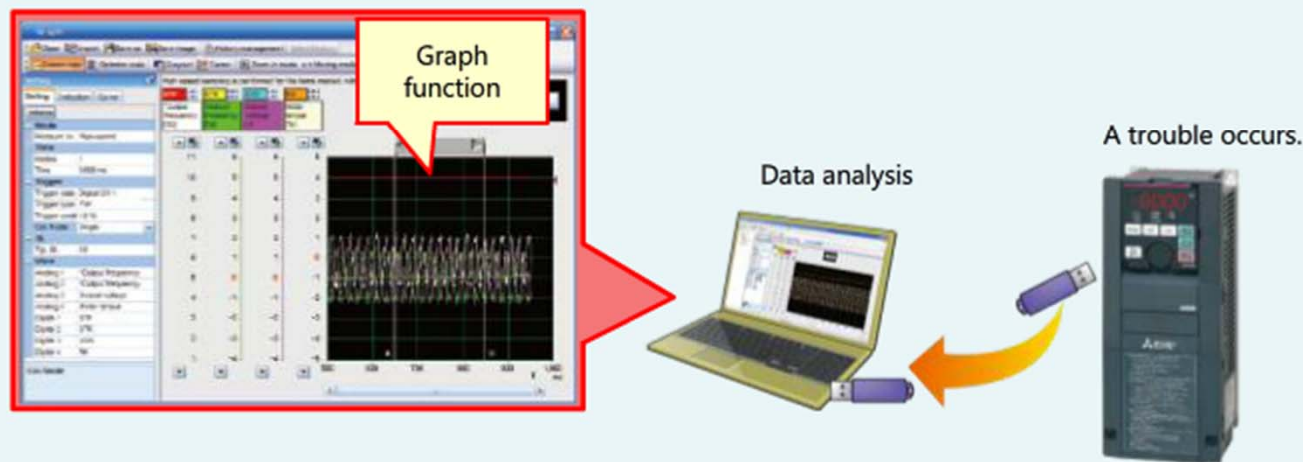
When a trouble occurs, the cause can be quickly investigated (**Trace function**).

#### Trace function

"Trace" means a hunt of the cause.

The "trace function" logs the inverter's operating status, and you can analyze the cause by dating back to when the trouble occurred.

The traced data (log) can be saved in the commercial USB memory device for analysis in other places.



For the details of the trace function, take "Inverter maintenance course".

## 1.2.3 Easy setup & operation

### ■ Streamlining the startup process and maintenance

It takes a lot of time and cost to start up and maintain a system.

To increase the working efficiency, the FR-A800 series inverter has dedicated functions and devices.

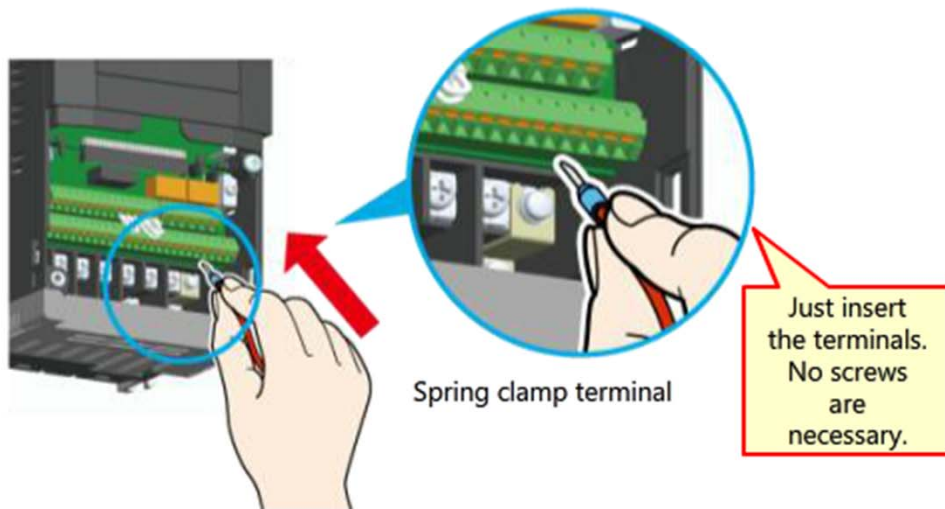
- The parameters can be copied to commercial USB memory devices.



## 1.2.3 Easy setup & operation

### ■ Streamlining the startup process and maintenance

- The control circuit can be connected easily.



## 1.2.4 Eco-friendly factories

### ■ Energy saving function

Electricity spent by industrial motors consists much of the electricity consumed in Japan; therefore, the motors are strongly regulated by the energy saving law.

Replacing the existing motors to High efficiency motor and adding an inverter in the existing system can save remarkable energy.

The FR-A800 series inverter is equipped with the following energy saving functions; therefore, more energy can be saved by combining those methods mentioned above.

- Multiple inverters can be connected to the power regeneration common converter (FR-CV)/high power factor converter (FR-HC2) via a common PN bus. Regenerative power is used at other inverters, and surplus energy is returned to the power supply, resulting in energy saving.



## 1.2.5 System support

### ■ Selecting the optimum capacity for the application

The FR-A800 series inverter provides a wide variety of lineup by capacity.

According to the four rating types, an optimum inverter for the system can be selected to suit the application.

The four rating types are classified by the load and can be freely switched according to the applications.

FR-A820 lineup

Inverter capacity	SLD (superlight duty)		LD (light duty)		ND (normal duty)		HD (heavy duty)	
	Motor capacity (kW)	Rated current (A)	Motor capacity (kW)	Rated current (A)	Motor capacity (kW)	Rated current (A)	Motor capacity (kW)	Rated current (A)
0.4K	0.75	4.6	0.75	4.2	0.4	3	0.2	1.5
0.75K	1.5	7.7	1.5	7	0.75	5	0.4	3
:	:	:	:	:	:	:	:	:

Rating and application

Rating	SLD	LD	ND	HD
	Superlight duty	Light duty	Normal duty	Heavy duty
Application	Fan and pump			
	Shield machines, winding and unwinding, printing machines			
			Cranes, press	
			Conveyor	
Overload current rating (inverse-time characteristics)	110% 60 s 120% 3 s	120% 60 s 150% 3 s	150% 60 s 200% 3 s	200% 60 s 250% 3 s
Surrounding air temperature	40°C	50°C	50°C	50°C



## 1.2.5 System support

### ■ Sequence control with an inverter

With only the FR-A800 series inverter, small-scale operations can be performed. (PLC function)

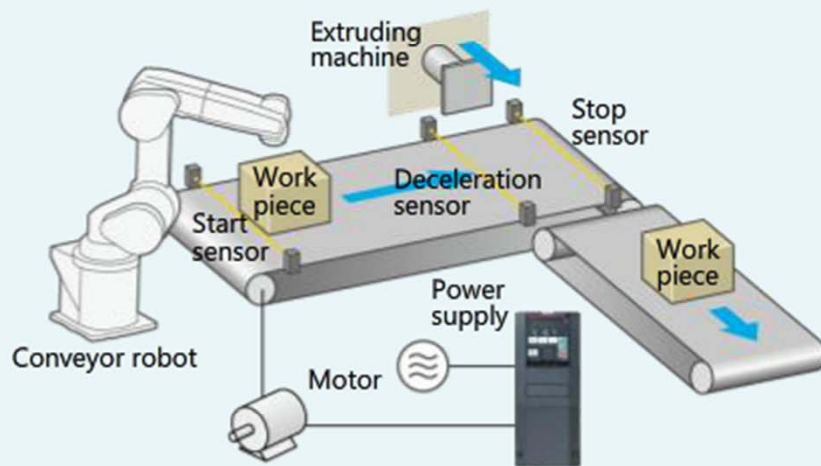
#### PLC function

Operating a target object as intended according to predefined sequences and conditions is called sequence control.

The PLC function enables the sequence control using the built-in functions of the inverter.

The following shows an example of conveyor control with the PLC function.

Capturing signals from sensors that detect workpieces, the inverter controls a motor, conveyor robot, and extruding machine in response to their individual movement.



For the details of the PLC function, take "Inverter FREQROL Basics (Function) course".

## 1.2.6

## Environment adaptability

### ■ Global compatibility

The FR-A800 series inverter is compliant with UL, cUL, EC Directive, Radio Waves Act (South Korea), and RoHS directive; therefore, it is suitable for exportation.



## 1.3

## FR-A800 Series Lineup

The lineup of the FR-A800 series inverters and how to read the model name are shown below.

#### ■ How to read the model name

The model name varies depending on factors such as the "Power supply voltage" or "Capacity".  
For details, refer to the FR-A800 series catalog.

FR - A 8 **2** 0 - **0.4K** -1

Symbol	Voltage class
2	200 V class
4	400 V class

Capacity	Description
0.4K to 500K	Inverter capacity (kW)
00023 to 06830	Inverter SLD rated current (A)

#### ■ Lineup

Capacity	0.4 K	0.75 K	1.5 K	2.2 K	3.7 K	5.5 K	7.5 K	11 K	15 K	18.5 K	22 K	30 K	37 K	45 K	55 K	75 K	90 K	110 K	132 K	160 K	185 K	220 K	250 K	280 K	315 K	355 K	400 K	450 K	500 K		
	Type																														
200 V class																															
400 V class																															

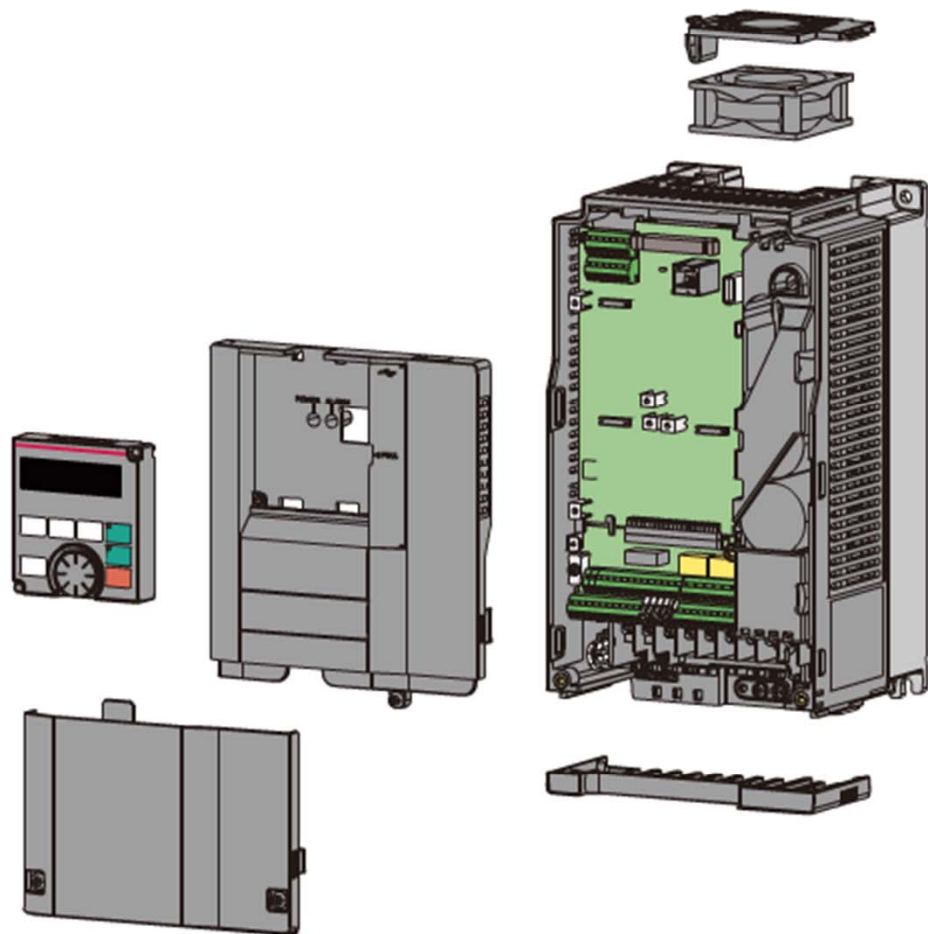


## 1.4

## Names and Functions of the FR-A800 Series

This section explains the names and functions of the FR-A800 series inverter, using the "FR-A820-1.5K" as an example. Placing the mouse cursor on a component on the following table or an FR-A800 component shows the corresponding part.

Name	Application
PU connector	Connects an operation panel, a personal computer, or a programmable controller for operation via communication.
USB A connector	Saves the inverter data into a USB memory device.
USB mini B connector	Connects a personal computer for communication with FR Configurator2.
RS-485 terminals	Connects a personal computer or a programmable controller for operation via communication.
Plug-in option connector 1 to 3	Connects options for extension. Refer to the product's manual to be used for details.
Voltage/current input switch	Switches between the voltage input and the current input when executing the frequency command with the external analog input.
Control circuit terminal block	Connects cables for the control circuit.
EMC filter ON/OFF connector	Switches between valid and invalid of the filter which suppresses noises generated by the inverter.
Main circuit terminal block	Connects the power supply and the motor.
Alarm lamp	Turns ON when the protective function of the inverter is activated.
Power lamp	Stays ON while the power is supplied to the control circuit.
Front cover	Remove this when connecting the plug-in option, when wiring RS-485 terminals or when switching voltage/current selection switch.
Terminal block cover	Remove this when wiring the main circuit or the control circuit.
Operation panel (FR-DU08)	Operates and monitors the inverter.
Cooling fan	Cools the inverter.



## 1.5 Summary of this Chapter

Here is what you have learned in this chapter.

- Basic inverter system configuration
- Features of the FR-A800 series
- FR-A800 series lineup
- Names and functions of the FR-A800 series

### Point

Basic inverter system configuration	You have learned the basic configuration of the inverter system.
Features of the FR-A800 series	You have understood the features of the FR-A800 series inverter.
FR-A800 series lineup	You have understood the lineup of the FR-A800 series inverters and how to read their model names.
Names and functions of the FR-A800 series	You have learned the names and functions of FR-A800 series inverter

## Chapter 2 Inverter System Configuration Procedure

This chapter explains the inverter system configuring procedure starting from the operation mode selection to the operation in External and PU operation mode.

2.1 Inverter System Configuration Procedure

2.2 Configuration of a Sample System

2.3 Summary of this Chapter

This flowchart shows the procedures for configuring an inverter system. Each procedure is explained in the order of the configuration.

(1) Selecting the operation mode ————— Chapter 3



(2) Installing and wiring the inverter and motor ————— Chapter 4



(3) Setting the operation mode and parameters ————— Chapter 5



(4) Starting operation ————— Chapter 6



(5) Responding to errors caused during operation ————— Chapter 7

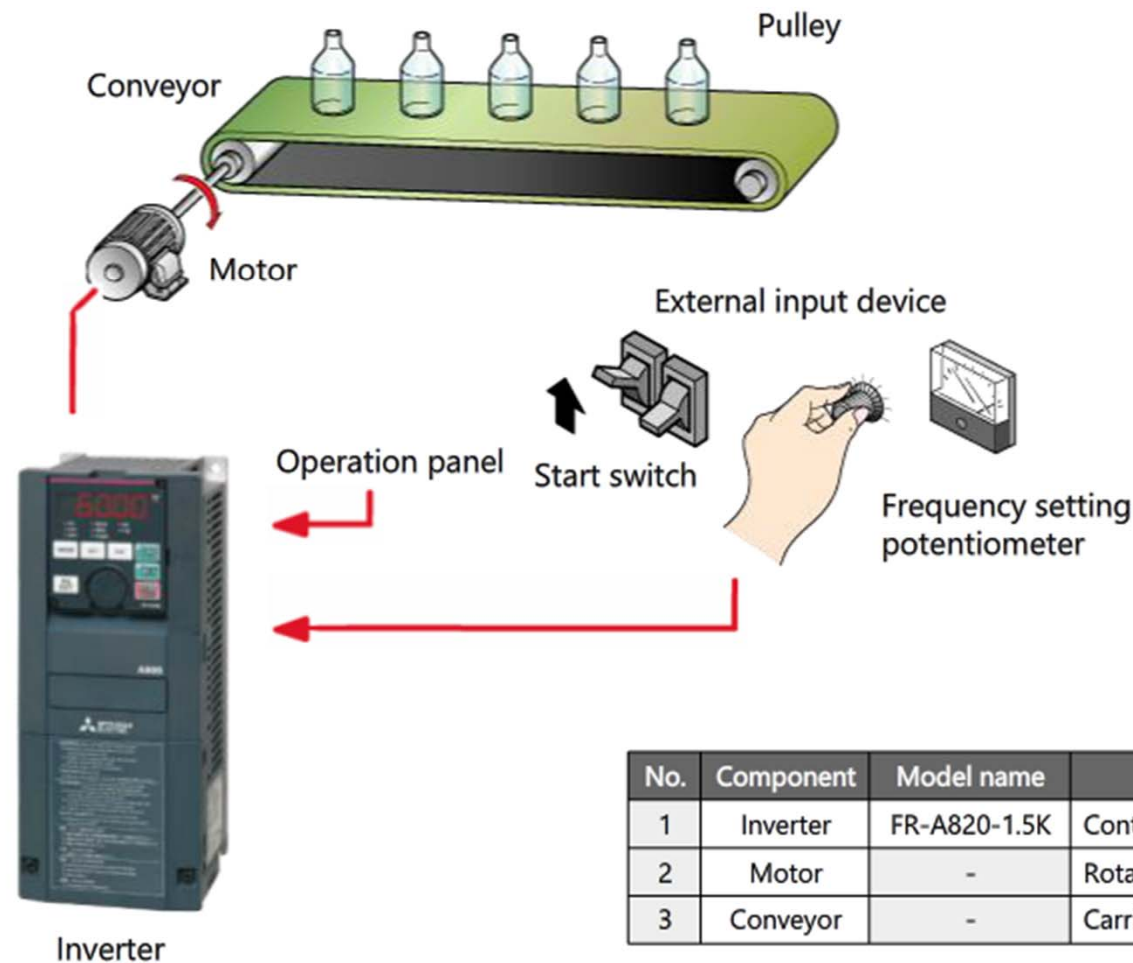
## 2.2 Configuration of a Sample System

In this course, you will learn how to configure a conveyor system to convey bottles, in the order of the configuration procedure explained in the last page.

You will learn two methods for changing the conveyor speed; one is to use the operation panel of the inverter, and the other is to use external input devices (three speed switches and potentiometer).

The components of the conveyor system are shown below.

### ■ Conveyor system



No.	Component	Model name	Description
1	Inverter	FR-A820-1.5K	Controls the rotation speed of the motor.
2	Motor	-	Rotates the conveyor.
3	Conveyor	-	Carries luggage (bottles).

**2.3****Summary of this Chapter**

Here is what you have learned in this chapter.

- System configuration procedure
- Specifications of the conveyor system example

**Point**

System configuration procedure	You have learned the configuration procedure of a general inverter system.
Specifications of the conveyor system example	You have learned the specifications of the conveyor system example.



## Chapter 3 Selecting the Operation Mode



This chapter explains the roles of start and frequency commands and different operation modes and their features. Select the optimal operation mode according to the configured inverter system.

3.1 Contents of this Chapter

3.2 Operation Modes

3.3 Summary of this Chapter

## 3.1 Contents of this Chapter

Contents of this chapter are shown below.

(1) Selecting the operation mode — Chapter 3



(2) Installing and wiring the inverter and motor — Chapter 4



(3) Setting the operation mode and parameters — Chapter 5



(4) Starting operation — Chapter 6



(5) Responding to errors caused during operation — Chapter 7

### Contents of Chapter 3

3.2 Operation Modes

3.2.1 PU operation mode

3.2.2 External operation mode

3.2.3 Combined operation mode

3.2.4 Network (NET) operation mode



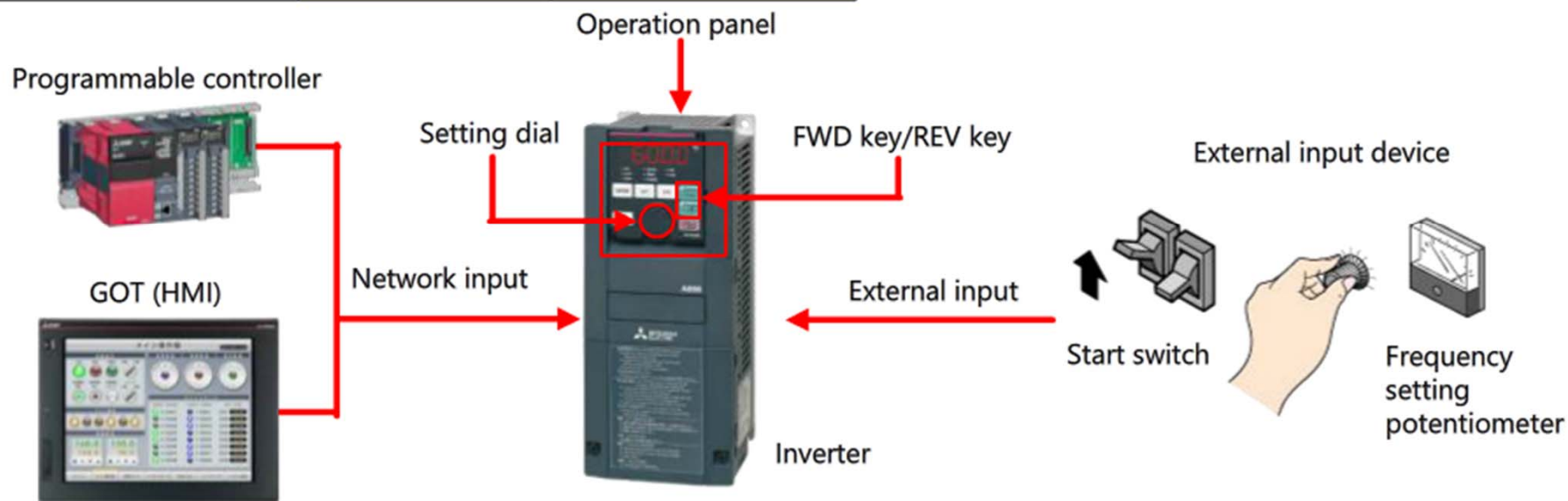
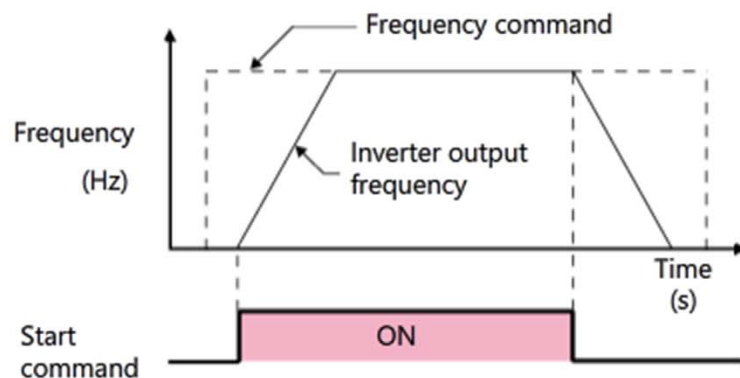
## 3.2 Operation Modes

A "start command" and a "frequency command" are required to operate an inverter.

Turning ON the start command rotates the motor, and the setting of the frequency command determines the motor speed. The FR-A800 refers to each inverter operation method as "operation mode".

For how to switch between operation modes, you will learn this in Chapter 5 Setting the Operation Mode and Parameters.

Operation mode	Start command source	Frequency command source
PU operation mode	Operation panel (FWD key/REV key)	Operation panel (setting dial)
External operation mode	External input (switch)	External input (potentiometer)
Combined operation mode (Combination 1)	External input (switch)	Operation panel (setting dial)
Combined operation mode (Combination 2)	Operation panel (FWD key/REV key)	External input (potentiometer)
NET (network) operation mode	Network input device	Network input device

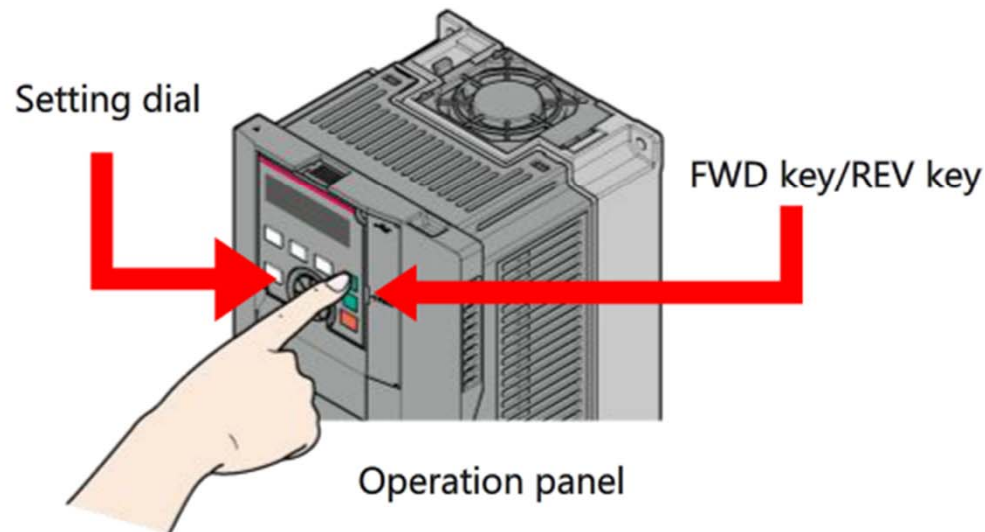


## 3.2.1

### PU Operation Mode

In PU operation mode, a start command and a frequency command are both input from the operation panel of the inverter. A simple system, which uses only one inverter as the command source, is operated under this PU operation mode. The setting dial can be used to change the frequency (rotation speed) during operation. The following figure shows the basic configuration example in the PU operation mode.

Start command	Operation panel (FWD key/REV key)
Frequency command	Operation panel (setting dial)



## 3.2.2 External Operation Mode

In the External operation mode, the frequency is controlled using input devices externally connected to the inverter.

This mode eliminates the need for directly operating the operation panel, for example, to change the motor speed according to the equipment status or workpiece status.

This mode is useful when the inverter is installed in the equipment and cannot be touched. According to the control, the frequency can be controlled in digital or analog.

The basic configuration of the External operation mode is shown below.

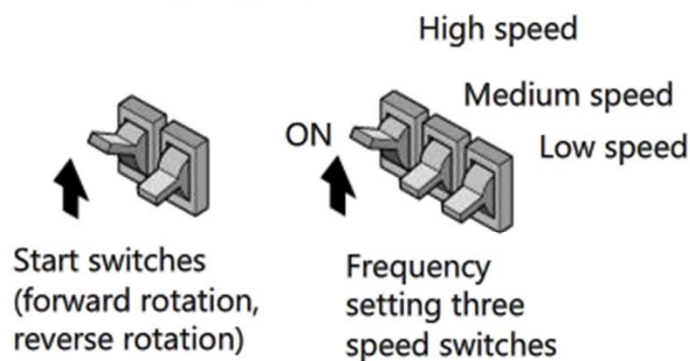
### ■ Changing the frequency using three speed switches

Start command source	Start switch
Frequency command source	Three speed switches

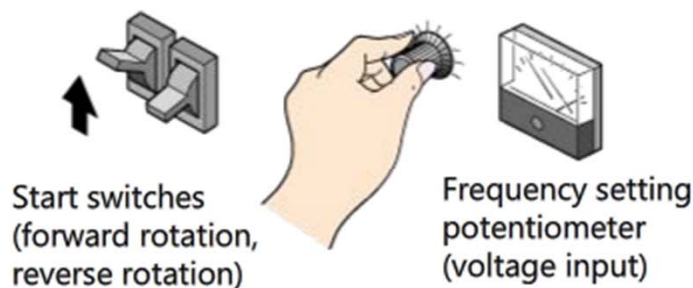
### ■ Changing the frequency using a potentiometer (voltage input)

Start command source	Start switch
Frequency command source	Potentiometer (voltage input)

External input device



External input device



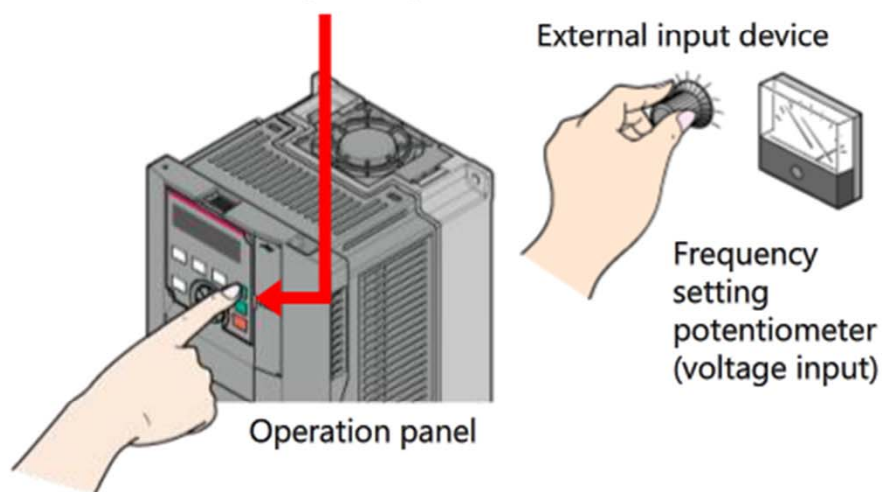
## 3.2.3 Combined Operation Mode

The combined operation mode is a combination of the PU operation mode and External operation mode. For example, a start command can be input from the operation panel (RUN key) and a frequency command can be input from an external input device (potentiometer), as shown in Combination 1. You can set parameters to change the combination. (Details are given in Section 5.4.2) The basic configurations of the combined operation modes are shown below.

### ■ Combination 1

Start command source	FWD or REV key on the operation panel
Frequency command source	Potentiometer (voltage input)

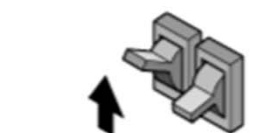
FWD key/REV key



### ■ Combination 2

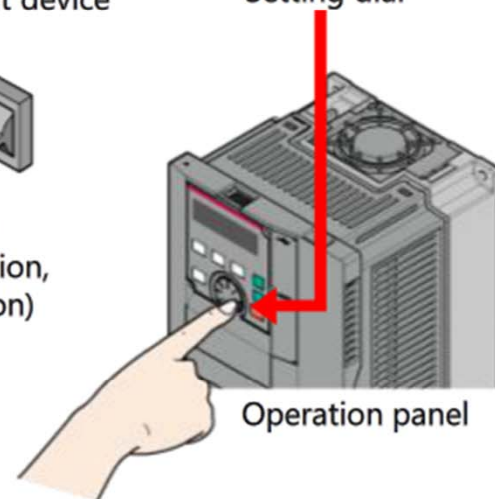
Start command source	Start switch
Frequency command source	Setting dial on the operation panel

External input device



Start switches  
(forward rotation,  
reverse rotation)

Setting dial



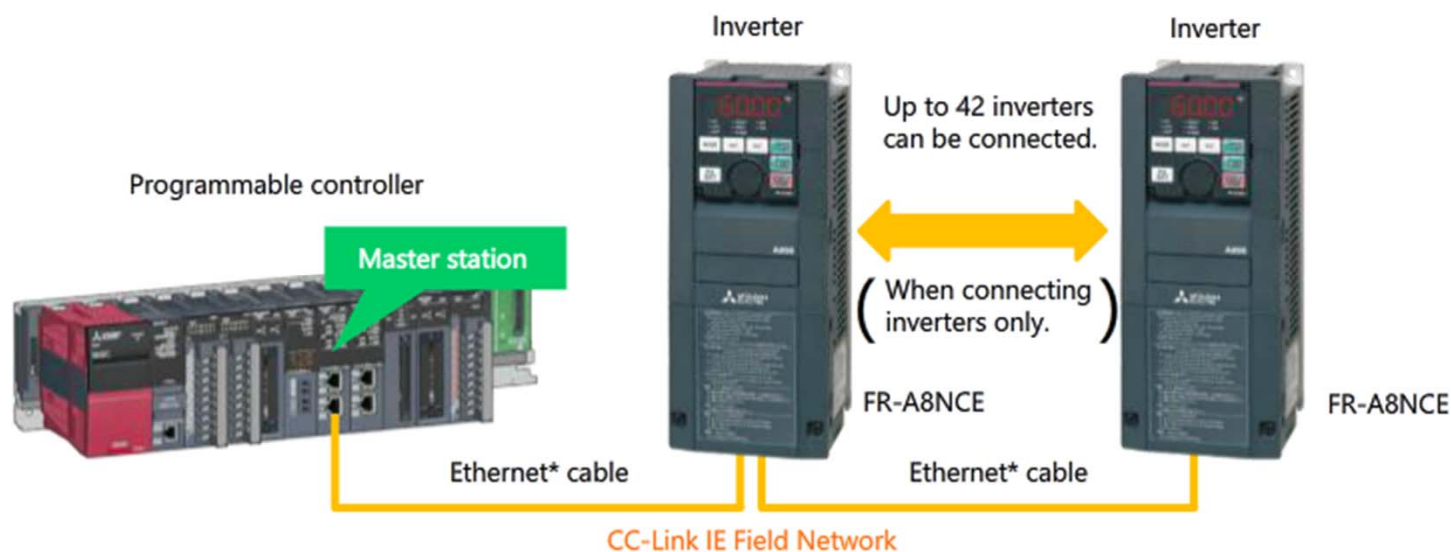


## 3.2.4 NET (Network) Operation Mode

In NET (network) operation mode, a start command and a frequency command are input via a network from a personal computer, programmable controller, or GOT (HMI) to the inverter equipped with PU connector (RS-485 communication) or another communication option.

This course explains briefly about NET operation mode. For more details, refer to the manuals.

### ■ Example of CC-Link IE Field Network connection



\* ETHERNET is a registered trademark of Xerox Corporation of the United States.

**3.3****Summary of this Chapter**

Here is what you have learned in this chapter.

- Operation modes
- Operating method and features of PU operation mode
- Operating method and features of External operation mode
- Operating method and features of combined operation mode
- Basics of NET (network) operation mode

**Point**

Operation modes	You have learned that a start command and a frequency command are required for inverter control and that you need to select the operation mode according to the configured inverter system.
Operating method and features of PU operation mode	You have learned that operation is possible with the inverter operation panel alone.
Operating method and features of External operation mode	You have learned that control from an external device (switch, potentiometer, etc.) is possible in an environment where the operation panel cannot be operated directly.
Operating method and features of combined operation mode	You have learned that PU and External operation modes can be used in combination to use different start and frequency command sources.

## Chapter 4 Installing and Wiring the Inverter and Motor

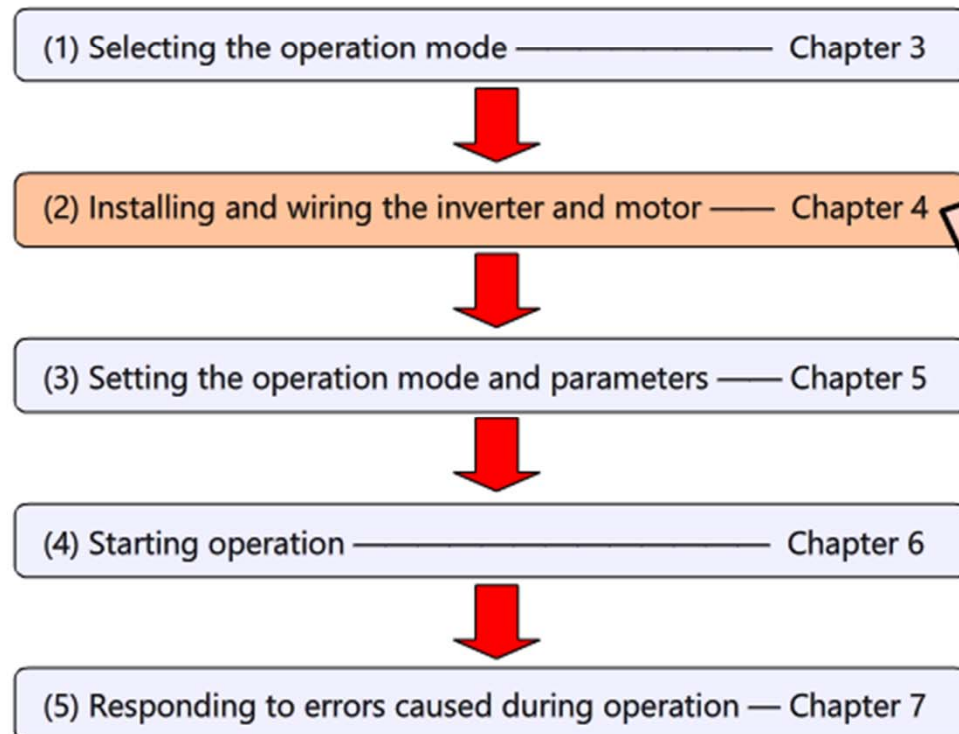
This chapter explains how to install and wire the inverter and motor.

Note that how to wire the external input device is different depending on the operation modes that you have learned in chapter 3.

- 4.1 Contents of this Chapter
- 4.2 Handling of the Terminal Block Cover
- 4.3 Installing the Inverter
- 4.4 Wiring the Inverter and Motor
- 4.5 Grounding the Inverter and Motor
- 4.6 Wiring to the Main Circuit Terminals
- 4.7 Wiring to the Standard Control Circuit Terminals
- 4.8 Summary of this Chapter

## 4.1 Contents of this Chapter

Contents of this chapter are shown below.



### Contents of Chapter 4

- 4.2 Handling of the Terminal Block Cover
- 4.3 Installing the Inverter
  - 4.3.1 Installation conditions and handling method
- 4.4 Wiring the Inverter and Motor
- 4.5 Grounding the Inverter and Motor
- 4.6 Wiring to the Main Circuit Terminals
  - 4.6.1 Connecting the power supply cable
  - 4.6.2 Connecting the motor cable
- 4.7 Wiring to the Standard Control Circuit Terminals
  - 4.7.1 Connecting the start switches
  - 4.7.2 Connecting the three speed switches
  - 4.7.3 Connecting the current inputs
  - 4.7.4 Connecting the voltage inputs



## 4.2

## Handling of the Terminal Block Cover

For the FR-A800 series inverter, the **Terminal block cover** must be removed when it is wired. How to remove and reinstall the **Terminal block cover** is explained below. (using FR-A820-1.5K as an example).

**■ Removal of the terminal block cover: FR-A820-30K or lower, FR-A840-30K or lower****■ Reinstallation of the terminal block cover: FR-A820-30K or lower, FR-A840-30K or lower**

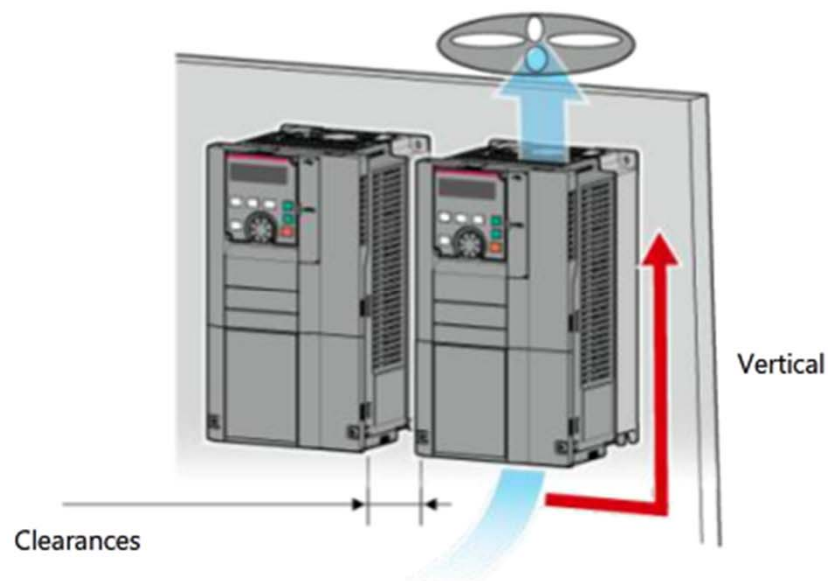
## 4.3 Installing the Inverter

This section explains how to install the FR-A800 series inverter.

Fix the inverter at the four points.  
For the FR-A840-160K (04320) or higher, fix it at the six points.



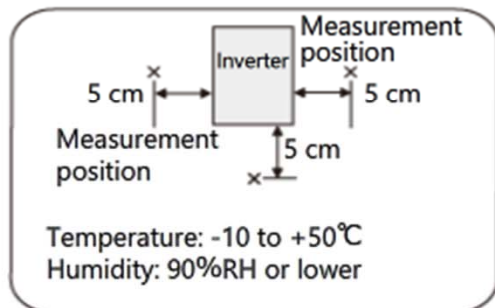
When encasing multiple inverters in an enclosure, install them in parallel and make sure to take measures for better ventilation.  
Install the inverter vertically.



## 4.3.1 Installation conditions and handling method

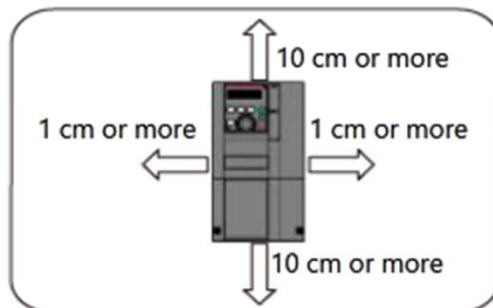
Install the FR-A800 series inverter under the following conditions:

Surrounding air temperature and humidity



Leave enough clearances and take cooling measures.

Clearances (front)

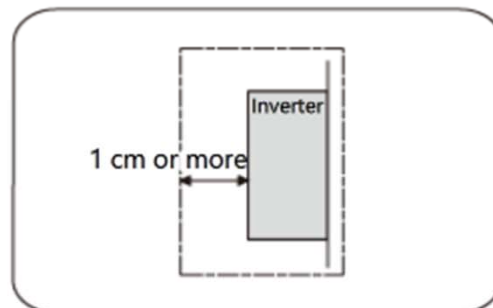


\* At a surrounding air temperature of 40°C or less, inverters can be installed without any clearance between them (0 cm clearance). (only 22K or lower)

When the surrounding temperature exceeds 40°C, clearances between inverters should be 1 cm or more (5 cm or more for 5.5K or higher capacity inverters).

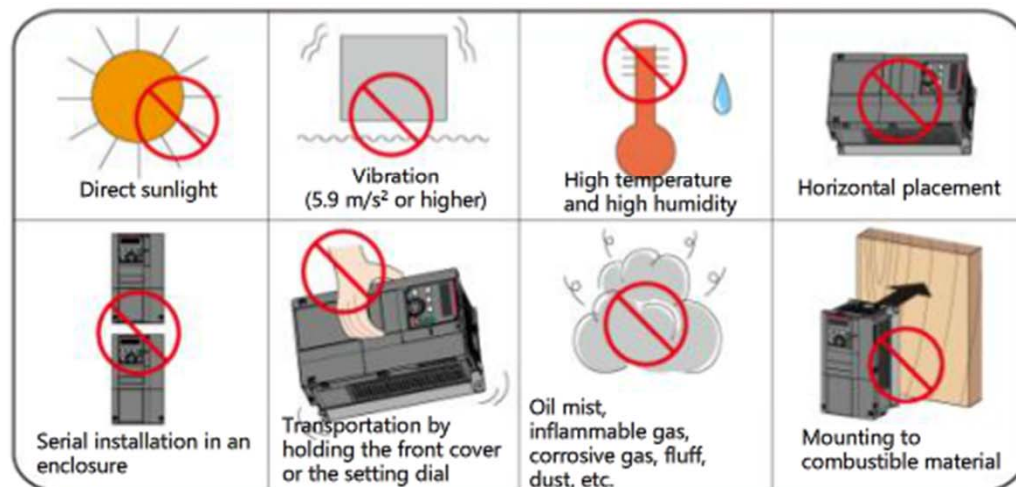
For 75K or higher capacity inverters, provide a clearance of at least 20 cm for both top and bottom and at least 10 cm for both right and left.

Clearances (side)



\* 5 cm or more is required for 5.5K or higher capacity inverters.

An inverter consists of precision mechanical and electronic parts. Never install or handle it in any of the following conditions as doing so could cause an operation fault or failure.

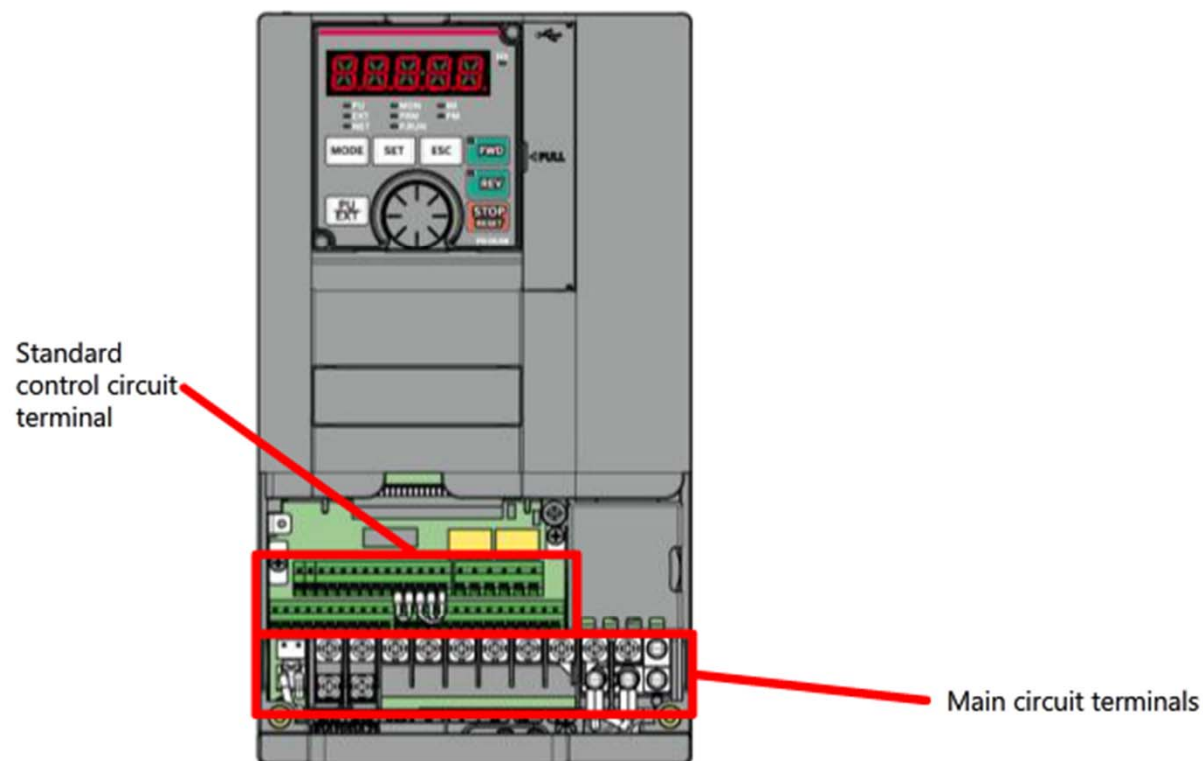


## 4.4

## Wiring the Inverter and Motor



This section explains how to connect the inverter and the motor. The inverter's input/output terminals for FR-A800 series consist of main circuit terminals and control circuit terminals. The power supply cable and the motor cable are connected to the main circuit terminals, and switches and frequency command devices for the external operation are connected to the standard control circuit terminals. The standard control circuit terminals are divided into the four terminal blocks.

**■ Front view of FR-A820-1.5K (with the terminal block cover removed)**

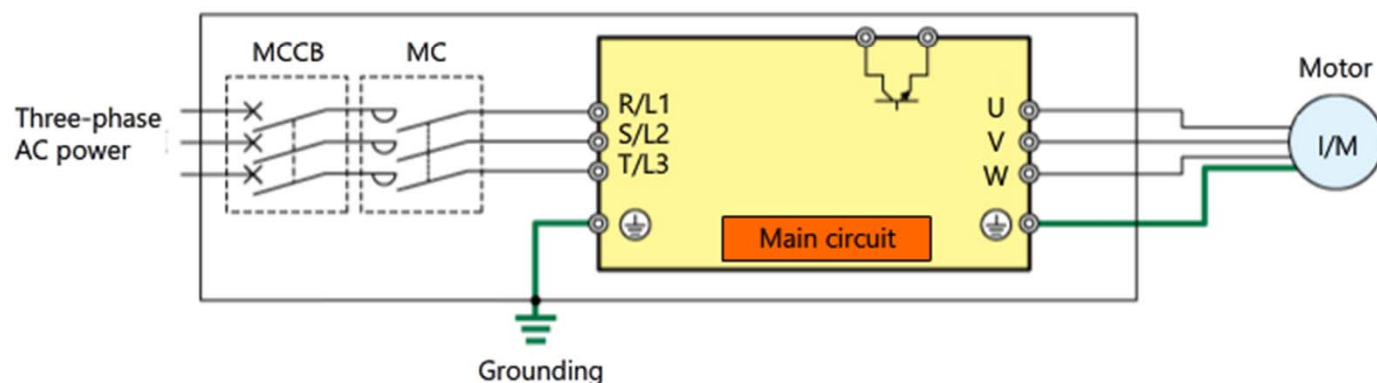


## 4.5 Grounding the Inverter and Motor

Before connecting the power supply, ground the inverter and motor.  
Do not fail to ground the inverter and motor to prevent an electrical shock and noise.

Generally an electrical device has a ground terminal, which should always be connected to the ground before use. An electrical circuit is generally insulated by an insulation material and housed in a case. However, no insulation material can completely shut out leakage current, and slight current always leaks to the case. The purpose of grounding is to prevent you from being electrically shocked by this leakage current when you touch the case of the electrical device. For devices dealing with weak signals and fast-running devices, such as audio equipment, sensors, and computers, this type of grounding is critical to minimize electromagnetic interferences (EMI).

### ■ Connection example



## 4.6

## Wiring to the Main Circuit Terminals

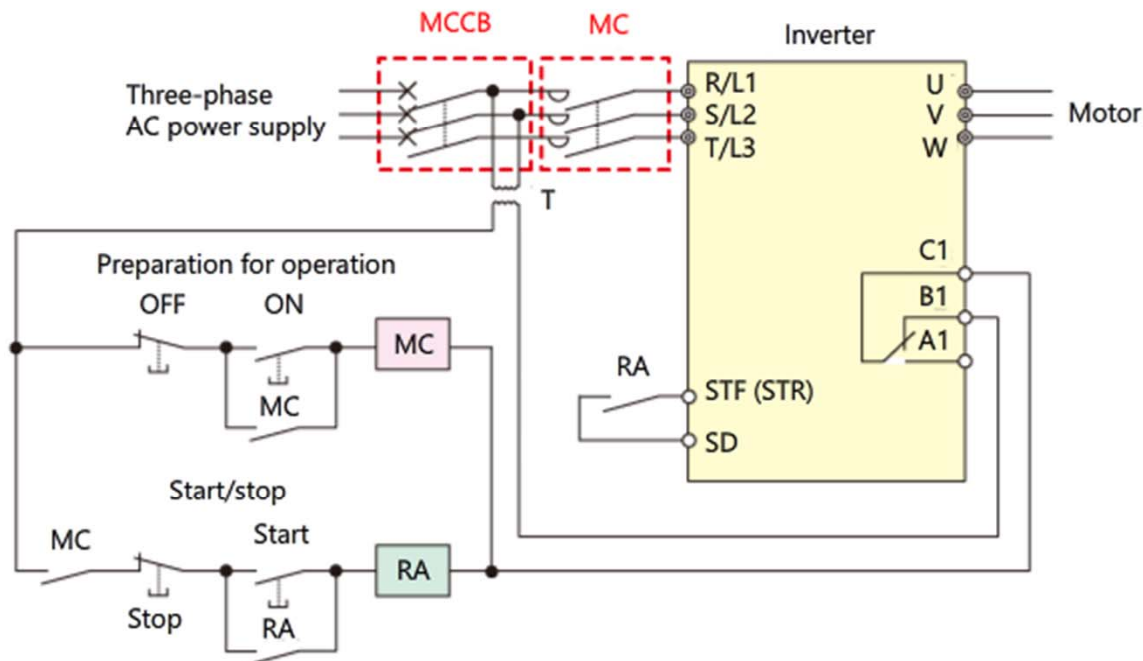
Connect the commercial power supply (three-phase AC power supply) to the inverter.

Always install a moulded case circuit breaker (MCCB) to the power supply cable.

Provide a magnetic contactor (MC) between the power supply and the main circuit terminals of the inverter for the following purposes:

- To disconnect the inverter from the power supply when a protective function activates or the driven machine fails (such as an emergency stop operation).
- To prevent accidents by the automatic restart of an inverter after a power failure, etc.
- To save some energy by disconnecting the power supply to the inverter when the inverter is to be stopped for a long time.
- To disconnect the inverter from the power supply to perform inspection and maintenance safely.

#### ■ Connection example



\* For the selection (including capacity selection) of the moulded case circuit breaker (MCCB) and magnetic contactor (MC), refer to the instruction manual of each product.



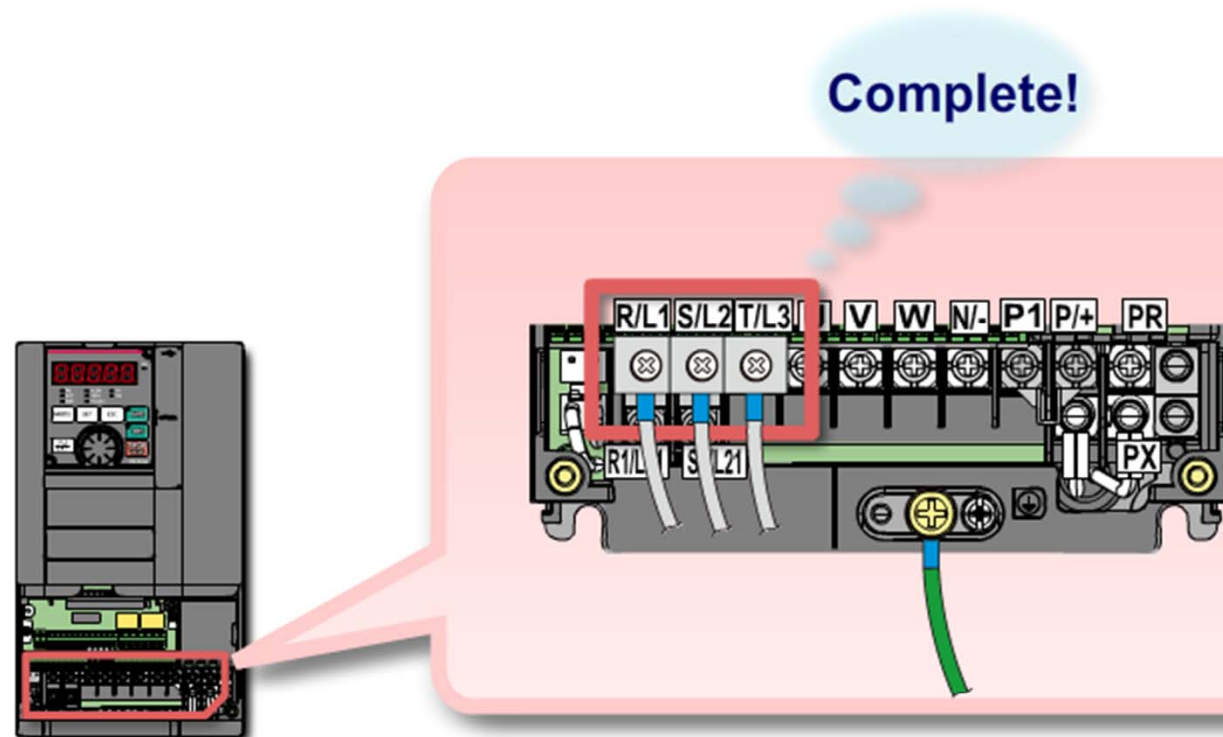
## 4.6.1 Connecting the Power Supply Cable

This section explains how to connect the power supply cable of FR-A800 series to the inverter.

Connect the power supply cable to main circuit terminals R, S, and T.

Never connect the power supply cable to output terminals U, V, and W of the inverter. Doing so will damage the inverter.

### ■ Wire connection diagram of FR-A820-1.5K



## 4.6.2

### Connecting the Motor Cable

This section explains how to connect the motor cable of FR-A800 series to the inverter.

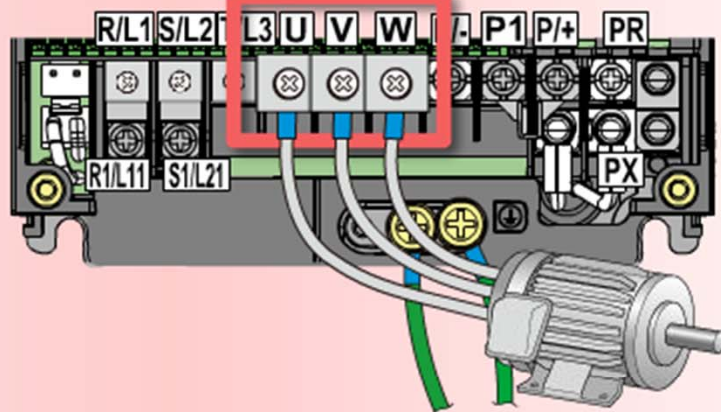
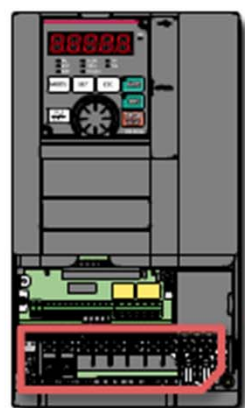
Connect the motor cable to main circuit terminals U, V, and W.

Confirm that the forward and reverse rotation commands match the motor's rotation direction.

Determine the appropriate total wiring length according to the inverter capacity. Refer to the manual for details.

#### ■ Wire connection diagram of FR-A820-1.5K

Complete!

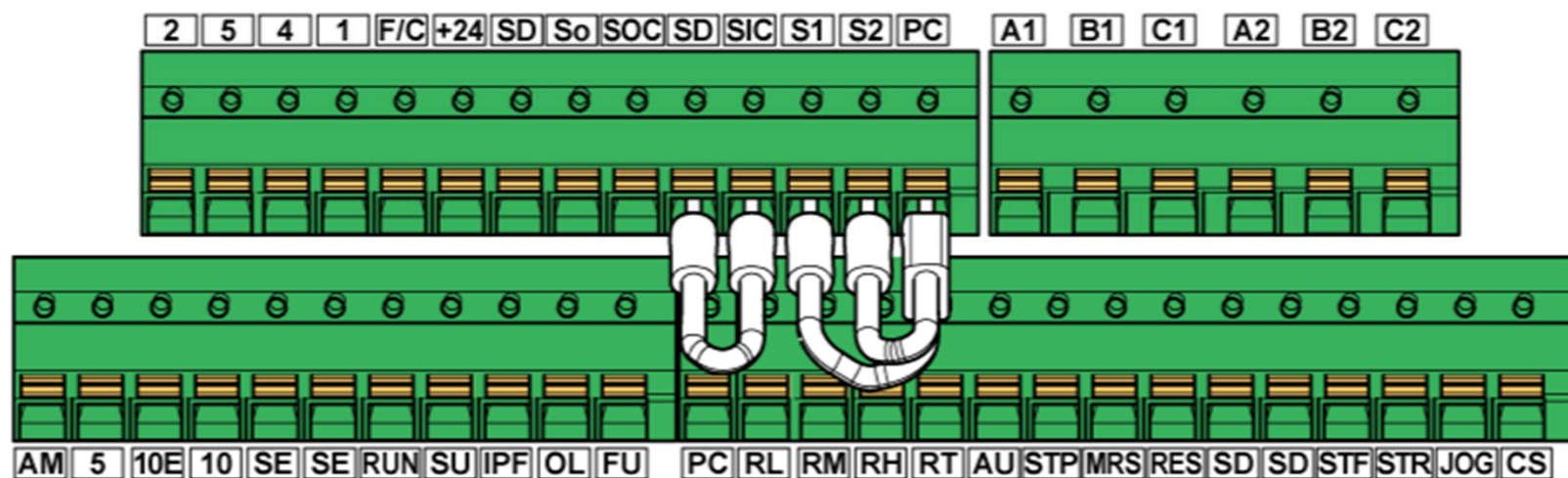


## 4.7 Wiring to the Standard Control Circuit Terminals

Let's learn how to wire switches and potentiometer, which control start/stop and speed of the motor in External and combined operation modes. Switches and potentiometer are connected to the standard control circuit terminals. When connecting these devices, note the following points:

- It is recommended to use a cable of 0.75 mm<sup>2</sup> for connection to the control circuit terminals.
- Use a wiring length of 30 m or less (200 m for terminal FM)
- Use a shielded cable or twisted-wire cable for the connection to the control circuit terminals and isolate such cable from the main circuit and strong electrical circuits (including the 200 V relay sequence circuit).
- SD, SE and 5 are common terminals for input/output signals. Do not ground these common terminals.
- The control circuit uses minute electric current for signal inputs. For the control circuit contacts, use at least two minute-signal contacts in parallel or twin-contact to prevent contact faults.
- Do not input a voltage to the contact input terminals (such as STF) of the control circuit.
- When using fault output terminals A1, B1 and C1, be sure to connect a load (such as a relay or lamp) to the terminals.

### (1) Layout of the standard control circuit terminals

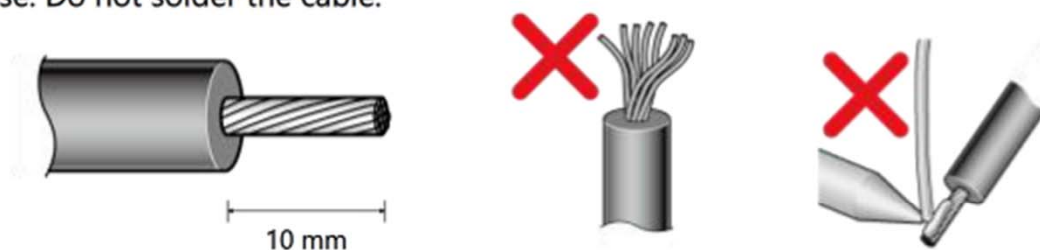


## (2) Wiring method

## ■ Preparation of cables

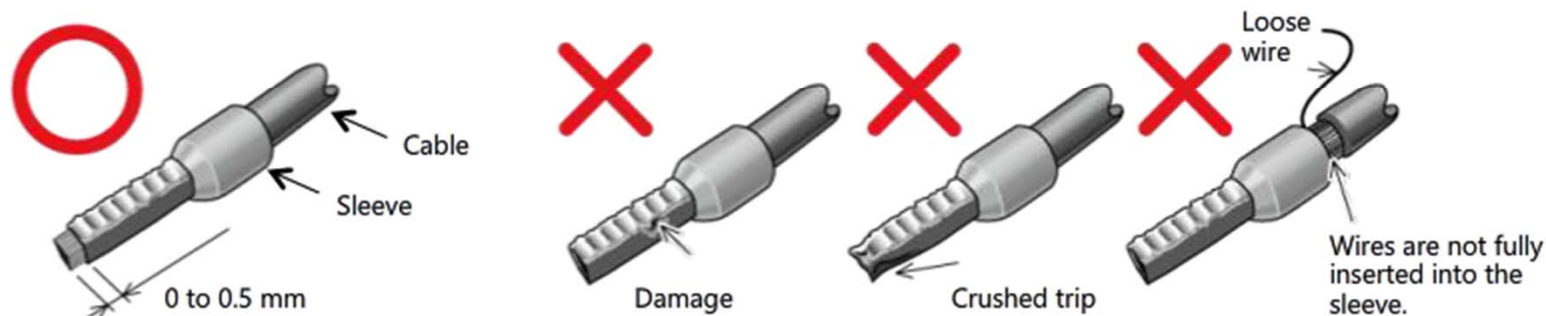
Strip off the sheath of a cable, and use it with a blade terminal. For a single wire, strip off the sheath of the wire and apply directly. Insert the blade terminal or the single wire into a socket of the terminal.

Peel the sheath as shown below. If you peel it too much, a short circuit may occur with adjacent cables. If the peeling length is too short, the cable may come off. Twist the wires to prevent them from getting loose. Do not solder the cable.



Crimp the blade terminal.

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



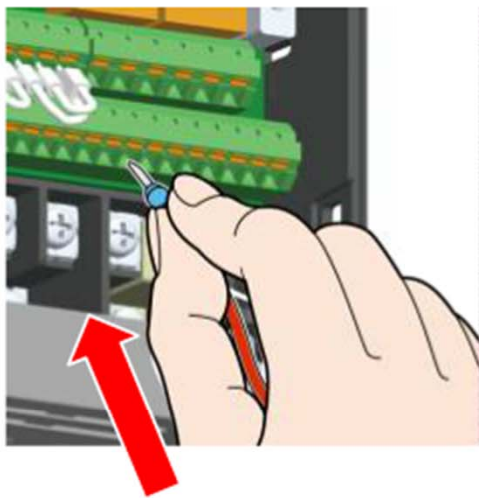


## 4.7

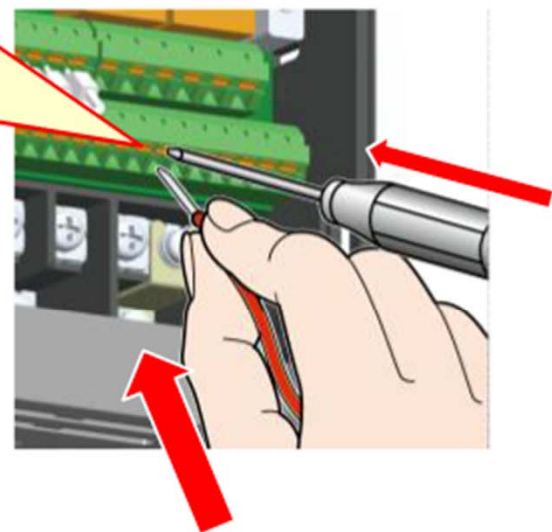
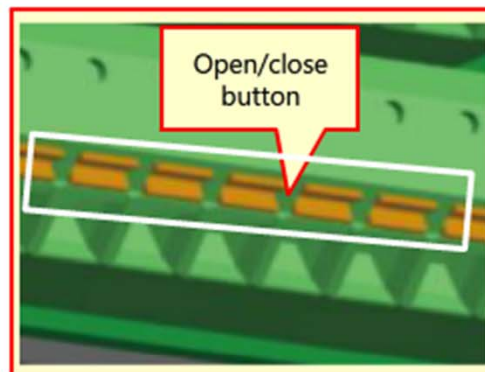
## Wiring to the Standard Control Circuit Terminals

## ■ Cable connection

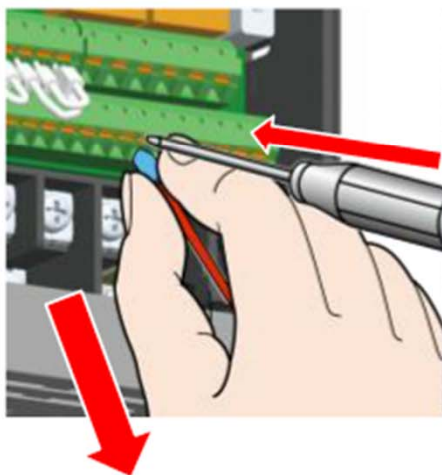
For connection of blade terminals, just insert them.



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



## ■ Wire removal



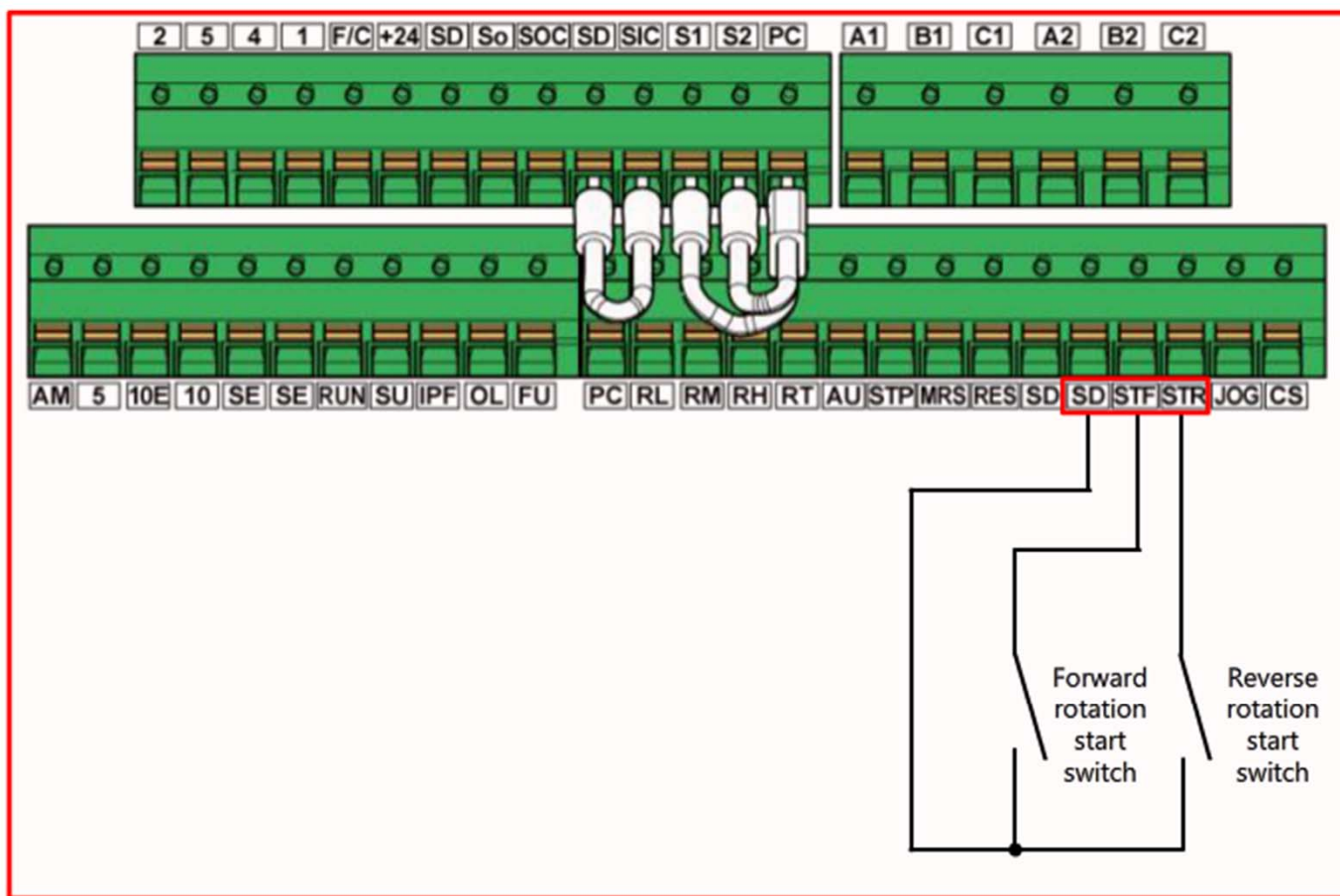
Pull the wire while pushing the open/close button all the way down firmly with a flathead screwdriver.

## 4.7.1 Connecting the start switches

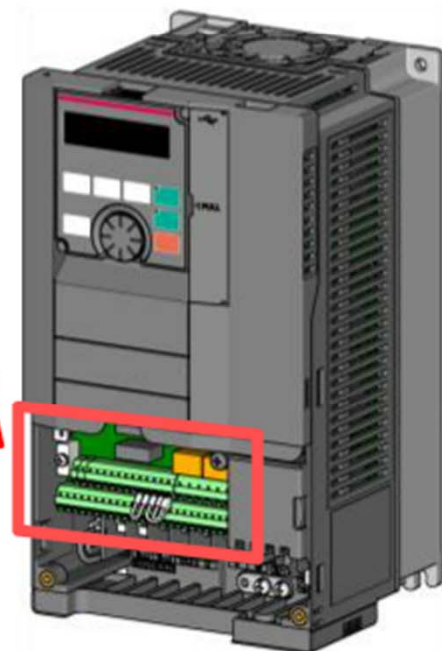
This section explains how to connect the forward and reverse rotation switches, which are used to start or stop the motor. Turning ON the STF signal (forward rotation start) or STR signal (reverse rotation start) starts the motor, and turning it OFF stops the motor.

Be careful not to turn ON the STF and STR signals together. Doing so will shut off the outputs.

### ■ Wire connection diagram of FR-A820-1.5K



Enlarged view of standard control circuit terminal block





## 4.7.2

## Connecting the three speed switches

This section explains how to connect the three speed switches (low, medium, and high speeds) to control the motor speed (frequency command).

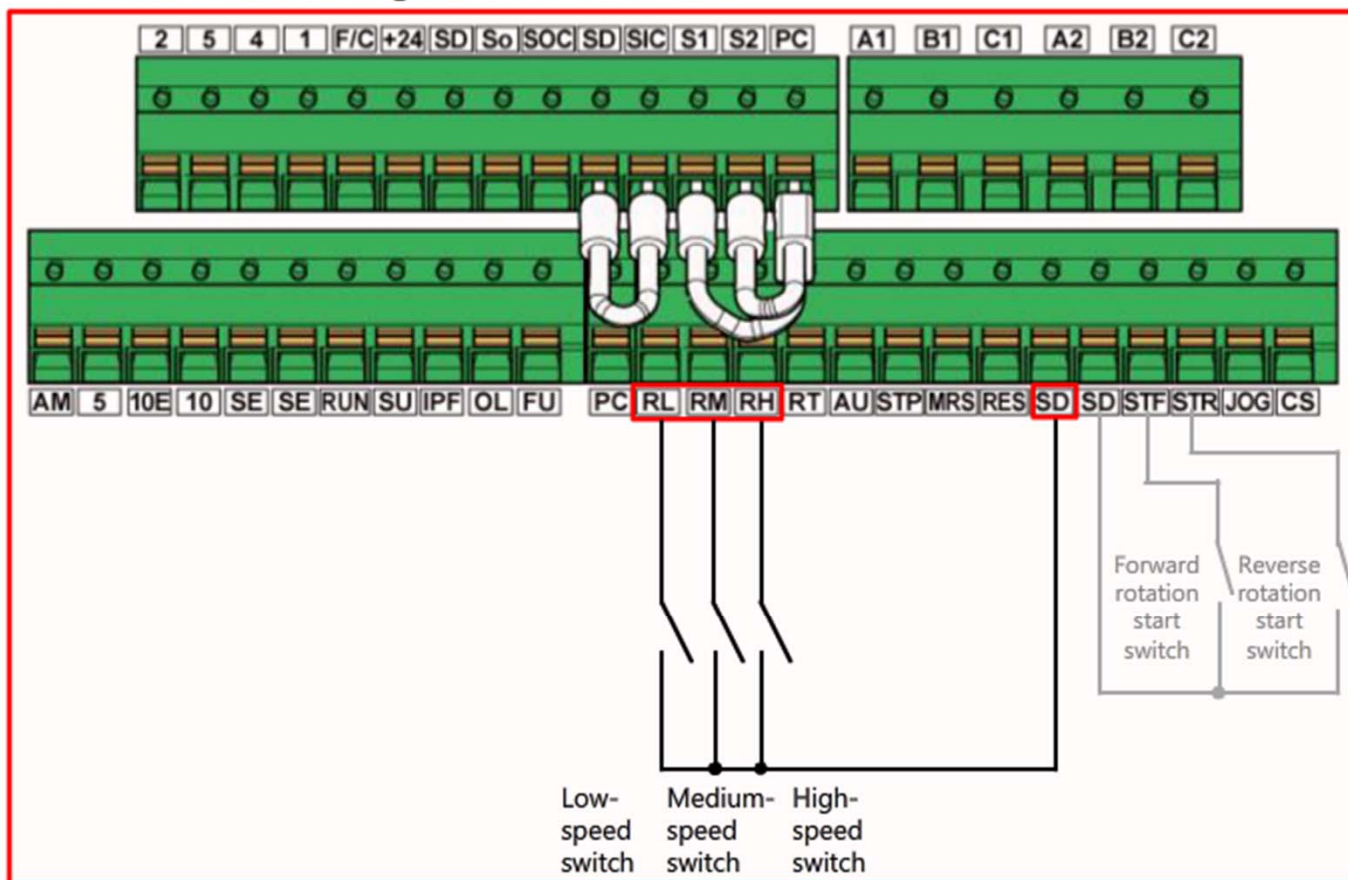
Turn on one of RL (low speed), RM (medium speed), or RH (high speed) signal to control the motor speed.

In the initial setting, the frequency of each signal is as follows: 10 Hz for RL signal, 30 Hz for RM signal and 60 Hz for RH signal.

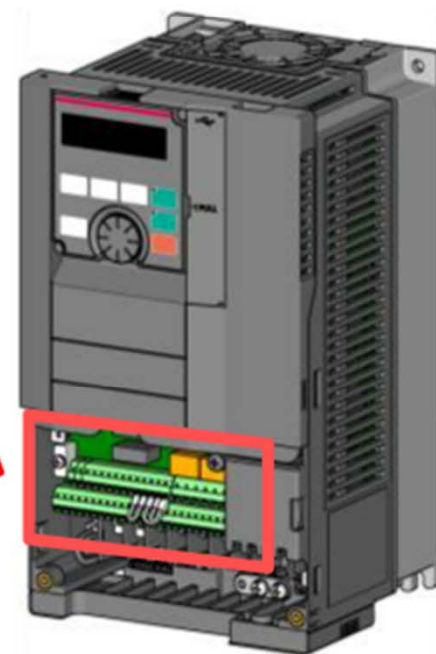
The three speed switches can also be used in conjunction with voltage or circuit input.

If a three speed signal and a voltage/current signal are input simultaneously, the three speed signal is given priority.

#### ■ Wire connection diagram of FR-A820-1.5K



Enlarged view of standard control circuit terminal block



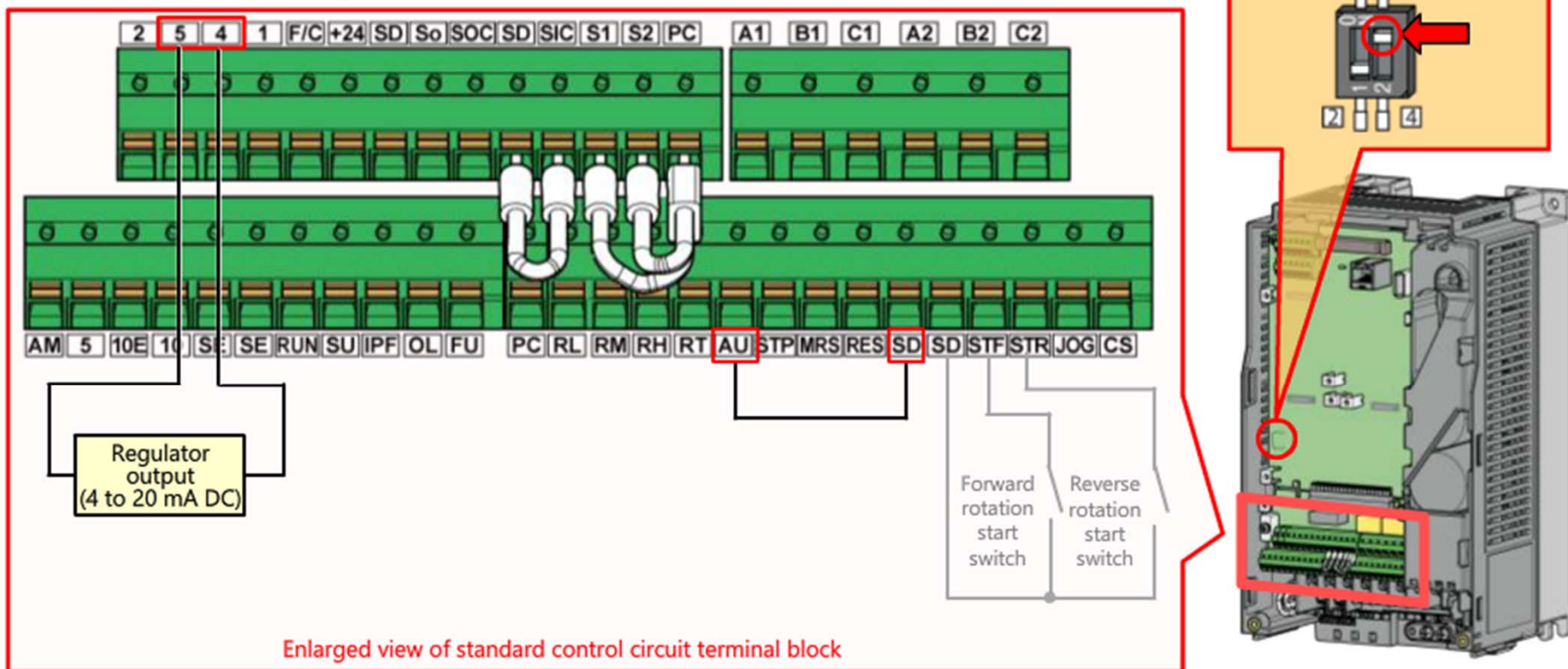
## 4.7.3 Connecting the current inputs

This section explains how to connect current inputs that control the motor speed (frequency command). The motor speed is controlled by current inputs (4 to 20 mA DC) from a controller (current output unit for numerical control, etc.) connected across terminals 4 and 5. The outputs are stopped at 4 mA, and the maximum frequency (initial value 60 Hz) is output as 20 mA. Current and frequency are thus proportional to each other. The maximum frequency (initial value 60 Hz) at 20 mA can be set using a parameter. (Details are given in Chapter 5.)

When connecting current inputs, note the following points:

- Set the voltage/current switch 2 (terminal 4 input) to "ON" (current input). (The switch is set to "ON" (current input) in the initial setting.)
- Turn ON the AU signal to enable terminal 4.

### ■ Wire connection diagram of FR-A820-1.5K





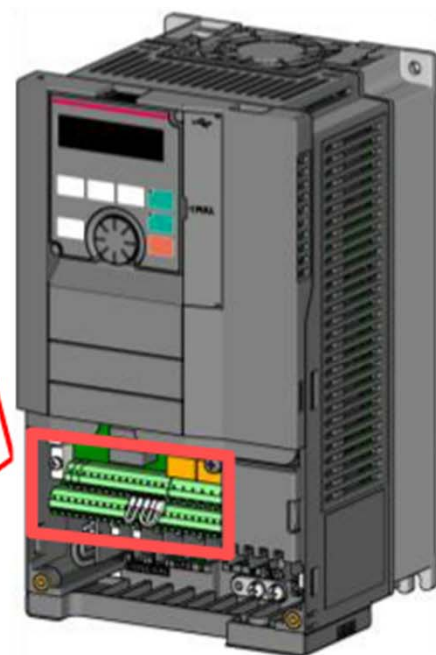
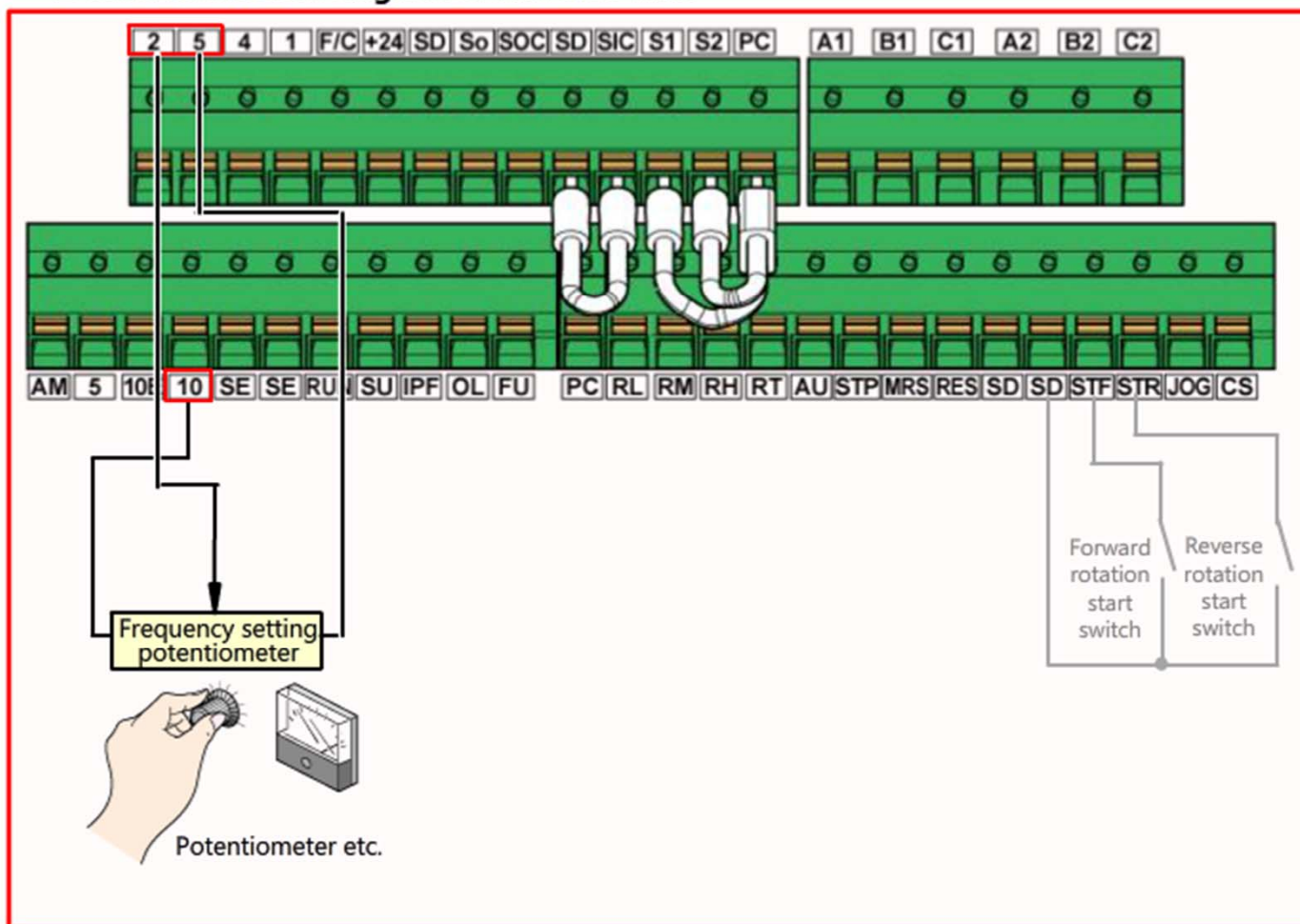
## 4.7.4 Connecting the voltage inputs

This section explains how to connect voltage inputs that control the motor speed (frequency command)

The motor speed is controlled by voltage inputs (0 to 5 V DC) from the frequency setting potentiometer connected to terminals 10, 2, and 5.

Outputs are stopped at 0 V, and the maximum frequency is output at 5 V. Voltage and frequency are thus proportional to each other. The maximum frequency (initial value 60 Hz) at 5 V can be set using a parameter. (Details are given in Chapter 5.)

### ■ Wire connection diagram of FR-A820-1.5K



Enlarged view of standard control circuit terminal block

## 4.8 Summary of this Chapter

Here is what you have learned in this chapter.

- Handling of the terminal block cover
- Installation of the inverter
- Grounding the inverter and motor
- Wiring to the main circuit terminals (power supply and motor)
- Wiring to the control circuit terminals (external input devices)

### Point

Handling of the front and wiring covers	You have learned that how to remove and reinstall the front and wiring covers that need to be done for wiring the FR-A800 series inverter.
Installation of the inverter	You have learned that how to install the FR-A800 series inverter and also learned the suitable environment and precautions on handling.
Grounding the inverter and motor	You have learned that how to ground the inverter and motor and why grounding is required.
Wiring to the main circuit terminals (power supply and motor)	You have learned how to connect the power supply and motor to the main circuit terminals of the FR-A800 series inverter. You have also understood why a molded case circuit (MCCB) and magnetic contactor (MC) are required for the power supply.
Wiring to the control circuit terminals (external input devices)	You have learned about wiring to the control circuit terminals and precautions on wiring. You have also learned how to connect external input devices (switch and potentiometer) that control start/stop and the speed of the motor.

## Chapter 5 Setting the Operation Mode and Parameters

This chapter explains how to use the operation panel to set operation modes and parameters.

5.1 Contents of this Chapter

5.2 Names and Functions of Operation Panel Components

5.3 How to Read Digital Characters Displayed on the Monitor

5.4 Basic Operation of the Operation Panel

5.5 Setting Parameters

5.6 Preventing Incorrect Operation of the Operation Panel

5.7 Finding the Changed Parameters

5.8 Summary of this Chapter

## 5.1 Contents of this Chapter

Contents of this chapter are shown below.

(1) Selecting the operation mode — Chapter 3



(2) Installing and wiring the inverter and motor — Chapter 4



(3) Setting the operation mode and parameters — Chapter 5



(4) Starting operation — Chapter 6



(5) Responding to errors caused during operation — Chapter 7

### Contents of Chapter 3

- 5.2 Names and Functions of Operation Panel Components
- 5.3 How to Read Digital Characters Displayed on the Monitor
- 5.4 Basic Operation of the Operation Panel
  - 5.4.1 Switching the between External and PU operation modes
  - 5.4.2 Switching to the combined operation mode
- 5.5 Setting Parameters
  - 5.5.1 Setting the maximum frequency
  - 5.5.2 Setting the upper and lower limits of output frequency
  - 5.5.3 Setting the motor acceleration and deceleration time
- 5.6 Preventing Incorrect Operation of the Operation Panel
- 5.7 Finding the Changed Parameters
  - 5.7.1 Checking the parameters changed from the initial value
  - 5.7.2 Resetting parameters



## 5.2

## Names and Functions of Operation Panel Components

The names and functions of operation panel components are shown below.

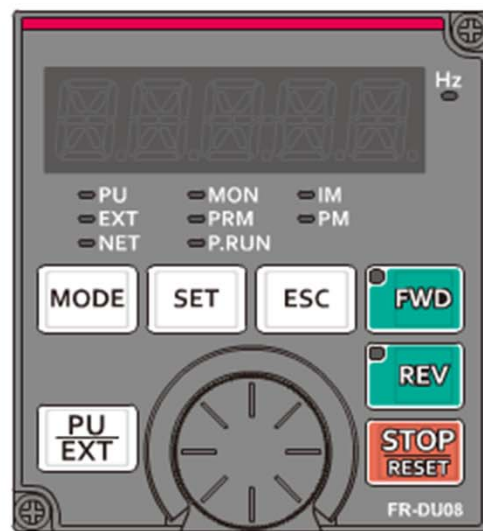
Place your mouse cursor on any LED component or operation keys in the table or on the operation panel. The corresponding part will be displayed.

## Display part

Operation mode indicator	PU: ON to indicate the PU operation mode. EXT: ON to indicate the External operation mode. NET: ON to indicate the Network operation mode.
Operation panel status indicator	MON: ON to indicate the monitoring mode. PRM: ON to indicate the parameter setting mode.
Control motor indicator	IM: ON to indicate the induction motor control. PM: ON to indicate the PM sensorless vector control.
Frequency unit indicator	ON to indicate frequency.
Monitor (5-digit LED)	Shows the frequency, parameter number, etc.
PLC function indicator	ON to indicate that the PLC function is activated.

## Operation part

FWD key, REV key	FWD key: Starts the forward operation. The LED is ON during forward operation. REV key: Starts the reverse operation. The LED is ON during reverse operation.
STOP/RESET key	Used to stop operation commands. Used to reset the inverter when the protective function is activated.
Setting dial	The setting dial is used to change the frequency and parameter settings with rotating operation.
MODE key	Used to switch setting modes. The following modes are provided. Monitor, Parameter setting, function and faults history
SET key	Determines each setting.
ESC key	Goes back to the previous display.
PU/EXT key	Switches between the PU mode and the External operation mode.



## 5.3 How to Read Digital Characters Displayed on the Monitor

There are the following correspondences between the actual alphanumeric characters and the digital characters displayed on the operation panel:

### ■ Correspondence between digital characters and actual characters

0	1	2	3	4	5	6	7	8	9	A	B(b)	C	c	D(d)
0	1	2	3	4	5	6	7	8	9	A	b	C	c	d
E(e)	F(f)	G(g)	H	h	I(i)	J(j)	K(k)	L(l)	M(m)	N	n	O	o	P(p)
E	F	G	H	h	I	J	K	L	M	N	n	O	o	P
Q(q)	R	r	S(s)	T(t)	U	u	V	v	W	w	X(x)	Y(y)	Z(z)	
Q	R	r	S	T	U	u	V	v	W	w	x	Y	Z	

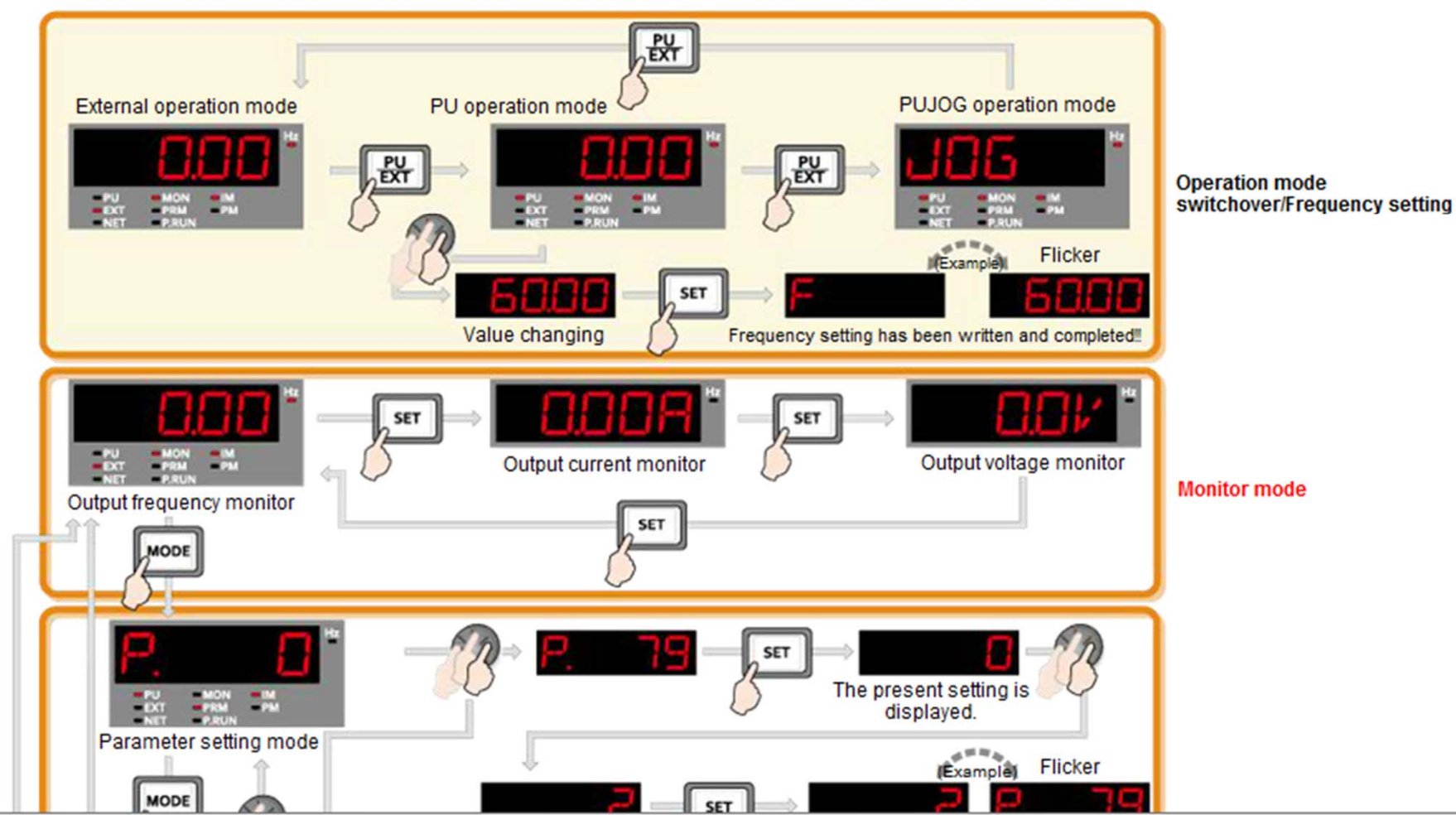
## 5.4

## Basic Operation of the Operation Panel

Let's learn about the basic operation of the operation panel.

Use the PU/EXT key to switch between External and PU operation modes, and use the MODE key to switch between the setting modes.

The flow of the basic operation is shown below.



## 5.4

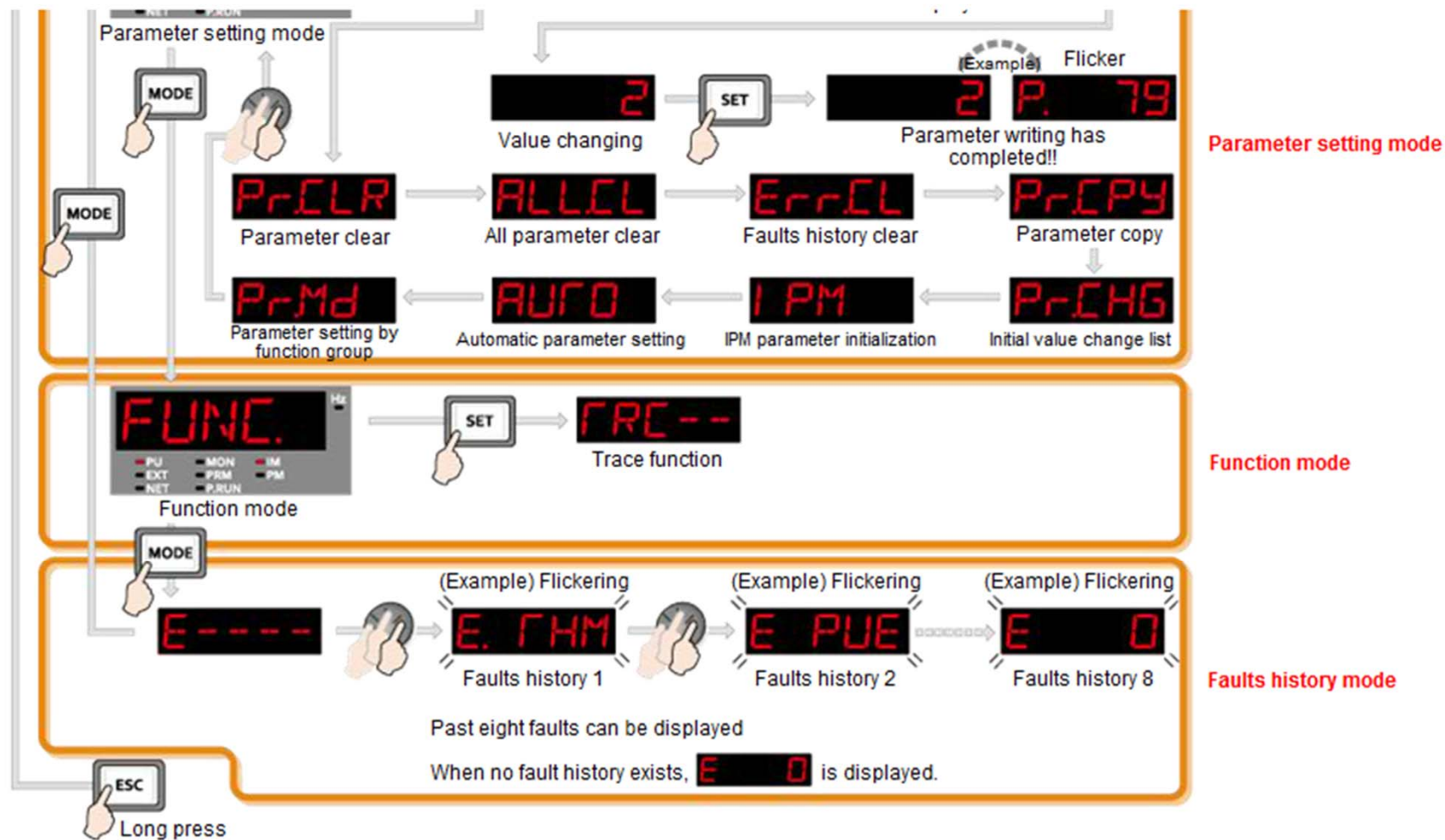
## Basic Operation of the Operation Panel

2/2

Let's learn about the basic operation of the operation panel.

Use the PU/EXT key to switch between External and PU operation modes, and use the MODE key to switch between the setting modes.

The flow of the basic operation is shown below.





## 5.4.1 Switching between External and PU operation modes

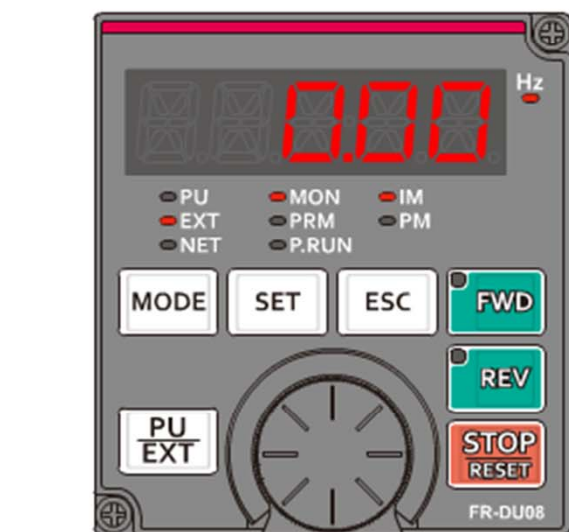
This section explains how to use the operation panel to change the operation mode that you have learned in Chapter 3.

With the PU/EXT key, the operation mode can be switched among the three modes ("External operation", "PU operation", and "PUJOG operation").

At power ON, the External operation mode is selected, and each time the PU/EXT key is pressed, the mode changes in the order of "External operation -> PU operation -> PUJOG operation".

\* This course does not cover the "PUJOG operation". Refer to the product's manual for details.

Switch between the External and PU operation modes using the operation panel simulator below.



The inverter is now in External operation mode.  
The operation for switching between external operation and PU operation mode is complete.

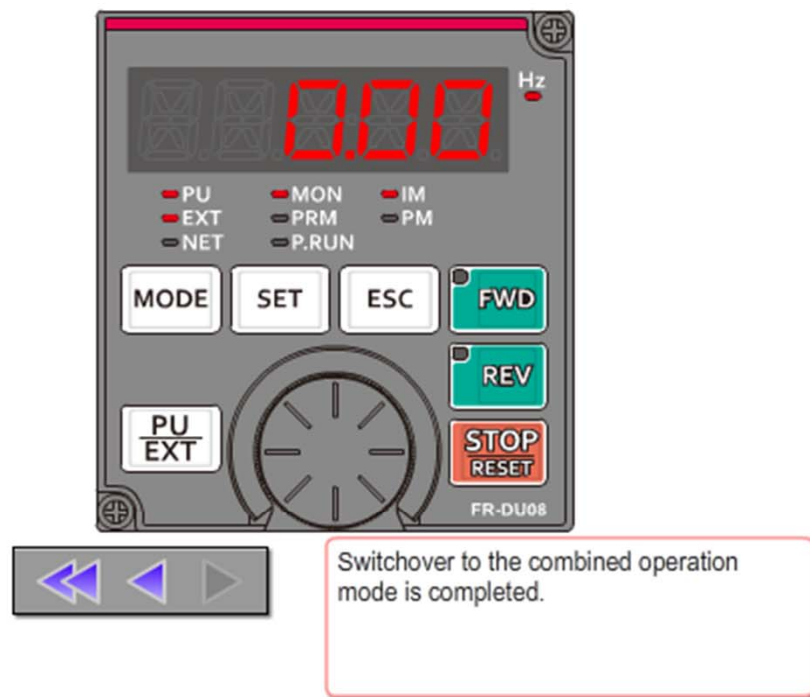










## 5.4.2 Switchover to Combined Operation Mode

This section explains how to switch over to the combined operation mode.

To switch over to the combination operation mode, press the PU/EXT and MODE keys together for 0.5 second. Use the setting dial to select the operation mode with appropriate start and frequency command sources. See the table below for the correspondences between the setting value and the operation modes.

Switch to the combined operation mode using the operation panel simulator below.



Operation panel indication	Operation mode	
	Start command source	Frequency command source
Flickering 		
Flickering 	External (STF, STR)	Analog voltage input
Flickering 	External (STF, STR)	
Flickering 		Analog voltage input

## 5.4.3 Switching between Setting Modes

This section explains how to switch between setting modes.

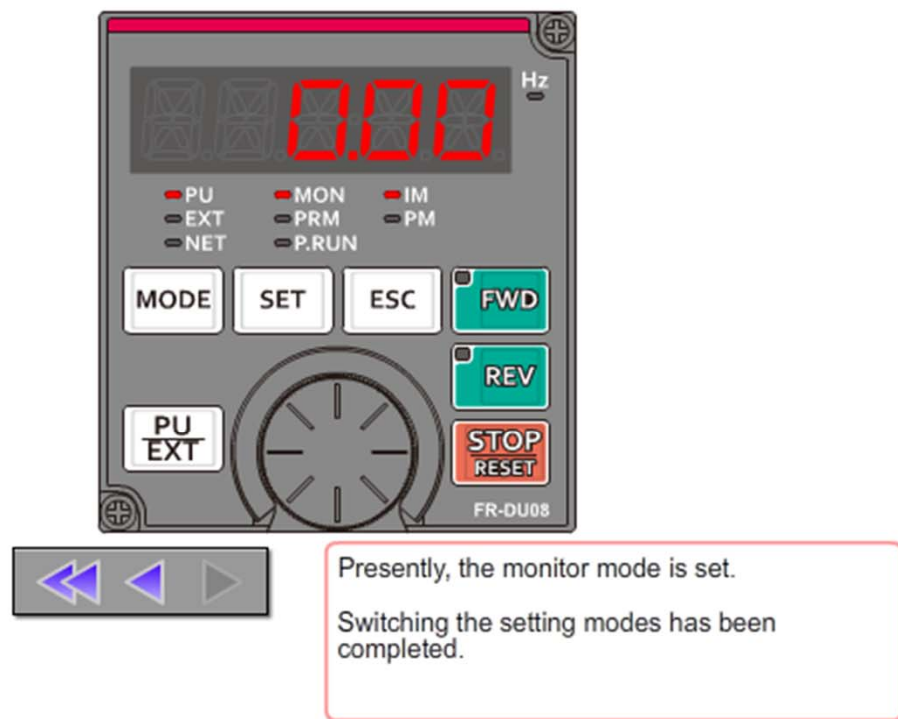
The setting mode can be switched among the four modes (monitor mode, parameter setting mode, function mode, and faults history mode).

The setting mode changes in the order of "monitor mode -> parameter setting mode -> function mode -> faults history mode" each time the MODE key is pressed. Before switching between the setting modes, switch the operation mode to "PU operation mode".

Switch between the setting modes using the operation panel simulator below.

\* The window of "Parameter setting mode" is changed from initial setting here. (change the display methods of parameters)

The details are explained below.



**5.5****Setting Parameters**

This section explains how to set parameters.

An inverter can perform simple variable-speed operation in the initial setting.  
Set necessary parameters according to the load and operational specifications.

To set parameters, press the PU/EXT key to enter the PU operation mode, and then press the MODE key to enter the parameter setting mode.

Most parameters cannot be set during operation.

In this section, you will simulate parameter settings of the frequently-used parameters (maximum frequency, upper and lower limits of output frequency, and motor acceleration and deceleration time).

These simulations will familiarize you with the parameter setting method.

## 5.5

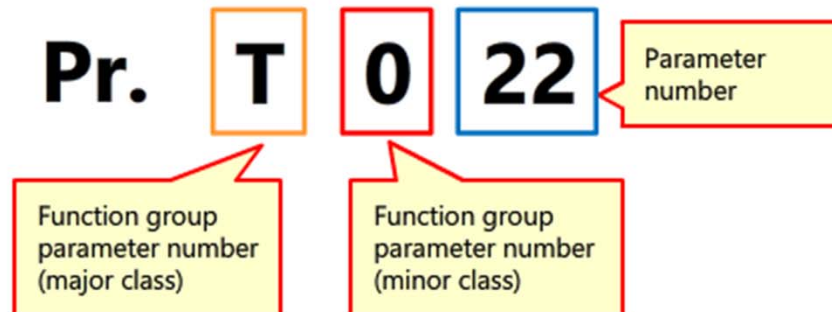
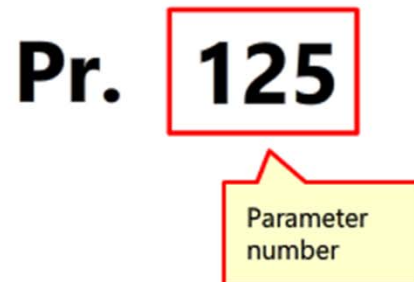
## Setting Parameters

Two methods are available to display parameters and they can be switched freely.

Such methods include the **parameter display by the function group** (method to display parameters by classifying them into the functional groups) and the **parameter display by the parameter number** (method to display parameters in numerical order).

The parameter display by the function facilitates the setting of the similar functions and helps you remember the parameter numbers.

In the FR-A800 series, the two parameter display methods can be switched freely. (The conventional model supports the parameter display by the parameter number only.)

**■ Parameter display by the function group****■ Parameter display by the parameter number**

This course shows the parameters in the combination format as "Parameter display by the function group (parameter display by the parameter number)".

Example: T022 (Pr.125)



## 5.5 Setting Parameters

The following shows the function group of the parameter.

Function group	Function name	Description
E	Environmental setting parameter	Sets the inverter operation characteristics.
F	Setting of acceleration/deceleration time and acceleration/deceleration pattern	Sets the motor acceleration/deceleration characteristics.
D	Operation command and frequency command	Specifies the inverter's command source and sets the motor driving frequency and torque.
H	Protective function parameter	Protects the motor and the inverter.
M	Monitor display and monitor output signal	Relates to the inverter operating status and sets the monitors and output signals.
T	Multi-function input terminal parameter	Sets the input terminals through which the commands are sent to the inverter.
C	Motor constant parameter	For the applied motor setting
A	Application parameter	Sets a specific application.
B	Position control parameter	For the position control setting
N	Operation via communication and its settings	Sets the communication specifications and operation for the communication operation.
G	Control parameter	For the motor control setting

For the parameter number in the function group, refer to the manual of the product to be used.

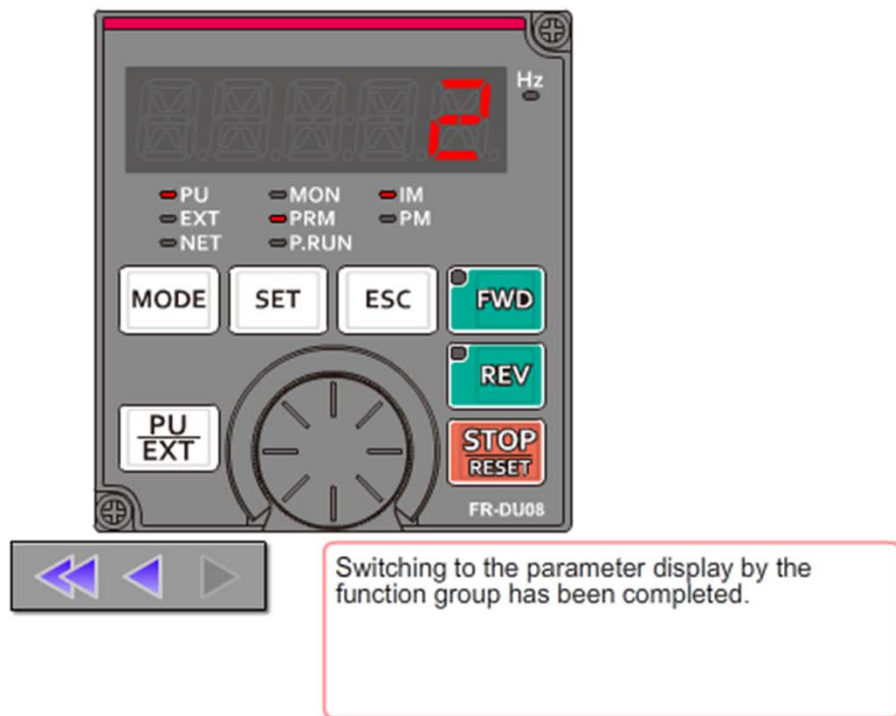


## 5.5.1

# Switching to parameter display by the function group

The parameter display can be switched with "Pr.MD" in the parameter setting mode.

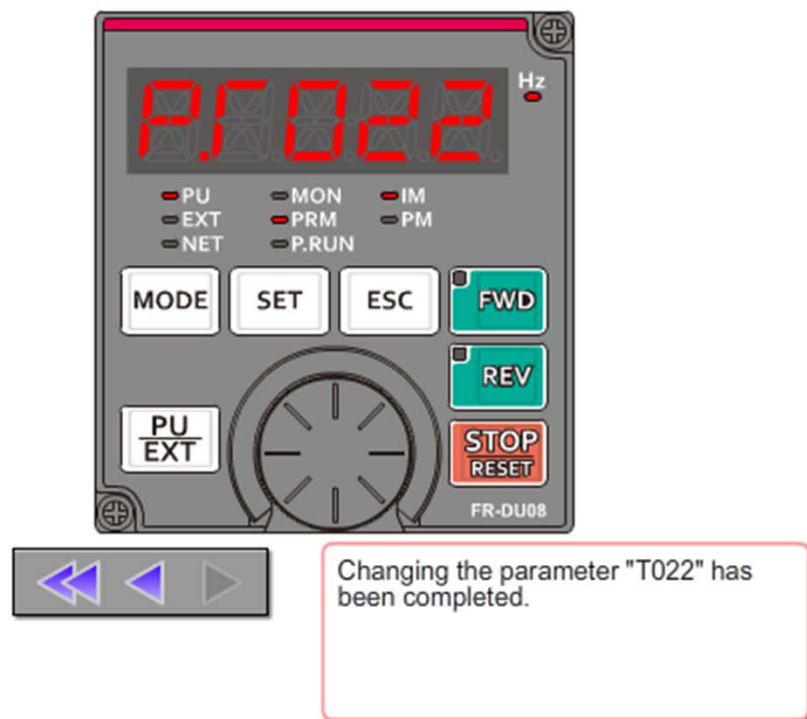
Change the parameter display setting from numerical order by default parameter number to Group parameter display using the operation panel simulator below.



## 5.5.2 Setting the maximum frequency

When you are using an external (voltage input) potentiometer and want to change the frequency at the maximum input (5 V), use "T022 (Pr.125) Terminal 2 frequency setting gain frequency". The initial value of this parameter is 60 Hz.

Change the "T022 (Pr.125)" setting from 60 Hz (initial value) to 50 Hz using the operation panel simulator below.



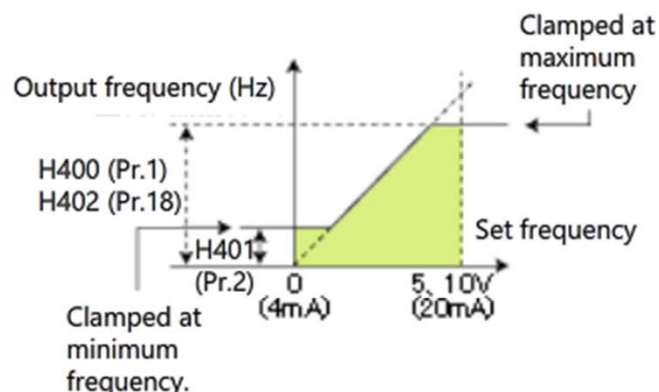
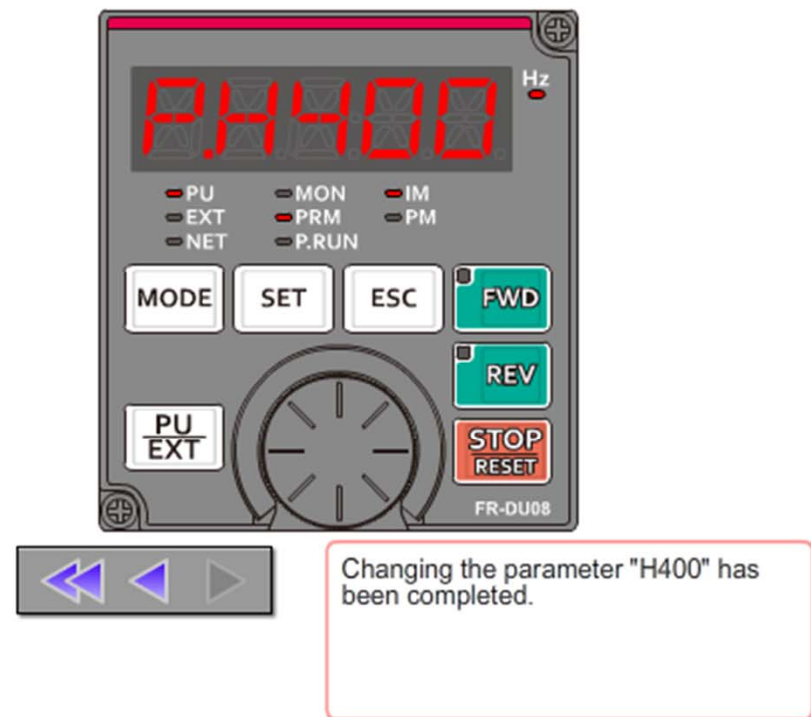
## 5.5.3 Setting the Upper and Lower Limits of Output Frequency

To set the upper and lower limits of the output frequency, use "H400 (Pr.1) Maximum frequency" and "H401 (Pr.2) Minimum frequency".

The initial values and the setting ranges of upper limit and lower limit frequencies are as follows.

Parameter No.	Parameter	Initial value	Setting range	Description
H400 (Pr.1)	Maximum frequency	120 Hz	0 to 120 Hz	Set the maximum output frequency.
H401 (Pr.2)	Minimum frequency	0 Hz	0 to 120 Hz	Set the minimum output frequency.

Change the "H400 (Pr.1) Maximum frequency" setting from "120 Hz" (initial value) to "60 Hz" using the operation panel simulator below.



## 5.5.4 Setting the Motor Acceleration and Deceleration Time

To set the motor acceleration time and deceleration time, use "F010 (Pr.7) Acceleration time" and "F011 (Pr.8) Deceleration time". The initial values and the setting ranges of the acceleration time and deceleration time are as follows. (The initial value varies depending on the inverter capacity.)

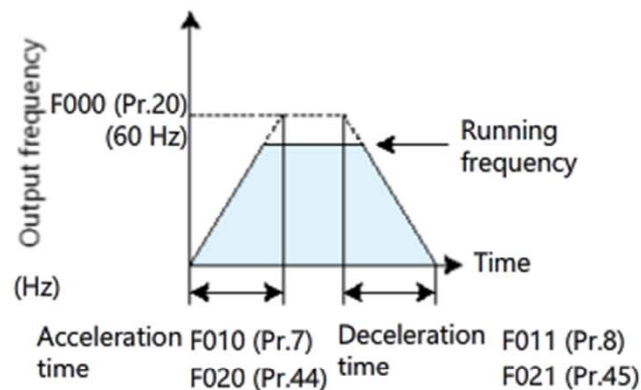
Parameter No.	Parameter	Initial value		Setting range	Description
F010 (Pr.7)	Acceleration time	7.5K or lower	5 s	0 to 3600/360 s *1	Set the motor acceleration time.
		11K or more	15 s		
F011 (Pr.8)	Deceleration time	7.5K or lower	5 s	0 to 3600/360 s *1	Set the motor deceleration time.
		11K or more	15 s		

\*1 Depends on the "F001 (Pr.21) Acceleration/deceleration time increments" setting. The initial setting range is "0 to 3600 s" and the setting increment is "0.1 s".

Change the "F010 (Pr.7) Acceleration time" setting from the "5.0 s" (initial value) to "10.0 s" using the operation panel simulator below.



Changing the parameter "F010" has been completed.



## 5.6

## Preventing Incorrect Operation of Operation Panel

This section explains how to lock the operation panel keys to prevent accidental operation. Even while the key operation is locked, the STOP/RESET key can be used to stop operation or reset the inverter system.

Lock and unlock the key operation using the operation panel simulator below.



The key operation is unlocked.

Locking and unlocking the key operation have been completed.



## 5.7

## Finding the Changed Parameters

This section explains how to find changed parameters and their changed settings.

The FR-A800 series inverter has the "initial value change list" and "parameter clear" function. The "initial value change list" shows the parameters changed from the initial settings. "Parameter clear" resets parameter settings to the initial values.

To find changed parameters, try the "initial value change list" first and make necessary changes.

If changed parameters are not identifiable with the "initial value change list", reset the parameter settings to the initial values with "parameter clear".

#### ■ Precautions on parameter clear

The FR-A800 series inverter does not back up the present parameter values.

Once the parameters are cleared, the previous settings cannot be restored.

To back up parameters, use an operation panel (FR-DU08/FR-LU08), FR Configurator2 (setup software), or commercial USB memory devices.

#### Operation panel

Operation panel



FR-DU08

LCD operation panel (option)



FR-LU08

#### Personal computer + FR Configurator2

High-speed graph function



FR Configurator2

Mini B connector



USB cable



Inverter

#### Commercial USB memory



## 5.7.1 Checking the Parameters Changed from the Initial Value

This section explains how to use the "initial value change list". The "initial value change list" allows you to check the parameters that have been changed from their initial values.

Using this function, you can confirm the parameters you have changed and change them again.

Find the parameters that have been changed from their initial values, and change their settings again, using the operation panel simulator below.

\* Initial value change list is displayed in the numerical order (by parameter number) even if the display method of the list is switched to the "parameter display by function group".



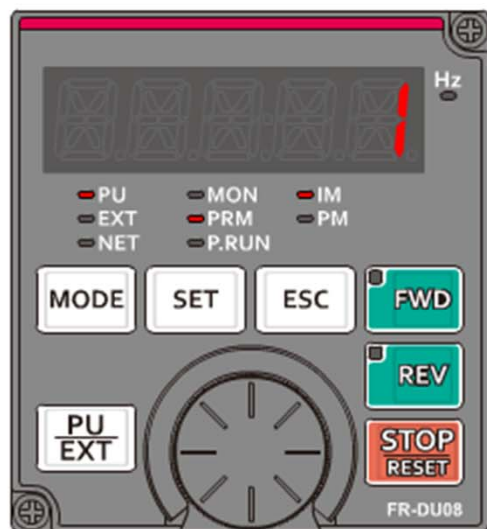
The setting of parameter "Pr.7" is completed.

The operation of the initial value change list is completed.

## 5.7.2 Resetting Parameters

This section explains how to use the "parameter clear" function that resets the parameters to their initial values. The FR-A800 series inverter does not back up parameter settings, so be careful when clearing parameters.

Perform the parameter clear using the operation panel simulator below.



The parameter is cleared.

The operation of parameter clear is completed.

## 5.8 Summary of this Chapter

Here is what you have learned in this chapter.

- Names and functions of operation panel components
- How to read the digital characters displayed on the monitor
- Basic operation of the operation panel
- How to switch between the operation modes
- How to switch between the setting modes
- Setting parameters
- Preventing incorrect operation of the operation panel
- Finding the changed parameters

### Point

Names and functions of operation panel components	You have understood the names and functions of operation panel components.
How to switch between the operation modes	You have learned how to switch the operation modes from External operation mode to PU operation mode or to combined operation mode.
How to switch between the setting modes	You have learned how to switch the monitor mode to parameter setting mode to function mode and then to faults history mode.
Setting Parameters	You have learned how to set parameters with the operation panel, using three parameter setting examples.
Parameter display	You have learned the parameter display can be switched between "parameter display in numerical order" and "parameter display by function group".
Preventing incorrect operation of the operation panel	You have learned how to lock the key operation of the operation panel.
Finding the changed parameters	You have learned how to find the parameters that have been changed from their initial values and how to reset the parameters to their initial values.

## Chapter 6 Operating the Inverter System

This chapter explains how to operate the inverter in PU and External operation modes.

6.1 Contents of this Chapter

6.2 Operation in the PU Operation Mode

6.3 Operation in the External Operation Mode

6.4 Monitoring the Output Frequency, Output Current, and Output Voltage during Operation

6.5 Summary of this Chapter



## 6.1 Contents of this Chapter

Contents of this chapter are shown below.

(1) Selecting the operation mode — Chapter 3



(2) Installing and wiring the inverter and motor — Chapter 4



(3) Setting the operation mode and parameters — Chapter 5



(4) Starting operation — Chapter 6



(5) Responding to errors caused during operation — Chapter 7

### Contents of Chapter 6

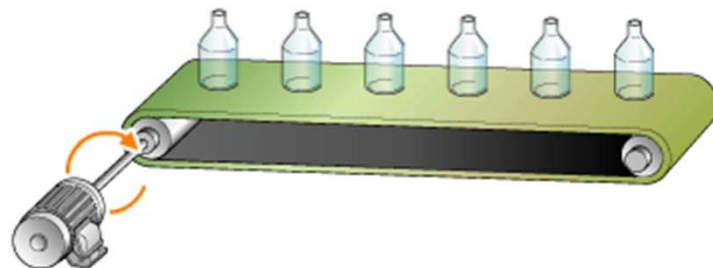
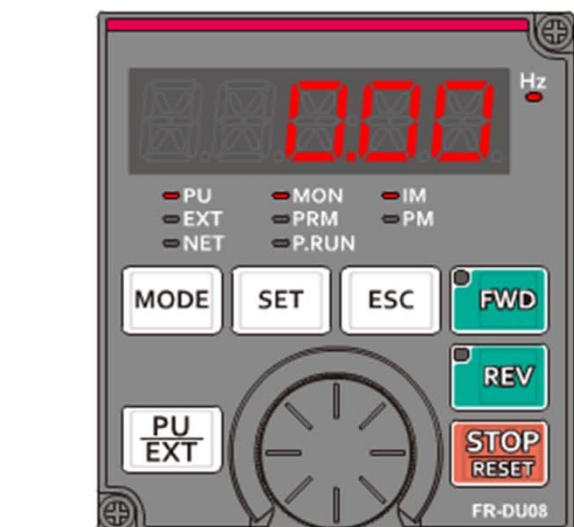
- 6.2 Operation in the PU Operation Mode
  - 6.2.1 Using the setting dial like a potentiometer
- 6.3 Operation in the External Operation Mode
  - 6.3.1 Changing the motor speed using the three speed switch
  - 6.3.2 Changing the motor speed using the potentiometer (voltage input)
- 6.4 Monitoring the Output Frequency, Output Current, and Output Voltage during Operation

## 6.2 Operation in PU Operation Mode

This section explains the inverter operation in PU operation mode.

In PU operation mode, the FWD key (forward rotation command) on the operation panel is used to start or stop the motor, and the setting dial is used to change the speed (frequency command). In this simulation, the acceleration/deceleration time is set to "5 s".

Operate the conveyor in PU operation mode using the operation panel simulator below.




Conveyor operation is finished.

## 6.2.1 Using the setting dial like a potentiometer


"E200 (Pr.161) Frequency setting/key lock operation selection" enables the setting dial to behave like a potentiometer while setting a frequency in the PU operation mode. With this parameter, you can use the setting dial to set a frequency in real time just like using the potentiometer. This means that you do not have to press the SET key whenever you change the frequency.

### ----- Operation -----

1. At power ON, the monitor window appears.

2. Press  to set the PU operation mode.

3. Set "1" in E200 (Pr.161).

4. Press  to run the inverter.

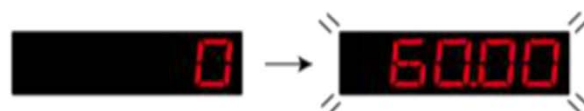
5. Turn  to "60.00 Hz".  
The set frequency flickers.

Pressing  is not necessary.

### ----- Indication -----



PU indicator is ON.



It flickers for about 5 seconds.

This section explains about the inverter operation in External operation mode.

In External operation mode, forward/reverse start switches on the external input device are used to start or stop (start command) the motor, and three speed switches and or a potentiometer (voltage input) are used to change the speed (frequency command).

In this course, you will simulate the inverter operation with two speed command sources: the three speed switches and a potentiometer (voltage input).

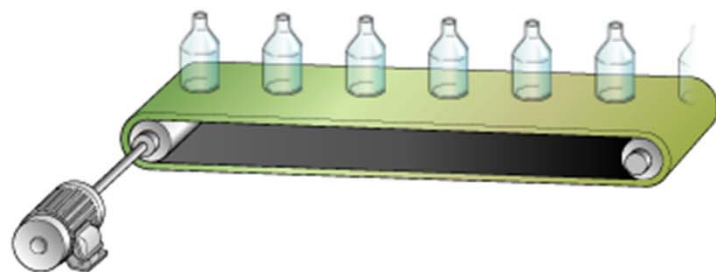
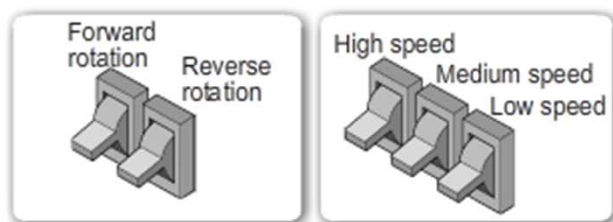
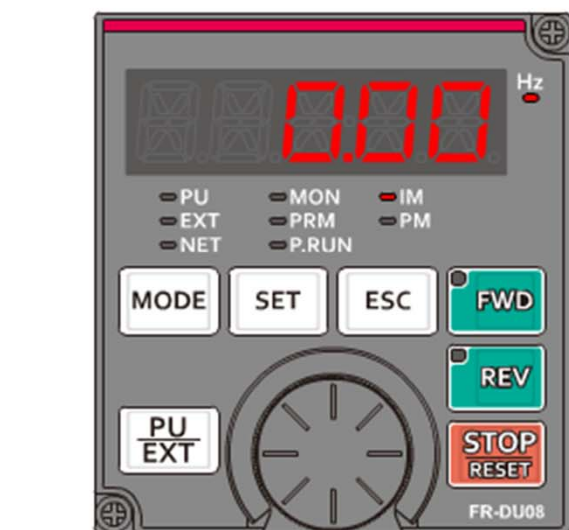
	Start command source	Frequency command source
Combination 1	Forward and reverse start switches	Three speed switches (low speed, medium speed, high speed)
Combination 2		Potentiometer (voltage input)

## 6.3.1 Changing the Motor Speed Using the Three Speed Switches

Let's learn how to change the motor speed (frequency command) using the three speed switches (low speed, medium speed, and high speed).

In this simulation, the frequencies of the three speed switches are set to "low speed 10.00 Hz", "medium speed 30.00 Hz", and "high speed 60.00 Hz".

Operate the conveyor in External operation mode using the operation panel and external input device of the simulator below.



The forward rotation start command has been turned off.

The conveyor has stopped operation.

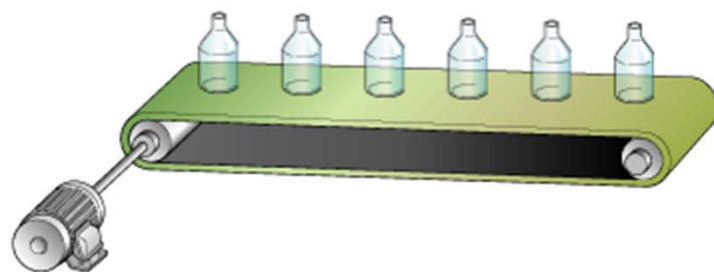
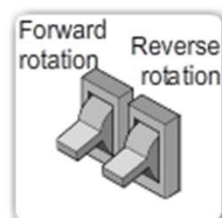
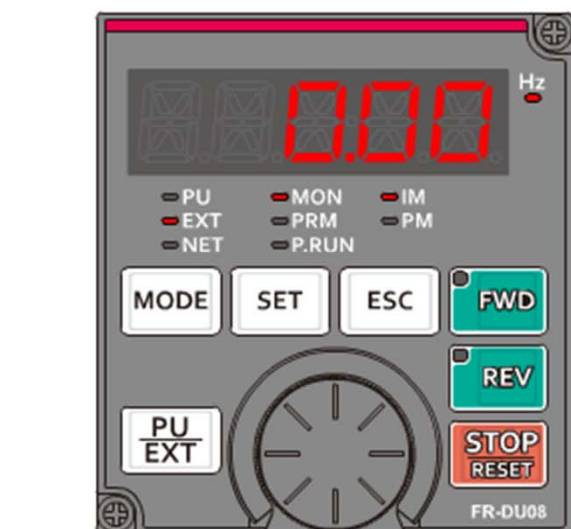


## 6.3.2

## Changing the Motor Speed Using the Potentiometer (Voltage Input)

The motor speed (frequency command) can be changed using the potentiometer (voltage input). In this simulation, the maximum value of the potentiometer (turned all the way to the right) is set to "60.00 Hz" and the acceleration/deceleration time set to "5 s".

Operate the conveyor in External operation mode using the operation panel and the external switches of the simulator below.



The forward rotation start command has been turned off.

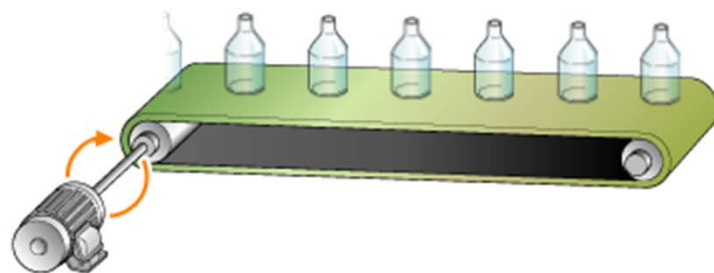
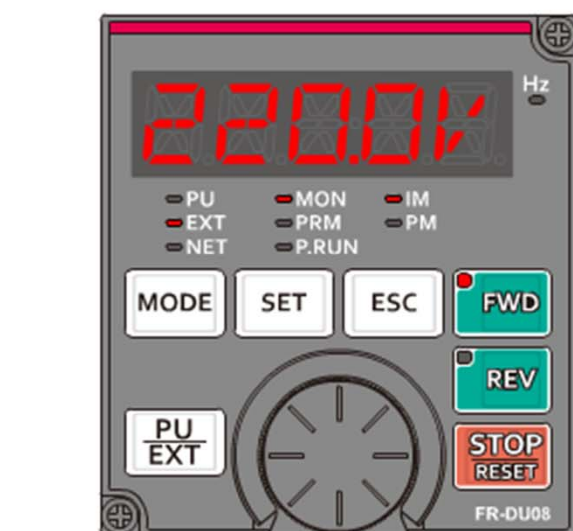
The conveyor has stopped operation.

## 6.4 Monitoring the Output Frequency, Output Current, and Output Voltage during Operation

Let's learn how to monitor the output frequency, output current, and output voltage during operation.

While the setting mode is the frequency command/monitor mode, press the SET key on the operation panel. The output frequency, output current, and output voltage during operation are sequentially displayed each time the SET key is pressed.

Check the monitored output frequency, output current, and output voltage during operation using the simulator below.



The output voltage is now being monitored.  
Monitoring during operation has been completed.

## 6.5 Summary of this Chapter

Here is what you have learned in this chapter.

- Operating the inverter in PU operation mode
- Using the setting dial on the operation panel like the potentiometer
- Operating the inverter in External operation mode
  1. Changing the speed using the three speed switches
  2. Changing the speed using the potentiometer (voltage input)
- Monitoring the output frequency, output current, output voltage during operation

### Point

Operating the inverter in PU operation mode	You have learned how to operate the conveyor, as an example, using the FWD key and setting dial on the operation panel.
Operating the inverter in the External operation mode	You have learned how to operate the conveyor, as an example, using the start switch on the external input device and also using the three speed switches and potentiometer for frequency setting.
Monitoring the output frequency, output current, output voltage during operation	You have learned how to monitor the output frequency, output current, and output voltage on the display during operation.

## Chapter 7 Responding to Errors During Operation

This chapter explains the fault display types, how to reset the protective function, how to check the faults history, and how to respond to a motor malfunction.

- 7.1 Contents of this Chapter
- 7.2 Inverter Fault Display
- 7.3 Resetting the Activated Protective Function
- 7.4 Confirming the Faults History
- 7.5 Corrective Action for a Non-Operable Motor
- 7.6 Summary of this Chapter

## 7.1 Contents of this Chapter

Contents of this chapter are shown below.

(1) Selecting the operation mode — Chapter 3



(2) Installing and wiring the inverter and motor — Chapter 4



(3) Setting the operation mode and parameters — Chapter 5



(4) Starting operation — Chapter 6



(5) Responding to errors caused during operation — Chapter 7

### Contents of Chapter 7

7.2 Inverter Fault Display

7.3 Resetting the Activated Protective Function

7.4 Confirming the Faults History

7.5 Corrective Action for a Non-Operable Motor



**7.2****Inverter Fault Display**

When a fault occurs in the inverter, the inverter trips and the operation panel display automatically changes to one of the following fault or alarm indications.

When any fault occurs, take an appropriate corrective action, then reset the inverter, and resume the operation. Not doing so may lead to an inverter fault or damage. (Details are given in Section 7.3.)

Inverter fault or alarm indications are generally categorized as below.

Fault display type	Description
Error message	A message regarding operational fault and setting fault by the operation panel (FR-DU08) and parameter unit (FR-PU07) is displayed. The inverter does not trip.
Warning	The inverter does not trip even when a warning is displayed. However, failure to take appropriate measures will lead to a fault.
Alarm	The inverter does not trip. An alarm can also be output with a parameter setting.
Fault	When a protective function activates, the inverter trips and a fault signal is output.

## 7.3




## Resetting the Activated Protective Function

This section explains how to reset the protective function that has been tripping an inverter.

The inverter can be reset by performing one of the following operations.

Note that the internal accumulated heat value of the electronic thermal relay function and the number of retries are cleared (erased) by resetting the inverter.

The inverter recovers about 1 s after the reset is released.

Item	Operation method
Operation 1	<p>Press the STOP/RESET key on the operation panel. (This may only be performed when a fault occurs.)</p> 
Operation 2	<p>Switch the power OFF once. After the indicator of the operation panel turns OFF, switch it ON again.</p> 
Operation 3	<p>Turn ON the reset signal (RES) for more than 0.1s. If the RES signal is kept ON, "Err." appears (flickers) to indicate that the inverter is in a reset status.</p> 

Refer to the product's manual for the fault display list and corrective actions.

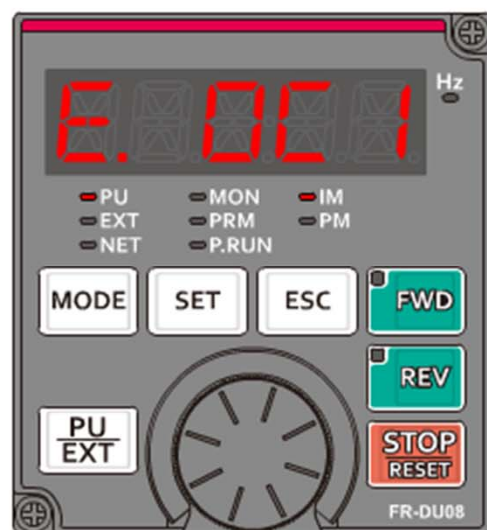
## 7.4

## Confirming the Faults History

You can check the past eight faults using the faults history.

Switch to the PU operation mode, and press the MODE key to switch to the faults history mode.

Check the faults in the faults history mode using the simulator below.



The display goes back to the fault "E.001".

The operation for checking the faults history has been completed.

This section explains how to respond when the motor does not start or is faulty. Explanation is mainly given about the cases in which the motor does not start even though no fault (error) is output. First, check the following points. If the cause is still unknown after every check, it is recommended to initialize the parameters, and then set the required parameter values and check again.

### 1. The motor does not start.

Where to check	Possible cause	Corrective action
Main circuit	Appropriate power supply voltage is not applied. (The operation panel is not displayed.)	Turn ON the circuit breaker (NFB), earth leakage circuit breaker (ELB), or magnetic contactor (MC). Check for input voltage drop, input phase loss, and wiring errors.
	The motor is not connected properly.	Check the wiring between the inverter and motor.
Input signal	The start signal is not input.	Check the start command source, and input a start signal. PU operation mode: FWD or REV key External operation mode: STF/STR signal
	Both the forward and reverse rotation start signals (STF, STR) are input together.	Turn ON only one of the forward and reverse start signals (STF, STR). If the STF and STR signals turn ON together in the initial setting, a stop command is given.
	The frequency command is zero.	Check the frequency command source and input a frequency command. If a start command is input when the frequency command is 0Hz, the LED of the FWD or REV key on the operation panel flickers.
	The output stop signal (MRS) or inverter reset signal (RES) is ON.	Turn OFF the MRS or RES signal. The motor starts with the given start and frequency commands. Before turning OFF, ensure the safety.
Load	Load is too heavy.	Reduce the load.
	The shaft is locked.	Check the machine (motor).

## 7.5

## Corrective Action for Non-Operable Motor

2. The motor generates heat abnormally.

Where to check	Cause	Corrective action
Motor	The motor fan is not working. (Dust is accumulated.)	Clean the motor fan. Improve the environment.
Main circuit	The inverter output voltage (U, V, W) are unbalanced.	Check the inverter output voltage. Check the insulation of the motor.

3. The motor rotates in the opposite direction.

Where to check	Cause	Corrective action
Main circuit	Phase sequence of output terminals U, V and W is incorrect.	Connect phase sequence of the output cables (terminal U, V, W) to the motor correctly.
Input signal	The start signals (forward rotation, reverse rotation) are connected improperly.	Check the wiring. (STF for forward rotation, STR for reverse rotation)

4. The speed greatly differs from the setting.

Where to check	Cause	Corrective action
Input signal	The frequency setting signal is incorrectly input.	Measure the input signal level.
	The input signal line is affected by external EMI.	Take measures against EMI such as using shielded cables for the input signal lines.
Load	Stall prevention function is activated due to a heavy load.	Reduce the load.
Motor		Check the capacities of the inverter and motor.



**7.6****Summary of this Chapter**

Here is what you have learned in this chapter.

- Inverter fault display
- Resetting the activated protective function
- Confirming the faults history
- Corrective action for the non-operable motor

**Point**

Inverter fault display	You have learned the inverter operation at fault occurrence and the types of fault displays.
Resetting the activated protective function	You have learned the three resetting methods for the activated protective function.
Confirming the faults history	You have learned how to check the faults occurred in the past.
Corrective action for the non-operable motor	You have understood the corrective action to be taken if the motor does not start even though no fault is indicated.

Now that you have completed all of the lessons of the **Inverter Basics (Operation) for the FR-800 series** Course, you are ready to take the final test. If you are unclear on any of the topics covered, please take this opportunity to review those topics.

**There are a total of 8 questions (39 items) in this Final Test.**

You can take the final test as many times as you like.

### How to score the test

After selecting the answer, make sure to click the **Answer** button. Your answer will be lost if you proceed without clicking the Answer button. (Regarded as unanswered question.)

### Score results

The number of correct answers, the number of questions, the percentage of correct answers, and the pass/fail result will appear on the score page.

Correct answers : 8

Total questions : 8

Percentage : 100%

To pass the test, you have to answer **60%** of the questions correct.

Proceed

Review

- Click the **Proceed** button to exit the test.
- Click the **Review** button to review the test. (Correct answer check)
- Click the **Retry** button to retake the test again.

## Test

## Final Test 1



The following explains the roles of the start command and frequency command.  
Fill in the blanks of the explanation.

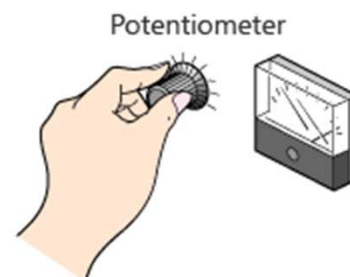
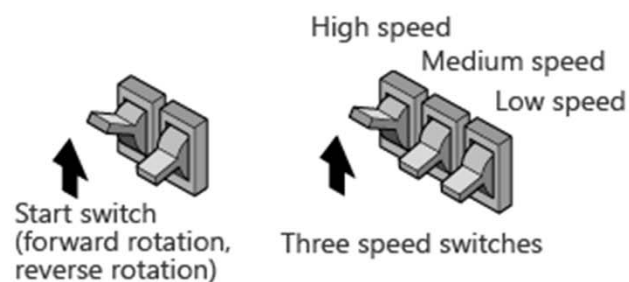
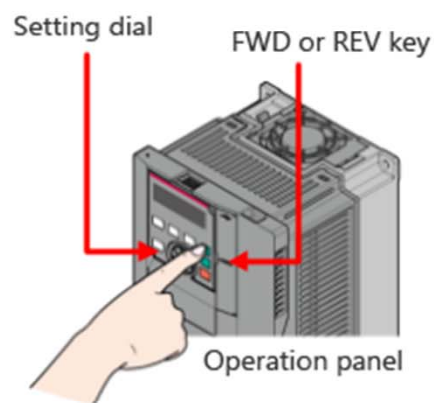
The start command controls  of the motor.

The frequency command controls  of the motor.

is  to the magnitude of the frequency.

Choose the optimal operation mode for each combination of the start and frequency commands.

Start command source	Frequency command source	Operation mode
Start switch	Setting dial	--Select--
Start switch	Potentiometer	--Select--
FWD or REV key	Three speed switches	--Select--
Start switch	Three speed switches	--Select--
FWD or REV key	Setting dial	--Select--



The following explains how to connect the power supply to the inverter.  
Fill in the blanks of the explanation.

Always use  in the power input cable.

Also, be sure to connect a  between the power supply and the main circuit terminal of the inverter and wire them so that the  will turn  to  in such cases that the protective function is activated or the driven machine fails (emergency stop, etc.).



Choose the appropriate name of each function.

Start command	Name
Resets parameters to their initial values.	--Select-- ▼
Displays the last eight faults.	--Select-- ▼
Checks/changes the parameters that have been changed from their initial values.	--Select-- ▼
Disables the setting dial and key operation from the operation panel.	--Select-- ▼
At fault output, shuts off the inverter outputs to protect the circuit.	--Select-- ▼

[Answer](#)[Back](#)

Choose the function of the operation panel used to perform each of the following operations.

Operation	Function of operation panel
Selects the frequency and various settings.	--Select-- ▼
Displays the last eight faults.	--Select-- ▼
Starts the motor running.	--Select-- ▼
Stops the motor running.	--Select-- ▼
Switches the setting mode.	--Select-- ▼
Switches between External and PU operation modes.	--Select-- ▼
Switches over to the combined operation mode.	--Select-- ▼
Releases from the activated protective function.	--Select-- ▼
Locks or unlocks key operation.	--Select-- ▼
Switches the monitored item (output frequency, output current, output voltage).	--Select-- ▼

[Answer](#)[Back](#)

Fill in the blanks of the explanation of the procedure for changing the "Pr.125 Terminal 2 frequency setting gain frequency" parameter from the initial value 60Hz to 50Hz in parameter setting mode.

- (1) Press   in External operation mode to switch to the PU operation mode.
- (2) Press   to switch to the parameter setting mode.
- (3) "PA0" is displayed.
- (4) Turn  to select the parameter "P.T0".
- (5) Press the  to set the parameter group.
- (6) Turn  to select the parameter "P.T022".
- (7) Press  to display the present value (60Hz) of "P.T022".
- (8) Turn  to change "60Hz" to "50Hz".
- (9) Press  to enter the set value "50Hz" that has been set.
- (10) "P.T022" and "50.00" flicker alternately to indicate the parameter value has been changed.

Choose the type(s) of error(s) that activate(s) the protective function to shut off the inverter output.

- Error message
- Warning
- Alarm
- Fault

Answer

Back

Choose the correct method(s) of resetting the protective function.

- Hold the reset signal ON for 0.1 second.
- Hold the reset signal OFF for 0.1 second.
- Turn off the power and, after the LED goes off, turn on the power again.
- Disconnect the inverter from the motor.
- Execute "parameter clear" in parameter setting mode.
- Press the STOP/RESET key on the operation panel.
- Press down the FWD or REV key on the operation panel for 2 seconds.

[Answer](#)[Back](#)



You have completed the Final Test. Your results are as follows.  
To end the Final Test, proceed to the next page.

Correct answers : 8

Total questions : 8

Percentage : 100%

Proceed

Review

**Congratulations. You passed the test.**

You have completed the **Inverter Basics (Operation) for the FR-800 series** Course.

Thank you for taking this course.

We hope you enjoyed the lessons and the information you acquired in this course will be useful in the future.

You can review the course as many times as you want.

**Review**

**Close**