MITSUBISHI ELECTRIC

FATEC

INVERTER SCHOOL TEXT
INVERTER PRACTICAL COURSE
(DEMONSTRATION MACHINE
OPERATING INSTRUCTION)

● SAFETY PRECAUTIONS ●

(Always read these instructions before the use.)

When designing a system, always read the relevant manuals and give sufficient consideration to safety.
During the training, pay full attention to the following points and handle the equipment correctly.

[Precautions during Training]

⚠ **WARNING**

- Do not touch the terminals while the power is on to prevent an electric shock.
- When opening the safety cover, turn the power off or conduct a sufficient check of safety before operation.
- Do not put your hand in the movable part.

⚠ **CAUTION**

- Follow the instructor's directions during the training.
- Do not remove the units of a demonstration machine or change the wiring without permission.
  Doing so may cause a failure, malfunction, injury and/or fire.
- When the demonstration machine emits an abnormal odor or noise, stop it by pressing the "power supply switch" or "emergency switch".
- When an error occurs, notify the instructor immediately.

CONTENTS

APPENDIX   APP-1

1 ABOUT DEMONSTRATION MACHINE

There is a training kit (the inverter demonstration machine) available, which is to confirm motor performance and inverter controllability/function in the operating condition that a motor is connected to an inverter and a load.
Use the training kit to obtain experiential knowledge in the said contents.

Chapter 1   ABOUT DEMONSTRATION MACHINE

The following items can be confirmed with the inverter demonstration machine.

(1) Difference in torque generated during low-speed operation under the V/F control, the Advanced magnetic flux vector control, and Real sensorless vector control.

(2) Acceleration/deceleration performance in accordance with the load weight

(3) Inverter operation, monitoring (for terminal I/O status, troubleshooting functions), etc. by the interactive parameter unit

(4) Output terminals assignment function

(5) Life diagnosis

1

ABOUT DEMONSTRATION MACHINE

2

CONFIGURATION OF THE DEMONSTRATION MACHINE

3

DESCRIPTION OF THE DEMONSTRATION MACHINE

4

OPERATION METHOD

5

HOW TO USE THE OPERATION PANEL FR-DU07

6

HOW TO USE THE PARAMETER UNIT FR-PU07

7

INVERTER SETUP SOFTWARE

8

EXERCISE

Chapter 2   CONFIGURATION OF THE DEMONSTRATION MACHINE
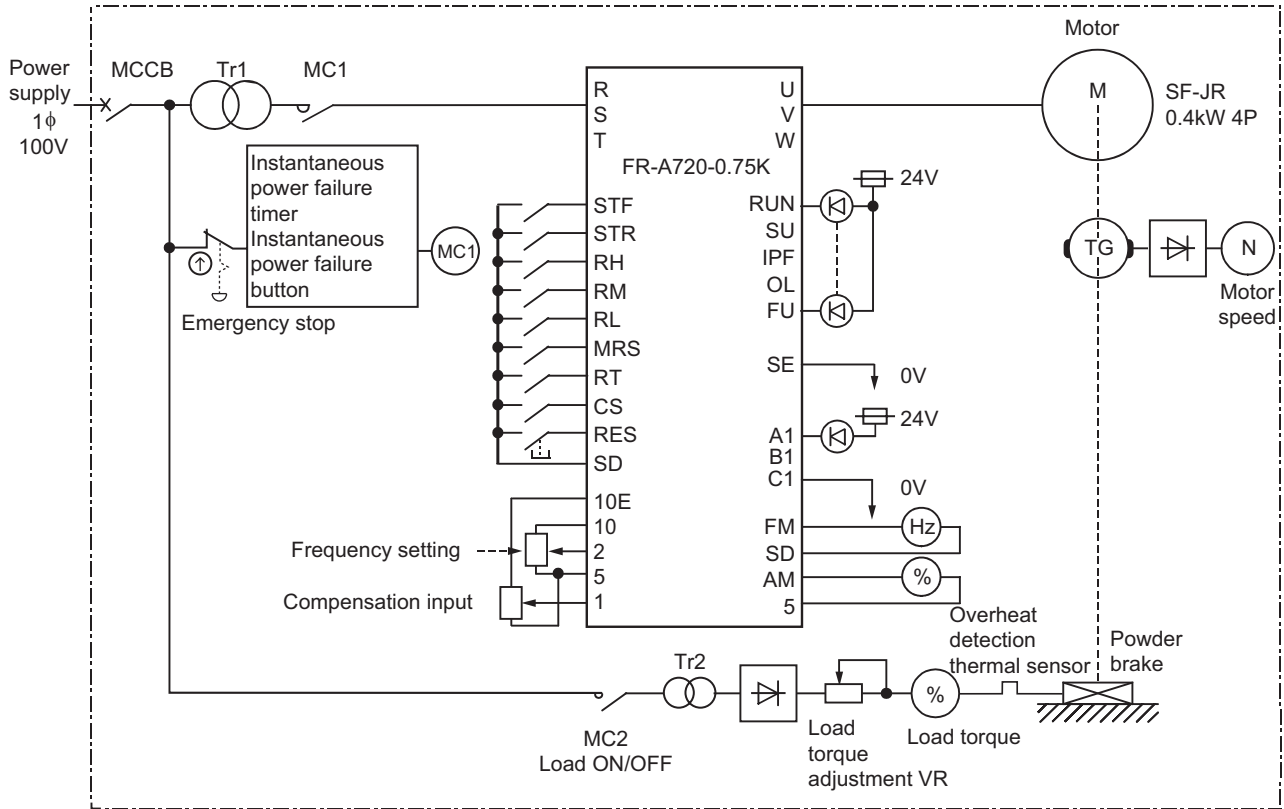
Fig.2.1 Inverter demonstration machine elementary wiring diagram

Chapter 3 DESCRIPTION OF THE DEMONSTRATION MACHINE

3.1 Outer appearance of demonstration machine and names

The following figure shows the configuration around the demonstration machine.

Fig.3.1 Outer appearance of the demonstration machine

1) FM terminal output ....Displays output frequency (pulse output) from the inverter.

2) AM terminal output ....Displays output frequency (analog output) from the inverter.

3) Running RUN..........................Turns ON when output frequency becomes higher than the starting frequency, indicating that the inverter is in operation.

4) Up to frequency SU ....Turns ON when output frequency enters in the range of ±10% of the set frequency, indicating that frequency increase has completed.

5) Instantaneous power failure IPF......................Turns ON when the instantaneous power failure function or the undervoltage protective function is activated, indicating that an instantaneous power failure occurred.

6) Overload OL ....Overload warning. Turns ON when the stall prevention operation is activated.

7) Frequency detection FU ....Turns ON when output frequency reaches or exceeds the optionally set detection frequency, indicating a frequency detection.

8) Fault output ABC......................Turns ON when the inverter's protective function is activated to stop the outputs.

9) Frequency setting
   terminal 2 ....Allows the set frequency to be output with analog voltage.

10) Compensation input
    terminal 1................................Allows extra voltage to be added to the analog voltage set with frequency setting.

11) High speed RH........................Selects high speed from the multi-speed setting. Note that up to seven different speeds are available in combination with middle speed and low speed.

12) Middle speed RM ....Selects middle speed from the multi-speed setting. Note that up to seven different speeds are available in combination with high speed and low speed.

13) Low speed RL ....Selects low speed from the multi-speed setting. Note that up to seven different speeds are available in combination with high speed and middle speed.

14) Second acceleration/
    deceleration RT ....Selects second acceleration/deceleration time.

15) Output stop MRS ....Stops the inverter output.

16) Selection of automatic
    restart after instantaneous
    power failure CS ....When the CS signal is assigned, the inverter restarts automatically at power restoration. (Parameter setting is required for the automatic restart after instantaneous power failure function.)

17) Forward STF ....Forward rotation start signal

18) Reverse STR ....Reverse rotation start signal

19) Inverter reset RES ....Resets the fault output during the protective function activation.

20) Load torque............................Indicates the load torque applied to the motor.

21) Motor speed............................Indicates the motor speed.

22) Load setting ....Sets the load applied to the motor.

23) Load ON/OFF ....A switch to turn on and off the load on the motor.

24) Overheat ....Turns ON when the motor load (powder brake) is overheated.

25) Thermal reset..........................Resets the thermal sensor when the motor load (powder brake) is overheated.

26) Power supply
    Moulded case circuit breaker ..Moulded case circuit breaker for powering ON the demonstration machine.

27) Emergency stop......................Shut off the power in case of emergency.

28) Instantaneous power failure....Shuts off the power supply for the inverter.

29) Instantaneous power
    failure time setting...................Set how long to activate the instantaneous power failure at the emergency stop button ON.

3 DESCRIPTION OF THE DEMONSTRATION MACHINE

3.2 Precautions for use

(1) Set <u>the maximum frequency to 60Hz.</u>

(2) Set <u>the acceleration/deceleration time to one second or longer.</u>
In an exercise in Chapter 8, you will set 0.5s. However, return the setting value to the original (1s or longer) after the exercise.

Technically, frequency can be set higher than 60Hz and acceleration time can be set shorter than 1 second. However, setting those values may damage the machine due to the use of the powder brake, tachogenerator (TG) and timing belt.

(3) <u>Do not leave the demonstration machine for a long time with the Load ON/OFF switch set to ON and the Load setting VR high.</u>

1 ABOUT DEMONSTRATION MACHINE

2 CONFIGURATION OF THE DEMONSTRATION MACHINE

3 DESCRIPTION OF THE DEMONSTRATION MACHINE

4 OPERATION METHOD

5 HOW TO USE THE OPERATION PANEL FR-DU07

6 HOW TO USE THE PARAMETER UNIT FR-PU07

7 INVERTER SETUP SOFTWARE

8 EXERCISE

Chapter 4   OPERATION MODE

4.1   Types of operation modes

A main characteristic of the inverter is the operation with various signals. This Chapter explains about operations (start, stop, speed variation) that can be made with the demonstration machine.

(1) External operation by giving external signals (Pr. 79 = 0, 2)
Operate the inverter with a frequency setting potentiometer or a start switch connected to the control circuit terminal of the inverter.

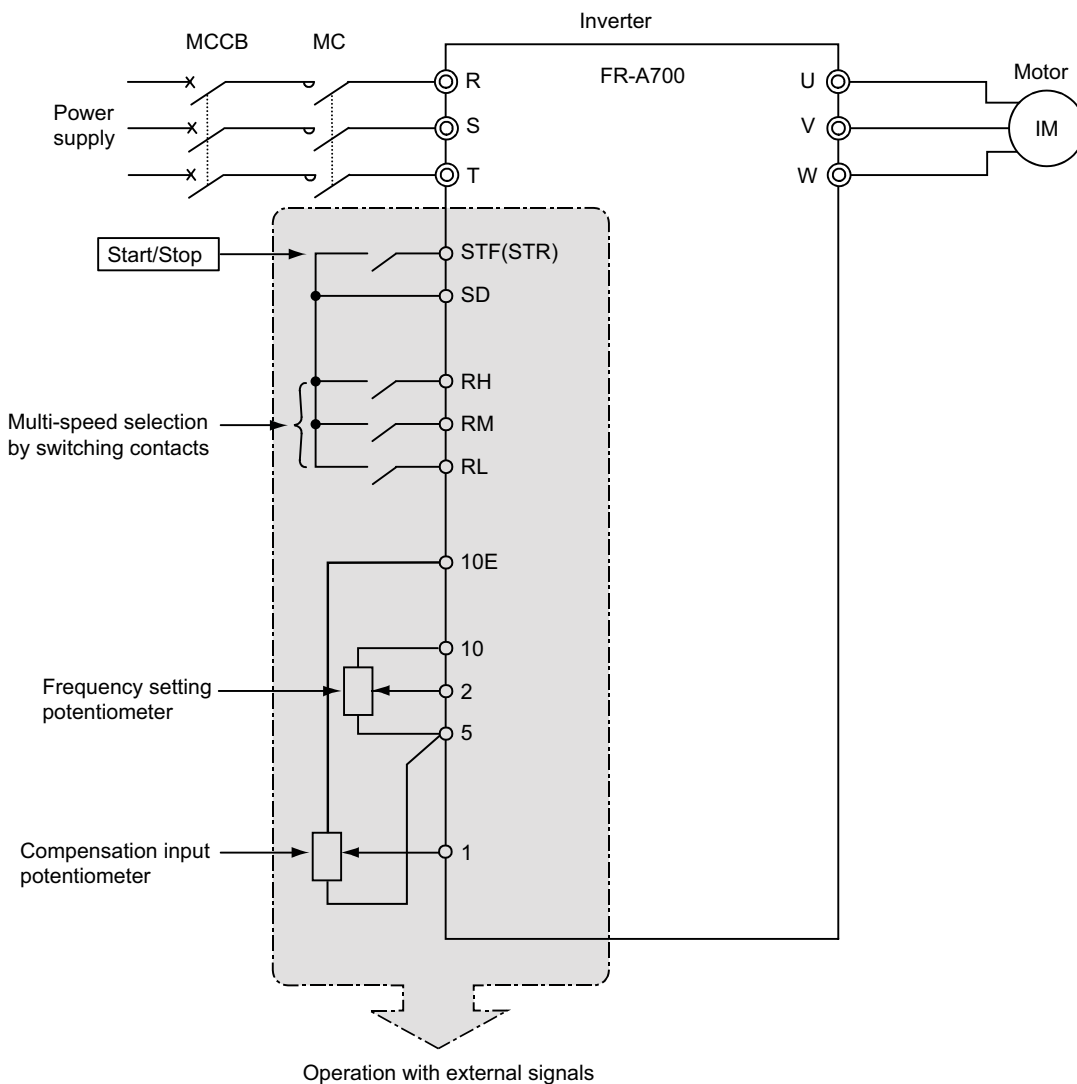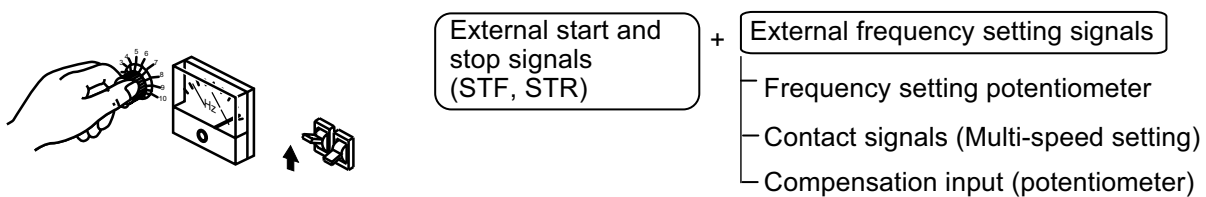External start and stop signals (STF, STR) + External frequency setting signals
├ Frequency setting potentiometer
├ Contact signals (Multi-speed setting)
└ Compensation input (potentiometer)

Operation with external signals

Fig.4.1 External operation mode

4 OPERATION MODE

1 ABOUT DEMONSTRATION MACHINE

2 CONFIGURATION OF THE DEMONSTRATION MACHINE

3 DESCRIPTION OF THE DEMONSTRATION MACHINE

4 OPERATION METHOD

5 HOW TO USE THE OPERATION PANEL FR-DU07

6 HOW TO USE THE PARAMETER UNIT FR-PU07

7 INVERTER SETUP SOFTWARE

8 EXERCISE

(2) PU operation with the operation panel or parameter unit (Pr. 79 = 0, 1)

Only the keys of the operation panel or parameter unit are used.
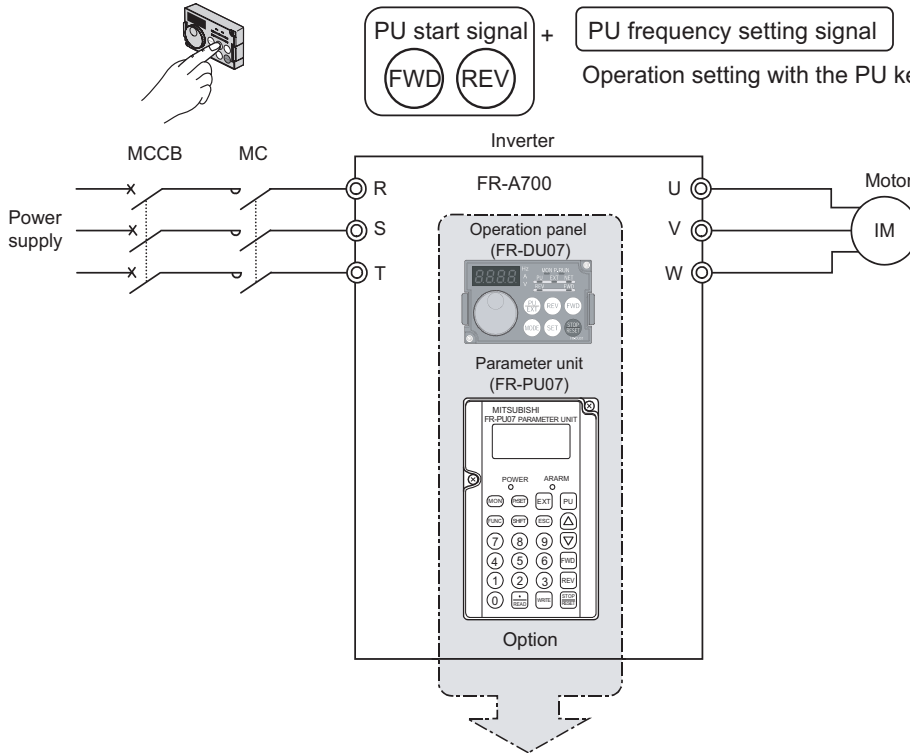
PU operation with the operation panel or parameter unit

Fig.4.2 PU operation mode

(3) External/PU combined operation mode (Pr. 79 = 3 or 4)

Set Pr. 79 = 3 to use the operation panel or parameter unit to input a frequency command and to use an external switch to input a start command.

Set Pr. 79 = 4 to use an external potentiometer or multi-speed switches to input a frequency command and to use the operation panel or parameter unit to input a start command.
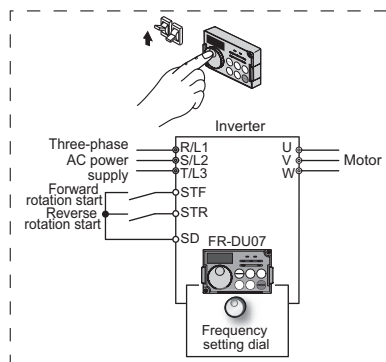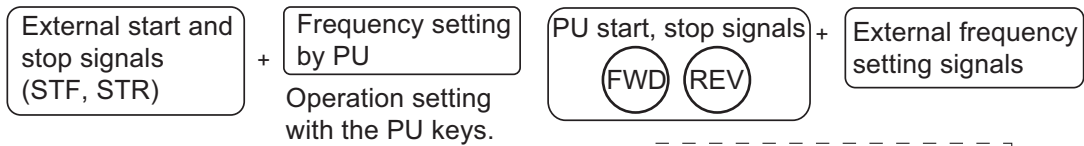

Fig.4.3 External/PU combined operation mode (When Pr. 79 = 3)
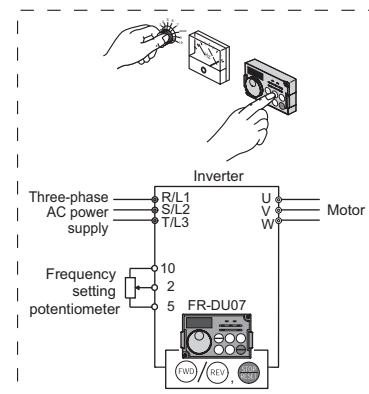
Fig.4.4 External/PU combined operation mode (When Pr. 79 = 4)

4.1 Types of operation modes

7

Chapter 5 HOW TO USE THE OPERATION PANEL FR-DU07

5.1 Basic operation

Operation mode switchover

At power-ON (External operation mode)

PU Jog operation mode

Monitor/frequency setting

**PU operation mode
(output frequency monitor)**

Value change

(Example)

F and frequency flicker.

Frequency setting has been written and completed!!

Output current monitor

Output voltage monitor

Parameter setting

Parameter setting mode

Display the present setting

(Example)

Value change

Parameter and a setting value flicker alternately.

Parameter write is completed!!

Parameter clear

All parameter clear

Faults history clear

Parameter copy

Faults history

[Operation for displaying faults history]

Past eight faults can be displayed.

(The latest fault is ended by ".".)

When no fault history exists, $E \quad 0$ is displayed.

5 HOW TO USE THE OPERATION PANEL FR-DU07

5.2   Parameter setting procedure

This section explains how to change the setting value of Pr. 1 Maximum frequency from 120Hz to 60Hz.

—————— Operation ——————   —————— Display ——————

1. Screen at power-ON
   The monitor display appears.

2. Press (PU/EXT) to choose the PU operation mode.

   PU indicator is lit.

3. Press (MODE) to choose the parameter setting mode.

   The parameter number read previously appears.

4. Turn ⊙ until *P. 1* (*Pr. 1*) appears.

5. Press (SET) to read the present set value. "*120.0*"(initial value) appears.

6. Turn ⊙ to change it to the set value "*60.00*".

7. Press (SET) to set.

   Flicker ⋯ Parameter setting complete!!

   · By turning ⊙ , you can read another parameter.

   · Press (SET) to show the setting again.

   · Press (SET) twice to show the next parameter.

   · Press (MODE) twice to return the monitor to frequency monitor.

☒ Good to know for checking an inverter

Push the setting dial ( ) to display the present set frequency.

5.3　All parameter clear

Set "1" in ALLC parameter clear to initialize all parameters. (Parameters are not cleared when "1" is set in Pr. 77 Parameter write selection.)

──── Operation ────　　　──── Display ────

1. Screen at power-ON
The monitor display appears.

2. Press ⬭(PU/EXT) to choose the PU operation mode.

PU indicator is lit.

3. Press (MODE) to choose the parameter setting mode.

P. 0

(The parameter number read previously appears.)

4. Turn ◉ until *ALLC* (all parameter clear) appears.

ALLC

5. Press (SET) to read the present set value.
"*0*"(initial value) appears.

0

6. Turn ◉ to change it to the setting value "*1*".

1

7. Press (SET) to set.

1 ALLC

Flicker ⋯ Parameter setting complete!!

· Press ◉ to read another parameter.

· Press (SET) to show the setting again.

· Press (SET) twice to show the next parameter.

5 HOW TO USE THE OPERATION PANEL FR-DU07

5.4 Parameter copy

Parameter settings can be copied to multiple inverters.

──── Operation ────　　　　──── Display ────

1. Connect the operation panel to the copy source inverter.
   - **Connect it during a stop.**

2. Press (MODE) to choose the parameter setting mode.

   (MODE) ⇨ $P. \quad 0$　The parameter number previously read appears.

3. Turn ◯ until $PCPY$ (parameter copy) appears.

   ⇨ $PCPY$

4. Press (SET) to read the present set value. "0"(initial value) appears.

   (SET) ⇨ 0

5. Turn ◯ to change it to the setting value "1".

   ⇨ 1

6. Press (SET) to copy the source parameters to the operation panel.

   (SET) ⇨ 1　Flickers for about 30s

   About 30s later ⇨ $1 \quad PCPY$

   Flicker ··· Parameter copy complete!!

7. Connect the operation panel to the copy source inverter.

8. After performing steps 2 to 5, turn ◯ to change it to "2".

   ⇨ 2

9. Press (SET) to write the parameters copied to the operation panel to the destination inverter.

   (SET) ⇨ 2　The frequency flickers for about 30s

10. When copy is completed, "2" and "$PCPY$" flicker.

    ⇨ $2 \quad PCPY$

    Flicker ··· Parameter copy complete!!

11. After writing the parameter values to the copy destination inverter, always reset the inverter, e.g. switch power off once, before starting operation.

1 ABOUT DEMONSTRATION MACHINE
2 CONFIGURATION OF THE DEMONSTRATION MACHINE
3 DESCRIPTION OF THE DEMONSTRATION MACHINE
4 OPERATION METHOD
5 HOW TO USE THE OPERATION PANEL FR-DU07
6 HOW TO USE THE PARAMETER UNIT FR-PU07
7 INVERTER SETUP SOFTWARE
8 EXERCISE

Chapter 6　HOW TO USE THE PARAMETER UNIT FR-PU07

6.1　Appearance and names of the FR-PU07

Front

POWER lamp
Lit when the power turns ON.

Monitor
- Liquid crystal display (16 characters × 4 lines with backlight)
- Interactive parameter setting
- Help function
- Trouble shooting guidance
- Monitor (frequency, current, power, etc.)

ALARM lamp
Lit to indicate an inverter alarm occurrence.

Operation keys

Rear

Connector
Connector to the inverter. Connects directly to PU connector of the inverter.

Connector for PU cable
Connects using the connection cable (FR-CB2□□).

Rating plate

Bottom

Fig.6.1 Outer appearance of FR-PU07

6.2 Parameter setting procedure
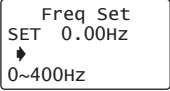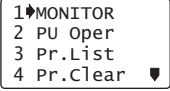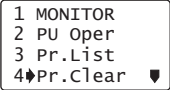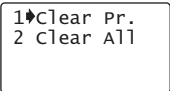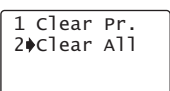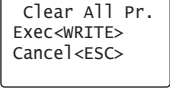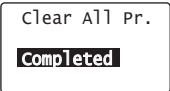
This section explains how to change the setting value of Pr. 8 Deceleration time from 5s to 180s.

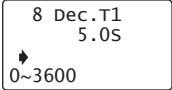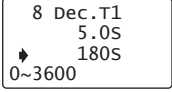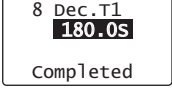| Step	Operation Procedure	Display
1	**Press** PU . The frequency setting screen appears, and operation mode changes to PU operation mode. (You need not press PU when the parameter unit is already in the PU operation mode.)	```Freq Set``` ```SET 0.00Hz``` ```0~400Hz```
2	**Press** PrSET . The parameter unit is in the parameter setting mode.	```SETTING MODE``` ```0~9:Ser Pr.NO.``` ```Select Oper ▼```
3	**Press** 8 . Enter the desired parameter number.	```SETTING MODE``` ```Pr.NO.``` ``` 8``` ```<READ> ▼```
4	**Press** READ . The present setting appears.	```8 Dec.T1``` ``` 5.0S``` ```0~3600```
5	**(1)Direct setting** **Press** 1 8 0 .* Enter the desired value. Or **(2)Step setting** **Press** ▲ ▼ . Display "180" using ▲ ▼ .	```8 Dec.T1``` ``` 5.0S``` ``` 180S``` ```0~3600```
6	**Press** WRITE . The set value is changed.	```8 Dec.T1``` **```180.0S```** ```Completed```
7	Press SHIFT to display the next parameter.	```9 Set THM``` ``` 2.55A``` ```0~500```

*   If you entered an incorrect value, press ESC to return to the pre-entry state.

6.3   All parameter clear

Perform an all parameter clear to return all parameter setting values to the initial values.
(Parameters are not cleared when Pr. 77 Parameter write selection = "1".)

Step	Operation Procedure	Display
1	**Press** PU **.** The frequency setting screen appears, and operation mode changes to PU operation mode. (You need not press PU when the parameter unit is already in the PU operation mode.)	```Freq Set\nSET 0.00Hz\n⬇\n0~400Hz```
2	**Press** FUNC **.** The function menu is called.	```1⬇MONITOR\n2 PU Oper\n3 Pr.List\n4 Pr.Clear ⬇```
3	Using ▲/▼, move the cursor to "4 Pr. Clear".	```1 MONITOR\n2 PU Oper\n3 Pr.List\n4⬇Pr.Clear ⬇```
4	**Press** READ **.** The parameter menu appears.	```1⬇Clear Pr.\n2 Clear All```
5	**Select the "Clear All".** Using ▲/▼, move the cursor to "2 Clear All" and press the READ.	```1 Clear Pr.\n2⬇Clear All```
6	"Clear All" is selected, and the confirmation screen for clearing execution is displayed.	```Clear All Pr.\nExec<WRITE>\nCancel<ESC>```
7	**Press** WRITE **.** The parameters are initialized. When canceling the initialization, press ESC on the confirmation screen.	```Clear All Pr.\n\nCompleted```

6.4 Parameter unit operation (PU operation)

Use the keys on the parameter unit to operate an inverter.
This section explains how to change the set frequency from 0Hz to 60Hz.

Step	Operation Procedure	Display

1	**Press** `PU`.
	The frequency setting screen appears.
		`Freq Set`
		`SET  0.00Hz`
		`♦`
		`0~400Hz`

2	**Press** `6` **and** `0`.
	Enter 60Hz. *
		`Freq Set`
		`SET  0.00Hz`
		`♦   60.00Hz`
		`0~400Hz`

3	**Press** `WRITE`.
	The 60Hz setting is completed.
		`Freq Set`
		`SET ` **60.00Hz**
		
		`Completed`

4	Press `FWD`/`REV` to perform forward or reverse rotation with the set frequency.	`READ:List`
		`60.00`Hz
		`STF FWD  PU`

5	**Press** `STOP RESET`.
	The motor is decelerated to a stop.
		`READ:List`
		`0.00`Hz
		`--- STOP PU`

* If you entered an incorrect value, press `ESC` to return to the pre-entry state.

⊠ Good to know for checking an inverter

Press `PU` to call the frequency setting screen and to change the set frequency.

1 ABOUT DEMONSTRATION MACHINE

2 CONFIGURATION OF THE DEMONSTRATION MACHINE

3 DESCRIPTION OF THE DEMONSTRATION MACHINE

4 OPERATION METHOD

5 HOW TO USE THE OPERATION PANEL FR-DU07

6 HOW TO USE THE PARAMETER UNIT FR-PU07

7 INVERTER SETUP SOFTWARE

8 EXERCISE

6.5   External operation

Use the switches on the demonstration machine to operate the inverter.

Step	Operation Procedure	Display
1	**Press** EXT **.** The operation mode indicator indicates EXT, and the External operation mode is selected.	READ:List 0.00 Hz --- STOP EXT
2	Enter the external frequency command. Select the multi-speed signal or turn the frequency setting potentiometer.*	Running frequency High speed / Middle speed / Low speed ON or
3	**Set the start switch (STF or STR) to ON.** The operation command indication changes to "STF" or "STR" and the operation status indication changes to the output (FWD or REV) indication. •If the forward and reverse rotation switches are both set to ON, the inverter will not start. Also, if these switches are both set to ON during operation, the motor is decelerated to a stop.	Start Forward / Reverse ON 60.00 Hz READ :List STF FWD EXT
4	**Set the start switch (STF or STR) to OFF.** The motor stops running.	Stop Forward / Reverse OFF Stop

*   When a frequency command from a potentiometer is input while a multi-speed setting signal is being input, the multi-speed setting frequency is used.

6.6 Monitor

The monitoring list appears and you can change from one monitor screen to another and set the first priority screen.

Step	Operation Procedure	Display
1	**Press (FUNC).** The function menu is called.	1▶MONITOR 2 PU Oper 3 Pr.List 4 Pr.Clear ▼
2	**Make sure that the cursor is located at "1 MONITOR".** If not, move the cursor with (▲)/(▼).	
3	**Press ⟨READ⟩.** The monitoring list is called.	1▶Frequency 2 Current 3 Voltage 4 Alarm His ▼
4	**Press (▲) or (▼) to move the cursor to the desired item.** Hold down (SHIFT) and press (▲)/(▼) to shift one screen.	1 Frequency 2▶Current 3 Voltage 4 Alarm His ▼
5	**Press ⟨READ⟩.** The monitor screen selected by the cursor appears. Press ⟨WRITE⟩ to give the first priority to this monitor screen.	READ:List 0.00 A --- STOP PU

☒ Good to know for checking an inverter

The monitoring list can be called only with pressing ⟨READ⟩ in the monitoring mode.

6.7 Frequency meter calibration

This section provides the way to calibrate the full-scale of meter connected to terminal FM using the parameter unit.

● Calibrating the meter at the running frequency of 60Hz

Step	Operation Procedure	Display
1	**Press** `PU`. The frequency setting screen appears, and operation mode changes to PU operation mode.	``` Freq Set SET 0.00Hz ⬥ 0~400Hz ```
2	**Press** `PrSET`. The parameter unit is in the parameter setting mode.	``` SETTING MODE 0~9:Ser Pr.NO. Select Oper ▼ ```
3	**Enter** `9` `0` `0` **and press** `·/READ`. The preset frequency is displayed.	``` 900 FM Tune ▲ Run Inverter ⬥ 0.00Hz PU ```
4	**Enter** `6` `0` **and press** `WRITE`. 60Hz is set.	``` 900 FM Tune ▲ Run Inverter 60Hz PU ```
5	**Press** `FWD`. Forward rotation is performed at 60Hz. You need not connect the motor.	``` 900 FM Tune MntrF 60.00Hz ⬥▼▲⬥ <WRITE>PU ```
6	**Using** `▲`/`▼`, **adjust the meter pointer to a predetermined position.** The meter pointer moves. (It takes a long time before the pointer moves.)	
7	**Press** `WRITE`. Calibration is completed.	``` 900 FM Tune Completed <MONITOR> ```
8	**Press** `MON` to return to the main monitor screen.	``` READ:List 60.00 Hz STF FWD PU ```

6.8 Parameter copy

The setting values of up to 3 inverters can be copied.

●Reading the parameter settings of the inverter and storing them to FR-PU07

Step	Operation Procedure	Display
1	Connect the FR-PU07 to the copy source inverter.	
2	**Press (FUNC).** The function menu appears.	1▶MONITOR 2 PU Oper 3 Pr.List 4 Pr.Clear ▼
3	**Select the "PRCpy set".** Using (▲)/(▼), move the cursor to "12 PRCpy set" and press [READ].	9 S/W ▲ 10 Selectop 11 Option 12▶PRCpy set
4	**Select the copy area.** The copy area selection screen is displayed. Then, move the cursor to any one of 1 to 3 and press [READ]. (Parameter settings of each inverter (three inverters in total) can be copied to the area 1, 2 or 3.)	1▶Copy area 1 2 Copy area 2 3 Copy area 3
5	**Select the "Read VFD".** Using (▲)/(▼), move the cursor to "1 Read VFD" and press [READ].	Copy area 1 1▶Read VFD 2 Write VFD 3 Verifing
6	**Give a name.** You can name each of copy areas 1 to 3. Select the characters with (▲)/(▼) and set them with [READ]. Press [WRITE] to set the name for the area.	Name:█12 ▲▼:Select Char READ:Decide Char WRITE:DecideName
7	**Write to the copy area of FR-PU07.** The screen for confirming the overwriting of the data in the FR-PU07 is displayed.	012 Overwrite area 1 WRITE:Executing ESC:Cancel
8	**Press [WRITE].** The parameter settings of the inverter are stored. When canceling, press (ESC).	Param Copy **Reading** Completed

1 ABOUT DEMONSTRATION MACHINE

2 CONFIGURATION OF THE DEMONSTRATION MACHINE

3 DESCRIPTION OF THE DEMONSTRATION MACHINE

4 OPERATION METHOD

5 HOW TO USE THE OPERATION PANEL FR-DU07

6 HOW TO USE THE PARAMETER UNIT FR-PU07

7 INVERTER SETUP SOFTWARE

8 EXERCISE

●Writing the parameter setting stored in FR-PU07 to the inverter

Step	Operation Procedure	Display
1	Connect the FR-PU07 to the copy destination inverter.	

2	**Press (FUNC).**
	The function menu appears.
		```1▸MONITOR```
		```2 PU Oper```
		```3 Pr.List```
		```4 Pr.Clear ▾```

3	**Select the "PRCpy set".**
	Using (▲)/(▼), move the cursor to "12 PRCpy set"
	and press [READ].
		```9 S/W ▴```
		```10 Selectop```
		```11 Option```
		```12▸PRCpy set```

4	**Select the copy area.**
	Point the cursor to the copy area that stores the
	parameter settings to be written to the inverter, and
	press [READ].
		```1▸Copy area 1```
		```2 Copy area 2```
		```3 Copy area 3```

5	**Select the "Write VFD".**
	Using (▲)/(▼), point the cursor to "2 Write VFD" and
	press [READ].
		```Copy area 1```
		```1 Read VFD```
		```2▸Write VFD```
		```3 Verifing```

6	Writing the parameter settings is selected, and the
	confirmation screen for writing is displayed.
		``` 012```
		```Area 1 to VFD```
		```WRITE:Executing```
		```ESC:Cancel```

7	**Press [WRITE].**
	The parameter settings stored in the FR-PU07 are copied
	to the copy destination inverter.
		```Param Copy```
		``` Writing```
		``` Completed```
		```Please Reset```

8	Reset the inverter.	

Chapter 7   INVERTER SETUP SOFTWARE

FR Configurator (FR-SW3-SETUP-WJ)
This software is an effective support tool for startup and maintenance of the Mitsubishi inverter.
Parameter setting and monitoring are easily performed on Windows personal computer screen.

7.1   Functions

- Startup (Desired function can be performed soon after starting up of this software)
- Easy Setup (From station number setting to parameter setting, setting with wizard style dialog (interactive) is available)
- Setting Wizard (Function setting without regard to parameter number)
- Tuning (Available from Setting Wizard. Only for the inverters that come with the tuning function.)
- Troubleshooting (Estimating cause and countermeasures at trouble occurrence)
- Parameter List (Displaying parameter list, functional list, initial value change list and editing and setting of the parameters are available)
- Convert (Parameter settings of a conventional inverter model can be transferred to a 700 series inverter)
- Diagnosis (Displaying faults history and parts life, and measuring main circuit capacitor life)
- Graph (Monitoring by High Speed sampling or Monitor sampling, and displays in graph form)
- Batch Monitor (Displaying monitor items of the inverter at the same time)
- I/O Terminal Monitor (Monitoring the state of the input and output terminals)
- I/O Terminal Assignment (Signal assignment of the input and output terminals)
- Test Operation (Send a start/stop command, or change the set frequency as if using the operation panel of the inverter)
- Machine Analyzer (Resonance point and anti-resonance point of the machine system can be obtained (For FR-A700, with vector control))
- Help (Instruction manual of the inverter and this software can be displayed in a window)

7.2   Screen examples

Fig.7.1 Screen example of the convert function
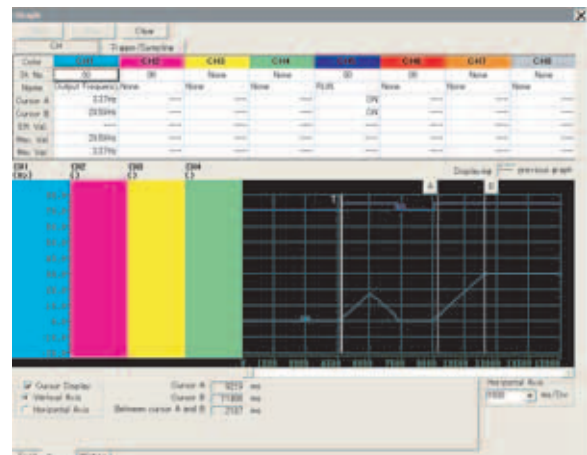
Fig.7.2 Screen example of the graph display

7.3 System configuration

The following devices are required to use FR Configurator. Setup the system in accordance with the instruction manual of each device.
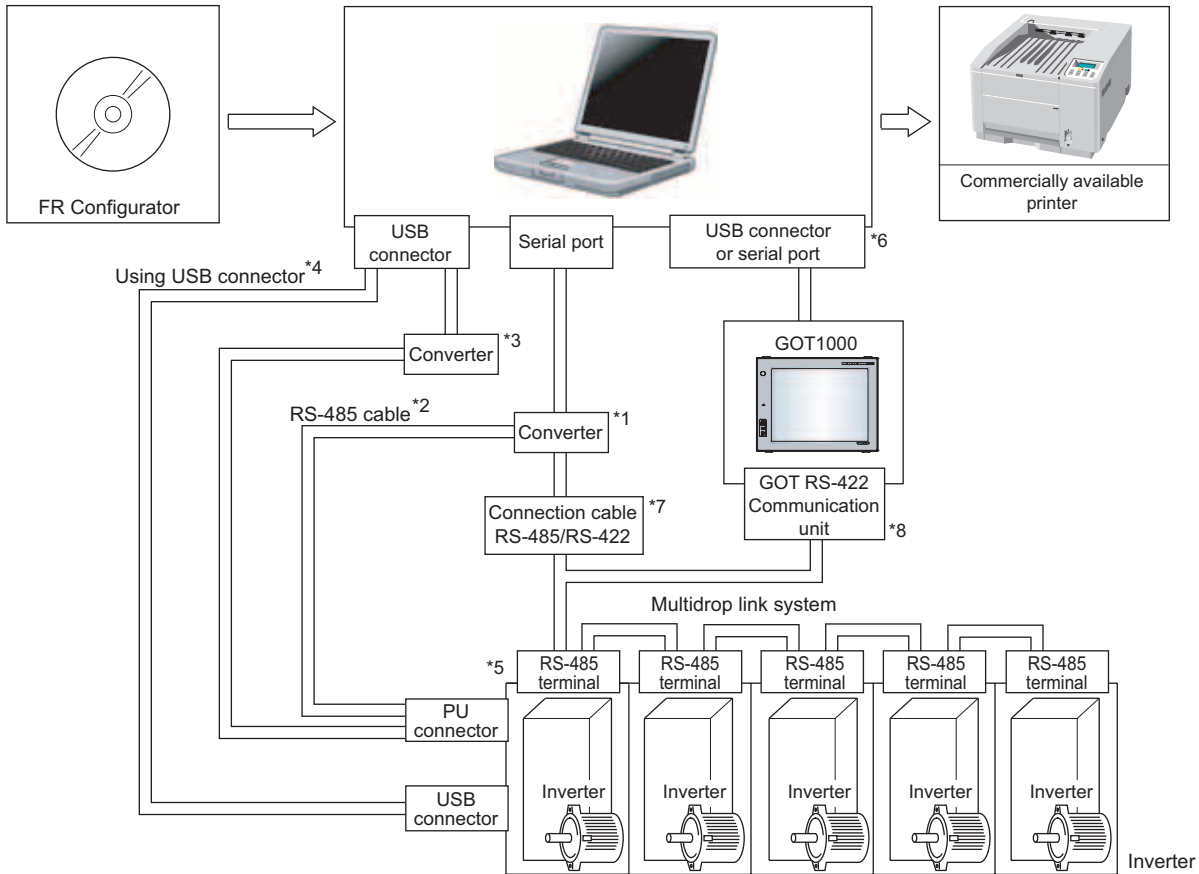
*1: When using serial port of a personal computer, a commercially available converter is required.
<Examples of product available on the market> (as of January 2010)
Model: DINV-CABV (with connectors and cable)
Diatrend Corp.

The converter cable cannot connect two or more inverters. (The computer and inverter are connected on a 1:1 basis). This is a RS-232C/RS-485 conversion cable with built-in converter. No additional cable or connector is required. Contact a maker for details of the product.

*2: Connection cable
<Examples of product available on the market> (as of January 2010)

Connector: RJ45 connector
Example: Tyco Electronics
5-554720-3

Cable: Cable in compliance with EIA568 (such as 10BASE-T cable)
Example: Mitsubishi Cable Industries, Ltd.
SGLPEV-T (Cat5e/300m) 24AWG x 4P

*3: USB/RS-485 convert cable
<Examples of product available on the market> (as of January 2010)

Model: DINV-U4
Diatrend Corp.

When using USB/RS-485 conversion cable, use the newest driver software. For a product details or the newest driver software, contact the cable manufacturer.

*4: Recommended USB cable for computer-inverter connection (For FR-E700)
<Examples of product available on the market> (as of January 2010)
Connector for personal computer   Connector for inverter
A-connector   mini-B-connector (5 pin)

*5: Communication with PU connector, RS-485 terminal, or USB connector (FR-A700, A701, B, B3, E700 series only) is available.

*6: Available communication port is USB or serial port (one of port 1 to 63), and set in communication settings screen of FR Configurator. (Using multiple ports at the same time is unavailable) Connection of a computer to GOT is 1:1 connection. When using USB for connecting with GOT, use dedicated cable GT09-C30USB-5P or GT09-C20USB-5P.

*7: Overall length of connection cable: 500m

*8: GOT RS-422 communication unit (GT15-RS4-9S) is required. The number of connectable inverter depends on GOT. Refer to GOT1000 series connection manual for details of RS-422 connection and compatible version of GOT.

	Product	Type	Maker
1)	Communication cable	SGLPEV-T (Cat5e/300m) 24AWG x 4P	Mitsubishi Cable Industries, Ltd.
2)	RJ-45 connector	5-554720-3	Tyco Electronics

7 INVERTER SETUP SOFTWARE

[Connection example of the USB cable and the USB connector]

USB cable

USB connector

Removal of cover
Place a flathead screwdriver, etc.
in a slot and push up the cover to open.
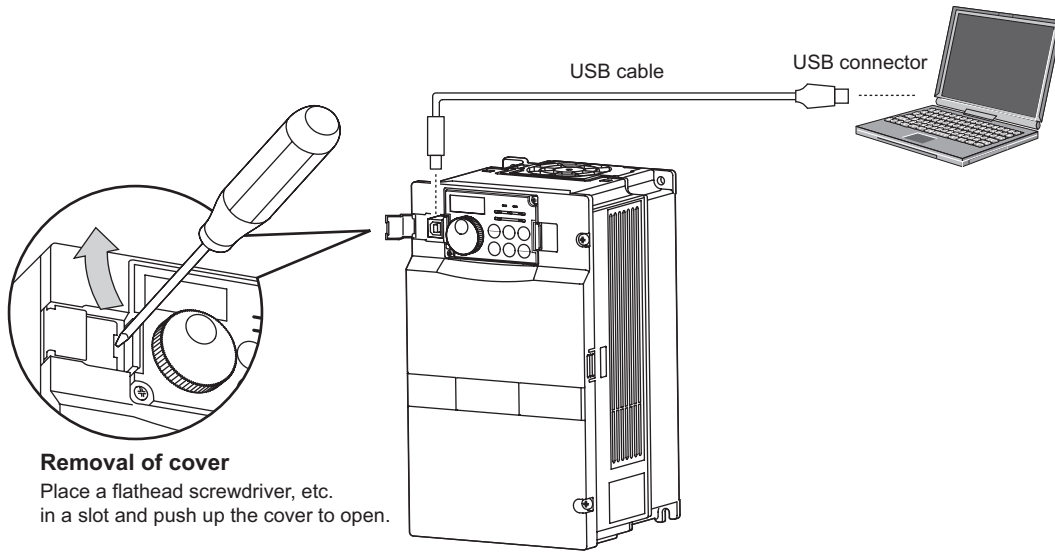
Connecting the demonstration machine

For the training, use a USB cable to connect the inverter to a personal computer.

1 ABOUT DEMONSTRATION MACHINE

2 CONFIGURATION OF THE DEMONSTRATION MACHINE

3 DESCRIPTION OF THE DEMONSTRATION MACHINE

4 OPERATION METHOD

5 HOW TO USE THE OPERATION PANEL FR-DU07

6 HOW TO USE THE PARAMETER UNIT FR-PU07

7 INVERTER SETUP SOFTWARE

8 EXERCISE

7.4 Startup

(1) Operation mode setting

Select an operation mode appropriate to operate the inverter with FR Configurator (parameter change, auto tuning, test operation). Select an operation mode from the tool bar.

Connecting method		Operation mode *1	Parameter setting *2 (For the FR-A700 series)	
Directly controlling the inverter from FR Configurator	PU connector RS-485 connector	PU	Pr. 122 PU communication check time interval ≠ 0 (initial value = 9999) Pr. 123 PU communication waiting time setting = 9999 (initial value)	
	RS-485 terminal	PU	Pr. 551 PU mode operation command source selection = 2 (initial value)	Pr. 336 RS-485 communication check time interval ≠ 0
		LINK	Pr. 551 PU mode operation command source selection = 1	Pr. 337 RS-485 communication waiting time setting = 9999 (initial value)
	USB connector	PU	Pr. 548 USB communication check time interval ≠ 0 (initial value = 9999) Pr. 551 PU mode operation command source selection = 3	
Controlling the inverter via GOT	PU connector (RS-485 connector)	PU	Pr. 123 PU communication waiting time setting = 0 Pr. 551 PU mode operation command source selection = 2 (initial value)	
	RS-485 terminal	PU	Pr. 551 PU mode operation command source selection = 2 (initial value)	Pr. 336 RS-485 communication check time interval ≠ 0
		LINK	Pr. 551 PU mode operation command source selection = 1	Pr. 337 RS-485 communication waiting time setting = 0

*1 Set to the following operation mode to use FR Configurator to write parameters and to input operation commands.

*2 The setting value of Pr. 551 is applied at power-ON or at inverter reset.

Demonstration machine setting

A USB cable is used for the training. Make the settings of the shaded area in the table above.

1) Operate the inverter under PU operation mode.

2) Set Pr. 551 = 3.

   (The Pr. 548 = 9999 (initial value) setting can be used as it is.)

3) Turn off, then turn on the power supply.

---

7 INVERTER SETUP SOFTWARE

1 ABOUT DEMONSTRATION MACHINE

2 CONFIGURATION OF THE DEMONSTRATION MACHINE

3 DESCRIPTION OF THE DEMONSTRATION MACHINE

4 OPERATION METHOD

5 HOW TO USE THE OPERATION PANEL FR-DU07

6 HOW TO USE THE PARAMETER UNIT FR-PU07

7 INVERTER SETUP SOFTWARE

8 EXERCISE

(1) System Setting

"Startup" window is displayed when FR Configurator is started.
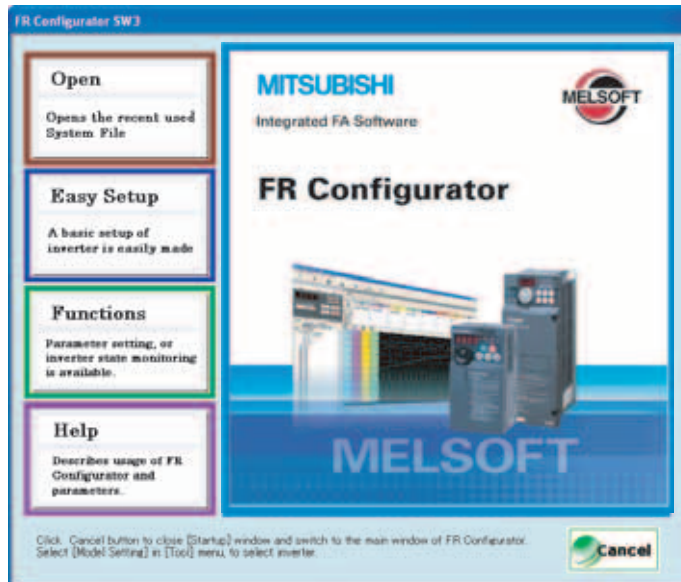
(a) Input information for creating a system file.

Type a system name (up to 32 one byte characters) for this system file. Click [Next>] after inputting the system name. When [Next>] is clicked, the screen proceeds to "Communication Setting".
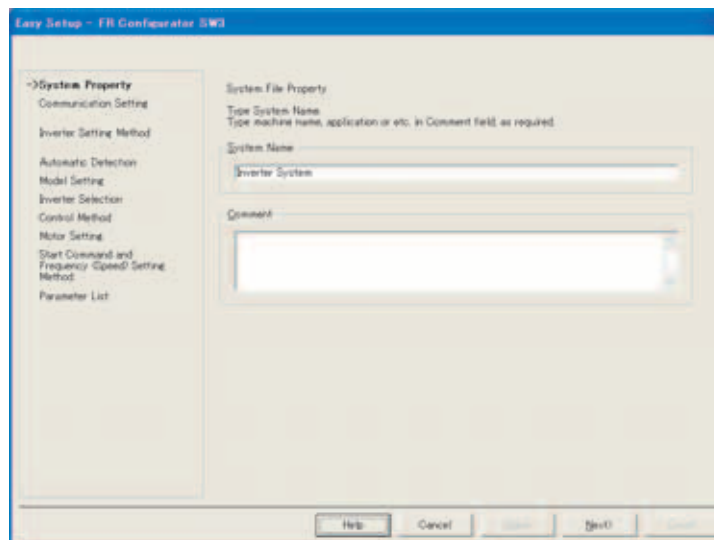
(b) Adjust the communication setting between a personal computer and inverter.
When communicating with inverter using an USB port of the personal computer, select

"USB" in "PC side Port" field, and click [Next>] .

When communicating with inverter using a serial port of the personal computer, select "RS-232C" in "PC side Port" field.

☒ POINTS for understanding !

Default communication setting is matching to an initial value of inverter.
Check the personal computer side port (RS-232C/USB) and personal computer port number (1 to 63).
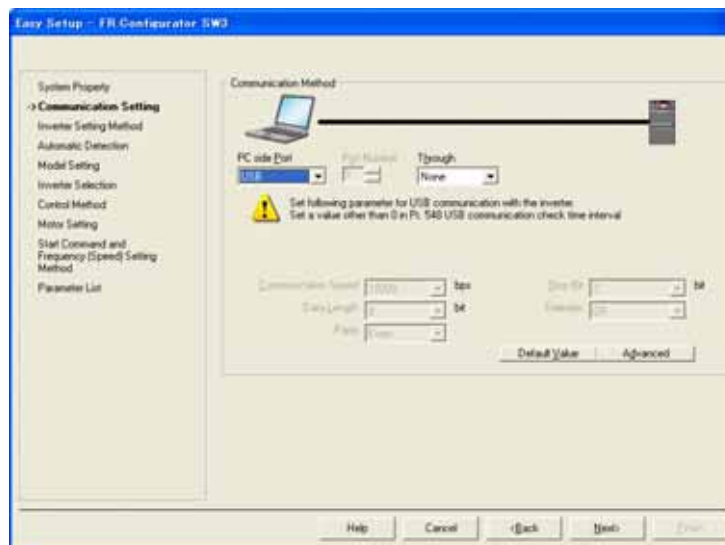
Demonstration machine setting

For the PC side Port, select USB. Other items can be used without any change.

7 INVERTER SETUP SOFTWARE

(c) Select inverter setting method between automatic recognition of the connected inverter, or manually model setting for this system.
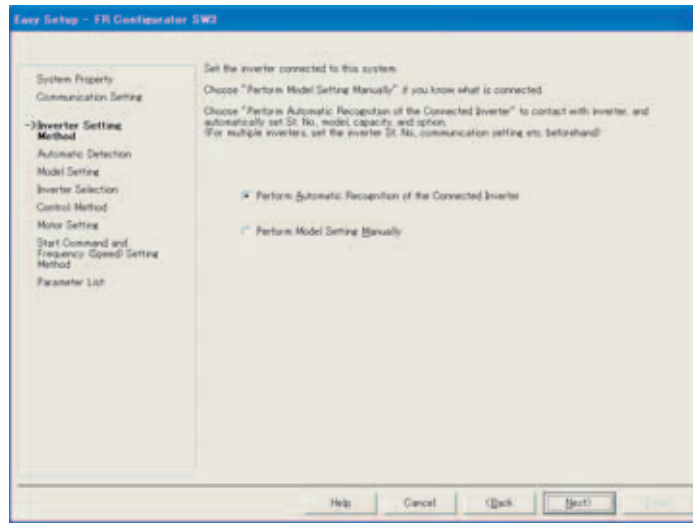
1 ABOUT DEMONSTRATION MACHINE

2 CONFIGURATION OF THE DEMONSTRATION MACHINE

3 DESCRIPTION OF THE DEMONSTRATION MACHINE

4 OPERATION METHOD

5 HOW TO USE THE OPERATION PANEL FR-DU07

6 HOW TO USE THE PARAMETER UNIT FR-PU07

7 INVERTER SETUP SOFTWARE

8 EXERCISE

When the automatic detection is selected

Click [Start] to detect inverter of which communication is available.

When the automatic detection of the inverter is completed, proceed to "Inverter Selection" screen.
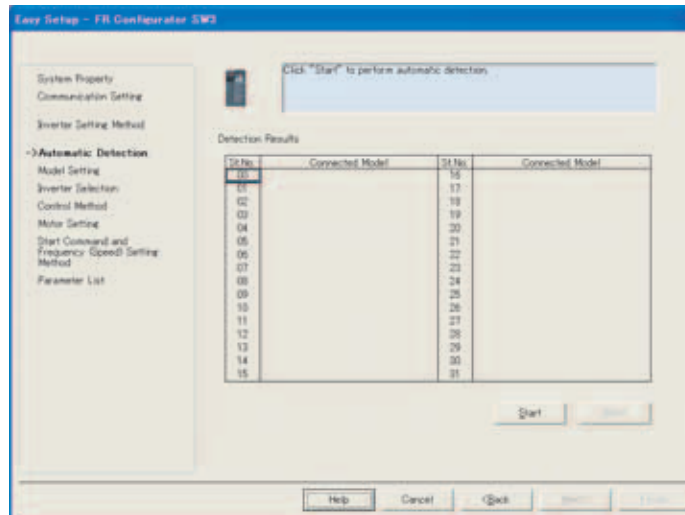
When the manual model setting is selected

Set the station number, model, capacity, and plug-in option.

Demonstration machine setting

Set "00" to St. No., "FR-A720" to the model, "0.75" to the capacity, and "nothing (blank)" to the option connectors 1 to 3. Then, click [Next] to proceed to "Inverter Selection".

(d) Click [Register System Setting] to register the system setting, and then parameter setting becomes available.

Choose an inverter (station number) for parameter setting, and click [Next>]. After parameter setting is finished, the window returns to "Inverter Selection" again.

Click [Finish] to close Easy Setup, and proceed to the Main frame window.

The system setting is completed.
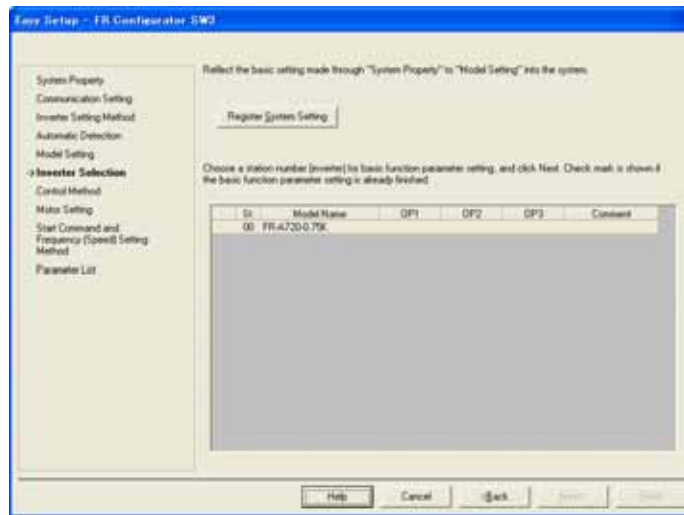
Demonstration machine setting

Make no parameter setting here. Click [Register System Setting] to apply the model setting to the system, then click [Finish].

After the following message appears, click [Yes].
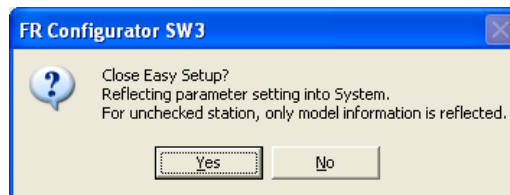
Chapter 8   EXERCISE

8.1   Basic tasks before starting up an inverter

(1) Clear all parameters (when using an inverter that has previously been used) (Done)

(2) Check input and output signals (sequence check)
The signals assigned to the control circuit terminals and their ON/OFF statuses are displayed.

Step	Operation Procedure	Display
1	**Press (FUNC).** The function menu is called.	1▸MONITOR 2 PU Oper 3 Pr.List 4 Pr.Clear ▼
2	**Using (▲)/(▼), move the cursor to "10 Selectop".** Hold down (SHIFT) and press (▲)/(▼) to shift one screen.	9 S/W ▲ 10▸Selectop 11 Option 12 PRCpy set
3	**Press (•/READ).** The signals assigned to the control circuit terminals and their ON-OFF states are displayed.	RL : 0 □ RM : 1 □ RH : 2 □ RT : 3 □ ▼

Indicates Pr.178 to Pr.196

Indicates terminal

Indicates signal is ON
Indicates signal is OFF

Indicates that no function is assigned
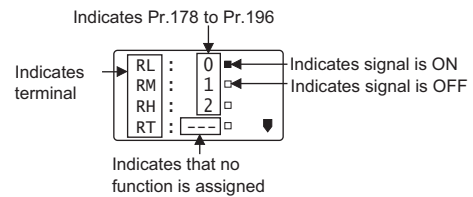
(3) Set the basic parameters
Examples:

1) Maximum frequency (Pr. 1) = 60Hz

[PU] (PrSET) (1) [•/READ] (6) (0) [WRITE]

2) Electronic thermal O/L relay (Pr. 9) = 2.0A

[PU] (PrSET) (9) [•/READ] (2) [•/READ] (0) [WRITE]

3) Frequency setting signal gains (Pr. 125) = 60Hz
   (The initial value is 60Hz. No change is required.)

[PU] (PrSET) (1) (2) (5) [•/READ] (6) (0) [WRITE]

(4) Calibrate the frequency meter (Done)

8 EXERCISE

1
ABOUT DEMONSTRATION MACHINE

2
CONFIGURATION OF THE DEMONSTRATION MACHINE

3
DESCRIPTION OF THE DEMONSTRATION MACHINE

4
OPERATION METHOD

5
HOW TO USE THE OPERATION PANEL FR-DU07

6
HOW TO USE THE PARAMETER UNIT FR-PU07

7
INVERTER SETUP SOFTWARE

8
EXERCISE

8.2   Operation of inverter (principle-related matter)

(1) Confirming the behavior of inverter DC voltage (V/F control)
Find out how the DC voltage in the inverter changes in the following conditions. Read the DC voltage value on the monitor.

Operating condition	DC voltage Vdc (V)	Reference value
1) When an inverter is at a stop		313V
2) During operation at 60Hz (without load)		303V
3) During operation at 60Hz (with 100% load)		290V

Operation procedure [PU] [FUNC]
```
1▶MONITOR
2 PU Oper
3 Pr.List
4 Pr.Clear  ▼
```
[·READ] [▲]/[▼]
Key operation
```
5 F Command ▲
6 RPM
7 shaft Trq
8▶DC Link   ▼
```
[·READ]

(2) Regenerative overvoltage
Check how the DC voltage behaves in the condition that the motor decelerates to a stop from the speed of 60Hz in the deceleration time of 1.0 seconds. (Display the peak Vdc on the monitor.)

	DC voltage Vdc(V)
1) Without load	
2) With 100% load	

Operation procedure [PU] [FUNC]
```
1▶MONITOR
2 PU Oper
3 Pr.List
4 Pr.Clear  ▼
```
[·READ] [▲]/[▼]
Key operation
```
 9 Br.Duty % ▲
10 Therm 0/L
11 Peak I
12▶DC Peak V ▼
```
[·READ]

After the operation is finished, set the deceleration time back to the initial setting.

(3) Confirming output voltage (V/F control)
Confirm output voltage with the torque boost (Pr. 0) set to 6%. Use a monitor function to read output voltage.

[PU] [MON] [SHIFT] [SHIFT]
```
        READ:List
   0.00v
--- STOP PU
```

Monitored value 1) .... When "9999" is set in Pr. 19
Monitored value 2) .... When the value of power supply voltage is set in Pr. 19 (output voltage is 200V during operation at 60Hz)

[PU] [PrSET] [1] [9] [·READ] [2] [0] [0] [WRITE]

Output frequency (Hz)	Monitored value 1) (V)	Monitored value 2) (V)
6		
10		
20		
30		
50		
60		

8 EXERCISE

8.3 Torque boost function and Real sensorless vector function (Confirming operations of V/F control and Real sensorless vector control)

(1) Check the current and voltage changes at different torque boost settings under V/F control.
Calculate output current and output voltage when the setting of the torque boost is changed.

1) Use the multi-speed signals under External operation mode, and operate at each frequency.

Parameter setting		Pr. 24 = 6Hz	Pr. 6 = 10Hz	Pr. 25 = 20Hz	Pr. 5 = 30Hz	Pr. 26 = 40Hz	Pr. 27 = 50Hz	Pr. 4 = 60Hz
Terminal input	RL	**ON**	**ON**	**ON**	OFF	OFF	**ON**	OFF
	RM	**ON**	OFF	OFF	**ON**	**ON**	**ON**	OFF
	RH	OFF	OFF	**ON**	OFF	**ON**	**ON**	**ON**

Conditions: V/F control, Pr. 14 = 0 (Rated torque load), Pr. 19 = 200V

Condition		Measured item	Output frequency (Hz)							Abbreviation
			6	10	20	30	40	50	60	
No load	Pr. 0 = 6	Voltage (V)								V1
		Current (A)								A1
		V/F								
	Pr. 0 = 12	Voltage (V)								V2
		Current (A)								A2
		V/F								
90% load	Pr. 0 = 6	Voltage (V)								V3
		Current (A)								A3
		V/F								
Pr. 60 = 4 Energy-saving mode (The voltage and current values change. Read them after they settle down.)										
No load	Pr. 0 = 6	Voltage (V)								V4
		Current (A)								A4
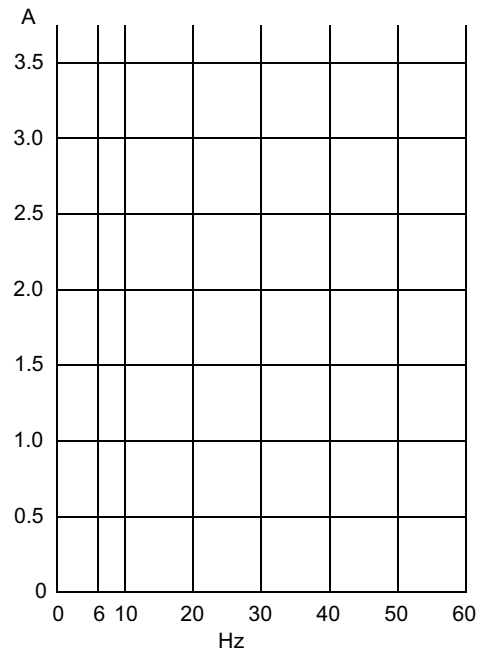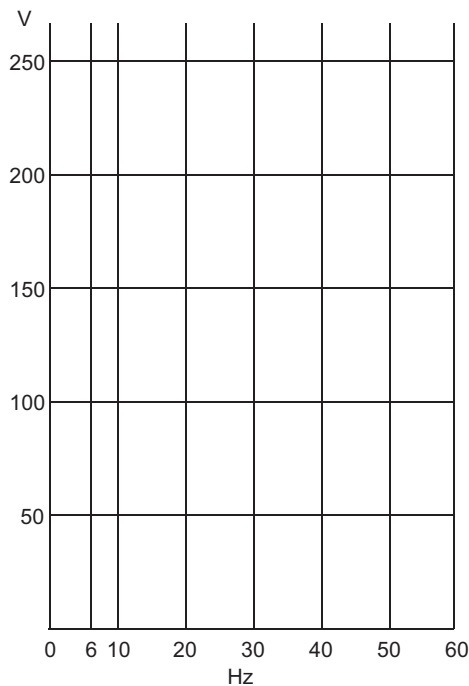
2) Operate at 2Hz under PU operation mode.

Conditions: V/F control, Pr. 14 = 0 (Rated torque load), Pr. 19 = 200V, Pr. 60 = 0

Torque boost setting	Load	Output current (A)	Output voltage (V)
Pr. 0 = 6%	0%		
	100%		
Pr. 0 = 12%	0%		
	100%		

(2) Check the generated torque at different torque boost settings under V/F control.

1) Keep increasing the load until the motor stops under the 6% torque boost setting. Check the load torque (percentage on the meter) and the current at motor stop, and stop the inverter once.

2) Set the torque boost to 12% and start the inverter. Check the motor rotation.

3) Increase the load, and check the load torque (percentage on the meter) and the current at motor stop.

4) Set the torque boost back to 6%.

Torque boost setting	Load torque at motor stop (%)	Output current (A)
Pr. 0 = 6%		
Pr. 0 = 12%		

(3) Check the current, voltage, and frequency change under Real sensorless vector control.

Check the following points while operating under Real sensorless vector control.

Refer to the next page for the Real sensorless vector control setting and the motor auto tuning method.

1) Operate at 2Hz under PU operation mode.

Conditions: Real sensorless vector control

Load (%)	Output current (A)	Output voltage (V)	Output frequency (Hz)
0			
100			

(4) Check the generated torque under Real sensorless vector control.

1) Operate at 2Hz under PU operation mode. Generate the same torque amount as the amount generated at motor stop with the 12% load torque setting under V/F control. Find out how the motor operates in this condition.

1 ABOUT DEMONSTRATION MACHINE

2 CONFIGURATION OF THE DEMONSTRATION MACHINE

3 DESCRIPTION OF THE DEMONSTRATION MACHINE

4 OPERATION METHOD

5 HOW TO USE THE OPERATION PANEL FR-DU07

6 HOW TO USE THE PARAMETER UNIT FR-PU07

7 INVERTER SETUP SOFTWARE

8 EXERCISE

8.3 Torque boost function and Real sensorless vector function (Confirming operations of V/F control and Real sensorless vector control)

33

8 EXERCISE

☒ How to perform auto tuning in the Real sensorless vector control ——

(1) Preparation
1) Stop the inverter operation and turn OFF the load switch.
2) Select the PU operation mode.

(2) Parameter setting
1) Motor type setting	Pr. 71 = 3 (for a standard motor)
2) Motor setting	Pr. 80 = 0.4(kW)
	Pr. 81 = 4(P)
3) Control method	Pr. 800 = 10 (for speed control)
4) Torque limit	Pr. 810 = 0
	Pr. 22 = 200(%)
5) Tuning method setting	Pr. 83 = 200(V)
	Pr. 84 = 60(Hz)
	Pr. 96 = 101 (tuning with rotation)
	Setting "1" in Pr. 96 allows tuning without rotation.
6) Electronic thermal relay setting	Pr. 9 = 2.0(A)

(3) Tuning operation

Press (MON).

1) In the PU operation mode, press [FWD] or [REV] to start tuning.

   After the tuning is completed, the display shows TUNE COMPLETION
   ```
   ||||||||||||||||||
   TUNE      103
   COMPLETION
   STF  STOP    PU
   ```
   or

   ```
   ||||||||||||||||||
   TUNE        3
   COMPLETION
   STF  STOP    PU
   ```
   .

   Press [STOP/RESET] to terminate the operation.

2) In the External operation mode, turn on the forward rotation switch or reverse rotation switch provided on the operation panel.
   After the tuning is completed, turn off the forward rotation switch or reverse rotation switch.

(4) Exiting the Real sensorless vector control (Returning to the V/F control)
Set "9999" in Pr. 80 and Pr. 81.

For parameters, refer to the catalog of FR-A700.

8 EXERCISE

8.4 Inverter-protection-related matter (V/F control)

Continue the training under V/F control. Set the parameters below.
Pr. 80 = 9999, Pr. 81 = 9999, Pr. 0 = 6%, Pr. 19 = 9999

(1) Electronic thermal relay (motor overheat protection)

1) Operate the electric thermal relay.

   Operate at 6Hz with no load and with Pr. 9 (Electronic thermal O/L relay) = 1.0A. A trip will occur in 20 to 30 seconds.

   Confirm Hz, I and V of when a trip is occurred by pressing (MON) ..... (SHIFT) ..... (SHIFT) .

2) Set "1" in Pr. 76 (Alarm code output selection) and make a trip.

   Check the result. IPF and FU of the demonstration machine turns ON.

   Set Pr. 76 back to "0" after this operation.

3) Use the retry function.

   Set Pr. 67 = 3 times, Pr. 68 = 5s, then operate.

   Check the results.

   Perform a retry.

4) During operation, check the operation status of the electric thermal relay.

   Set Pr. 52 (Monitor output signal selection) = 10, then operate.

   Check the display status on the monitor.

   ```
   0.00Hz
   0.00A
   0.0%
   --- STOP EXT
   ```

5) Check the pre-alarm function.

   In addition to step 4), set "8" in Pr. 191 (Output terminal function selection) and make the lamp SU turn on.

   Check the lighting timing of SU. It turns ON when the cumulative thermal value reaches 85%.

6) Reset signal

   The followings are how to enable external reset signals during abnormal operation as well as disable the signals when they are input during normal operation.

   · Use the reset switch on the operation panel to input reset signals.

   · Confirm that "15" is set in Pr. 75 (Reset selection).

   After the above exercise, set Pr. 9 (Electric thermal relay) back to 2.0A.

(2) Operation of the stall prevention function (V/F control)

Check the operation status at motor start in the condition that 40% is set in Pr. 22 (Stall prevention activation level) and 0.5 seconds is set as acceleration time. Rotate the motor with 100% load at 60Hz.

OL appears on the PU display. Check the motor rotation status.

```
           READ:LIST
  60.00  OL
         Hz
  STF  FWD  PU
```

At the end, return the acceleration time and the stall prevention operation level to the initial settings.

For parameters, refer to the catalog of FR-A700.

1 ABOUT DEMONSTRATION MACHINE
2 CONFIGURATION OF THE DEMONSTRATION MACHINE
3 DESCRIPTION OF THE DEMONSTRATION MACHINE
4 OPERATION METHOD
5 HOW TO USE THE OPERATION PANEL FR-DU07
6 HOW TO USE THE PARAMETER UNIT FR-PU07
7 INVERTER SETUP SOFTWARE
8 EXERCISE

8.5 Operation-related matter (V/F control)

(1) Find out how many seconds it takes to accelerate to 30Hz while Pr.20 (Acceleration/deceleration reference frequency) = "60Hz (initial value)" and the acceleration time is set to 5s.

[   ] seconds

Note that the setting of Pr. 20 (Acceleration/deceleration reference frequency) is relevant.

(2) Perform multi-speed operation of seven speeds.
Set any different frequency in Pr. 4 to Pr. 6 and Pr. 24 to Pr. 27, and perform the operation.
(The multi-speed selection of 15 speeds is also available, but the REX signal must be assigned to a free terminal.)
Set "1" in Pr. 28 to make auxiliary input variable.
Turn the frequency setting potentiometer and input a multi-speed signal. Find out at which frequency the inverter is operating.

(3) Use the parameter unit (PU) to start a motor (forward or reverse rotation). Adjust the frequency setting potentiometer on the demonstration machine or set multi-speed operation mode to make frequency settings.
— Set "4" in Pr. 79 (Operation mode selection). —

(4) To activate the electric brake smoothly, inverter output must be turned off immediately after the start signal is turned off.
Use Pr. 250 (Stop selection) to do this. Perform the following setting and check the resulting operation.
Set Pr. 250 = 0s, accelerate to 60Hz under External operation mode, then turn OFF the start signal.

(5) Check the operation of DC control.
Set "3" or "10" in Pr. 10, "0.5" or "5" in Pr. 11, and "0" or "4" in Pr .12.

(6) Check detected output frequency.
Set Pr. 13, Pr. 41 and Pr. 42.
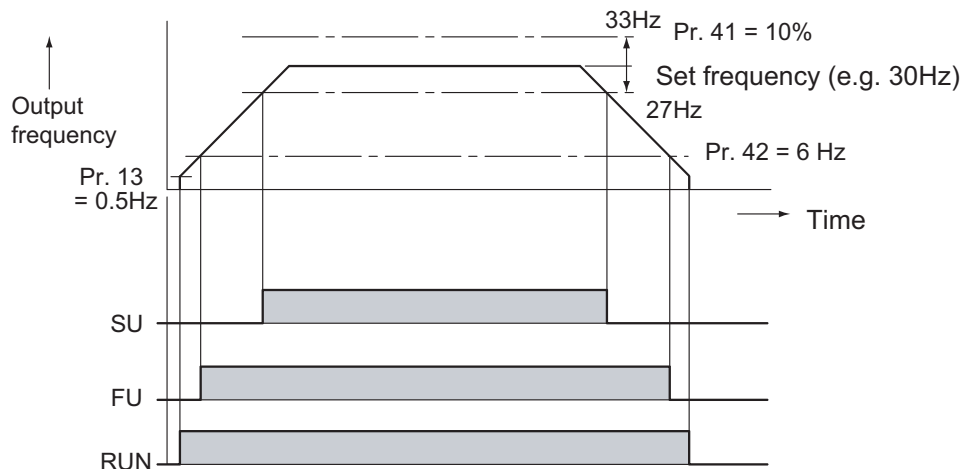
(7) Change the monitor display and frequency setting to the machine speed.
Example: Change Pr. 37 from "0" to "50" or change Pr. 144 from "4" to "104".
For parameters, refer to the catalog of FR-A700.

Answer for 8.5 (1): 2.5s

8 EXERCISE

8.6 Safety-measure-related functions

(1) [Overspeed prevention] by applying a limit to the maximum output frequency
This setting keeps the frequency signal in a safe range even if an excessive frequency is commanded.

1) Check the set value of the maximum frequency setting (Pr. 1).
2) Make a gain frequency setting for frequency setting signals (e.g. Pr. 125).
   · Set a gain so that the output frequency is 65Hz when the frequency setting potentiometer is turned to the maximum.
   When Pr. 125 is set to 65Hz
   Remark: Gain can be adjusted in C4 (Pr. 903). The parentheses indicate the parameter for the FR-PU07.

Pr. 903 (FR-PU07)   65 Hz

[PU] [PrSET] (9) (0) (3) [READ] [READ] (6) (5) [WRITE]

Turn the frequency setting potentiometer to the maximum. [WRITE]

C.4 (operation panel FR-DU07)

Press (PU/EXT) and (MODE) to display **P. 0** (previously read parameter number), and rotate the setting dial to

display **C. . .** . Press (SET). Turn the setting dial to display **C   4** , and press (SET).

Turn the potentiometer to the maximum, and press (SET).

(2) [Minimum speed guarantee] by applying a limit to the minimum output frequency
Set the lower limit frequency for applications, such as cooling pump for a compressor, where the overheating or other failure may occur in a ultra-low-speed operation.

1) Use the minimum frequency setting (Pr. 2).
   · Find the running frequency when turning the start signal on with the minimum frequency set to 10Hz.
   Set Pr. 7 (acceleration time) to approximately 20 seconds for this exercise.
2) Bias setting for the frequency setting signal (Pr. 902, Pr. 904)

(3) [Overrun prevention, drop prevention] by the timing that the electromagnetic brake activates
An abnormally operating electromagnetic brake will cause overrunning and drops.

1) Output frequency detection (Pr. 42, Pr. 43)
2) Brake sequence function (Pr. 278 to Pr. 285)

(4) [Incorrect input prevention]
1) Reset input selection (Pr. 75)
2) Reverse rotation prevention (Pr. 78)

1 ABOUT DEMONSTRATION MACHINE
2 CONFIGURATION OF THE DEMONSTRATION MACHINE
3 DESCRIPTION OF THE DEMONSTRATION MACHINE
4 OPERATION METHOD
5 HOW TO USE THE OPERATION PANEL FR-DU07
6 HOW TO USE THE PARAMETER UNIT FR-PU07
7 INVERTER SETUP SOFTWARE
8 EXERCISE

(5) [Misoperation prevention, Fault signal check]

1) Disconnected PU detection, PU stop selection (Pr. 75)

When PU disconnection is detected, the inverter trips. Thus, the disconnected PU detection can be used to check the inverter operation at fault occurrence.

Set Pr. 75 = 16, then remove the operation panel or parameter unit from the inverter.

2) PU operation interlock, operation mode external signal switching (Pr. 79 = 7)

· Assign the X12 signal to the terminal RT. (Pr. 183 = 12)

Check if the operation mode can be switched (between PU operation mode and External operation mode) by switching the X12 signal.

· Set "0" in Pr. 76 and "10" in Pr. 191 so that the lamp SU turns on during PU operation mode. (PU signal assigned)
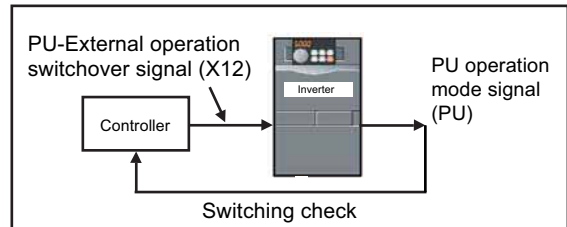
(6) [Resonant operation prevention]

An inverter changes the running speed of a motor. When the resonance points of the motor and of the machine coincide, large vibration and noise may be generated. One way to operate to avoid such resonance points would be:

1) Frequency jump(Pr. 31 to Pr. 36)

(7) [Sudden stop at power failure] sudden stop of high-speed rotating object

The inverter operation stops at power failure, and the motor coasts.

A mechanical brake is sometimes used to stop a high-speed rotating blade, etc. Such operation, however, may cause seizing of the brake. An electric brake would be a better option for such case.

1) Power failure stop function [Pr. 261 to Pr. 266]
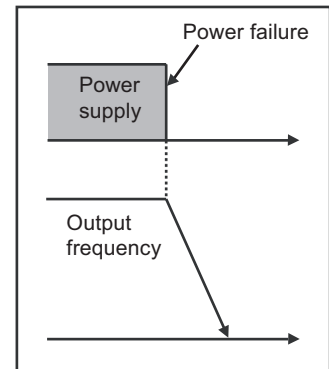
(8) [Automatic restart after instantaneous power failure]

Pr. 57 = 0, Pr. 162 = 0, CS signal ON.

Set an instantaneous power failure time period under External operation and make an instantaneous power failure. (Press the instantaneous power failure button.)

For parameters, refer to the catalog of FR-A700.

8 EXERCISE

8.7 Life diagnosis of inverter parts (FR-A700)

(1) Measuring a capacity of the main circuit capacitor and displaying a service life

1. Confirm that the motor is connected and at a stop.

2. Set "1" in Pr. 259.

3. Turn off the power supply. A capacity of the capacitor is measured at this time.

4. Confirm that the POWER lamp has been turned off, and then turn the power supply on again.

5. Confirm that "3" (measurement completion) is set in Pr. 259, and then check Pr. 258 for life display.

(2) Confirm Pr. 256 for life display of the inrush current limit circuit and Pr. 257 for life display of the control circuit capacitor.

For parameters, refer to the catalog of FR-A700 series.

8.8 Selection-related matter

(1) Select the inverter capacity most suitable for the parallel operation shown below.

Inverter   FR-A720 - ☐☐☐☐☐ K

200V 60 Hz

Power supply ——— Inverter

IM 2. 2kW 4P

IM 2. 2kW 4P
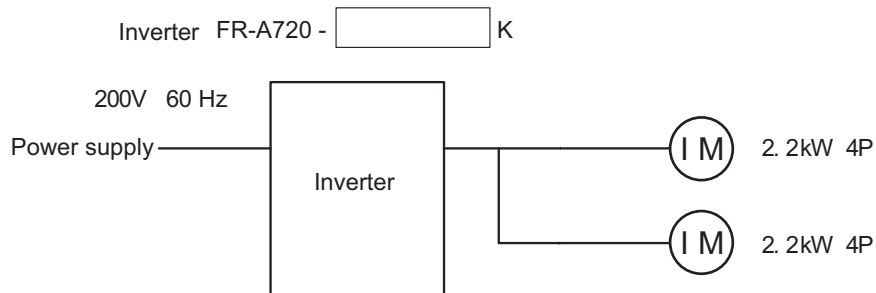
(Note) The rated motor current is 10A.

Answer for 8.8 (1): 5.5 (may differ depending on the operation pattern.)

1 ABOUT DEMONSTRATION MACHINE

2 CONFIGURATION OF THE DEMONSTRATION MACHINE

3 DESCRIPTION OF THE DEMONSTRATION MACHINE

4 OPERATION METHOD

5 HOW TO USE THE OPERATION PANEL FR-DU07

6 HOW TO USE THE PARAMETER UNIT FR-PU07

7 INVERTER SETUP SOFTWARE

8 EXERCISE

APPENDIX

Appendix 1 Additional exercise

Appendix 1.1 RS-485 communication exercise

(1) About RS-485 communication

FR-A700 series inverters have RS-485 terminals as standard. Via the RS-485 terminal, inverter operation, monitoring, parameter setting can be made from a programmable controller. Learn the basic settings by operating the inverter from the programmable controller.

(2) System configuration

APPENDICES
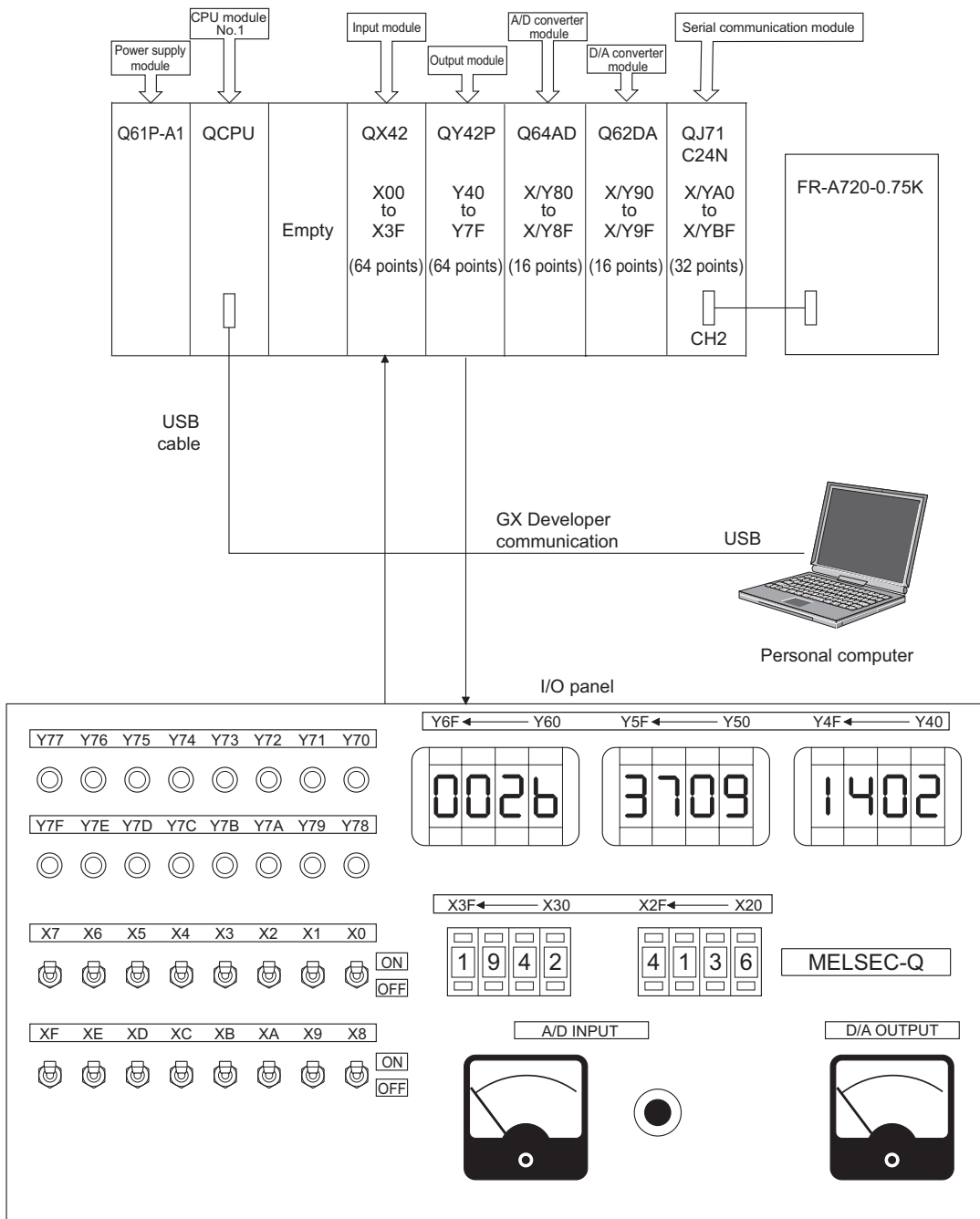
(3) Wiring
●Connection of a computer to the inverter (1:1 connection)
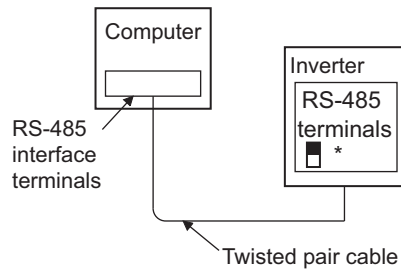
*Set the terminating resistor switch to the "100Ω" position.

●Wiring of one RS-485 computer and one inverter
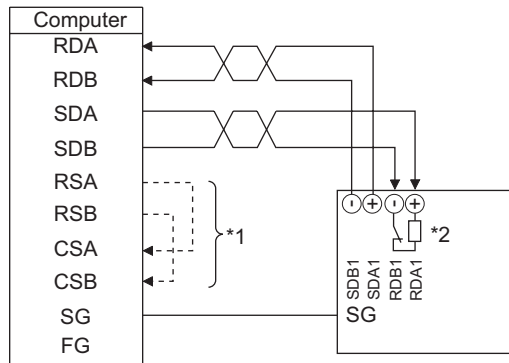
*1   Make connections in accordance with the manual of the computer used.
     Fully check the terminal numbers of the computer since they change with the model.
*2   For the inverter farthest from the computer, set the terminating resistor switch to ON (100Ω side).
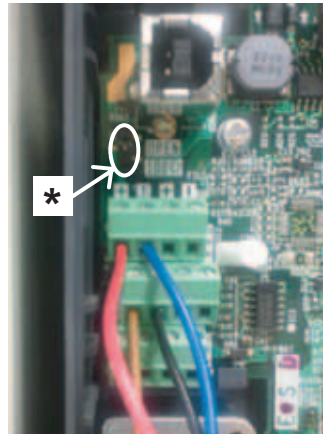
*   Set the terminating resistor switch to the "100Ω" position.

(4) Parameter settings at the inverter side

Inverter parameters

·Pr. 336 (RS-485 communication check time interval) : 9999
·Pr. 341 (RS-485 communication CR/LF selection)   : 2
(initial values for other parameters)

Communication specifications at the inverter side

·Station	: 0
·Transmission speed	: 9600bps
·Stop bit	: 2 bits
·Data bit	: 8 bits
·Parity bit	: 2 bits (even number)
·Control code	: CRLF
·Sum check	: Required

(5) Settings at the programmable controller side

Use the nonprocedural protocol to match with the communication specifications of the inverter.

[Parameter] → [PLC parameter] → [I/O assignment]

APPENDICES

[Parameter] → [PLC parameter] → [I/O assignment] → [Switch setting]
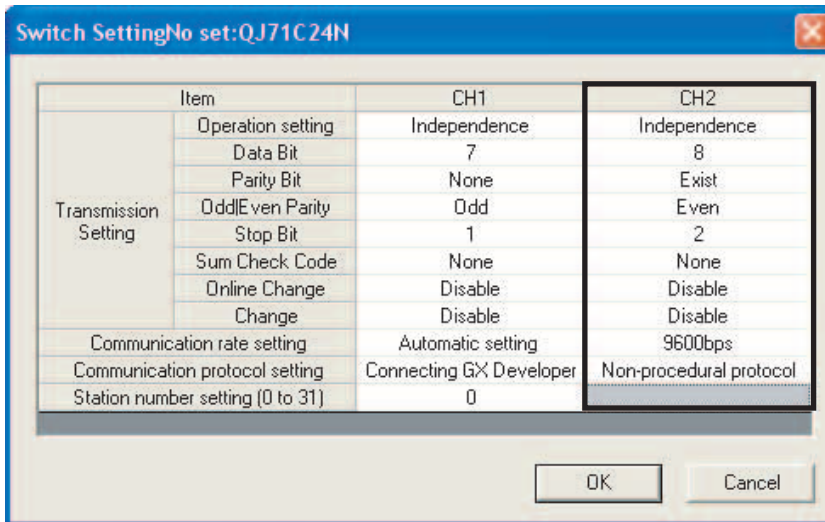
[Parameter] → [PLC parameter] → [PLC system]

[Parameter] → [PLC parameter] → [Program]

(6) Sequence program

• RS-485 communication training for the inverter practical course appendix
Program: OUTPUT

Operation mode change (Network operation mode)

```
      X0      X0BE
0  ──┤├──────┤├──────────────────────────────────────[CALLP   P100 ]
```

Operation mode change (External operation mode)

```
      X1      X0BE
26 ──┤├──────┤├──────────────────────────────────────[CALLP   P110 ]
```

Speed change (60Hz)

```
      X2      X0BE
48 ──┤├──┬───┤├──────────────────────────────────────[CALLP   P120 ]
         │
     M120│
     ──┤├┘
```

Speed change (30Hz)

```
      X3      X0BE
63 ──┤├──┬───┤├──────────────────────────────────────[CALLP   P121 ]
         │
     M121│
     ──┤├┘
```

Speed change (0Hz)

```
      X4      X0BE
77 ──┤├──┬───┤├──────────────────────────────────────[CALLP   P122 ]
         │
     M122│
     ──┤├┘
```

Forward rotation start

```
      X5      X0BE
91 ──┤├──┬───┤├──────────────────────────────────────[CALLP   P130 ]
         │
     M130│
     ──┤├┘
```

Stop command

```
       X6      X0BE
102 ──┤├──┬───┤├─────────────────────────────────────[CALLP   P140 ]
          │
      M140│
      ──┤├┘
```

Automatic speed change

```
       X8
113 ──┤↑├───────────────────────────────────────────[SET     M150 ]

      M150
123 ──┤├──┬──────────────────────────────────────────[PLS     M130 ]
          │                                               K5
          └──────────────────────────────────────────────(T0    )

       T0
130 ──┤├──┬──────────────────────────────────────────[PLS     M121 ]
          │                                               K80
          └──────────────────────────────────────────────(T1    )

       T1
137 ──┤├──┬──────────────────────────────────────────[PLS     M120 ]
          │                                               K100
          └──────────────────────────────────────────────(T2    )
```

APPENDICES


```
          T2
144      ─┤├────────────────────────────────────────────────[PLS    M122 ]

                                                                      K60
                  └──────────────────────────────────────────────────(T3   )

          T3
151      ─┤├────────────────────────────────────────────────[PLS    M140 ]

                  └──────────────────────────────────────────[RST    M150 ]

          Y70
155      ─┤├────────────────────────────────────────────────[PLS    M10  ]
```

Transmission from PLC

```
          M10    X0BE
158      ─┤├─────┤├──────────────────────────────────────────[PLS    M11  ]

          M11
174      ─┤├────────────────────[G.OUTPUT    U0A    D0     D11    M0  ]
```

Transmission result judgment

```
          M0     M1
184      ─┤├─────┤/├──────────────────────────────────────────────(M12  )

                 M1
                ─┤├──────────────────────────────────────────────(M13  )

                  └──────────────────────────────────────────[RST    Y70  ]
```

Successfully completed

```
          Y71    T4     M13
201      ─┤├─────┤/├────┤/├──────────────────────────────────────(Y71  )

          M12
         ─┤├──────┘
```

Ended abnormally

```
          Y72    T4     M12
212      ─┤├─────┤/├────┤/├──────────────────────────────────────(Y72  )

          M13
         ─┤├──────┘
```

LED lit time processing

```
          Y71    M0                                                 K10
223      ─┤├─────┤/├──────────────────────────────────────────────(T4   )

          Y72
         ─┤├──────┘


240      ───────────────────────────────────────────────────────[END  ]
```

APPENDICES

• RS-485 communication training for the inverter practical course appendix
  Program: COMMAND

Operation mode change (Network operation mode)

```
      P100   SM400
   0 ──┤ ├───┤ ├────────────────────────────────[MOV    H3005     D11  ]

                         ─────────────────────[$MOV   "0FB10000D9"  D12  ]

                         ──────────────────────[MOV    H0A0D     D17  ]

                         ──────────────────────[MOV    K2        D0   ]

                         ──────────────────────[MOV    K0        D1   ]

                         ──────────────────────[MOV    K7        D2   ]

                         ───────────────────────────[SET    Y70  ]

  43 ─────────────────────────────────────────────────[RET  ]
```

Operation mode change (External operation mode)

```
      P110   SM400
  44 ──┤ ├───┤ ├────────────────────────────────[MOV    H3005     D11  ]

                         ─────────────────────[$MOV   "0FB10001DA"  D12  ]

                         ──────────────────────[MOV    H0A0D     D17  ]

                         ──────────────────────[MOV    K2        D0   ]

                         ──────────────────────[MOV    K0        D1   ]

                         ──────────────────────[MOV    K7        D2   ]

                         ───────────────────────────[SET    Y70  ]

  83 ─────────────────────────────────────────────────[RET  ]
```

APPENDICES

APP
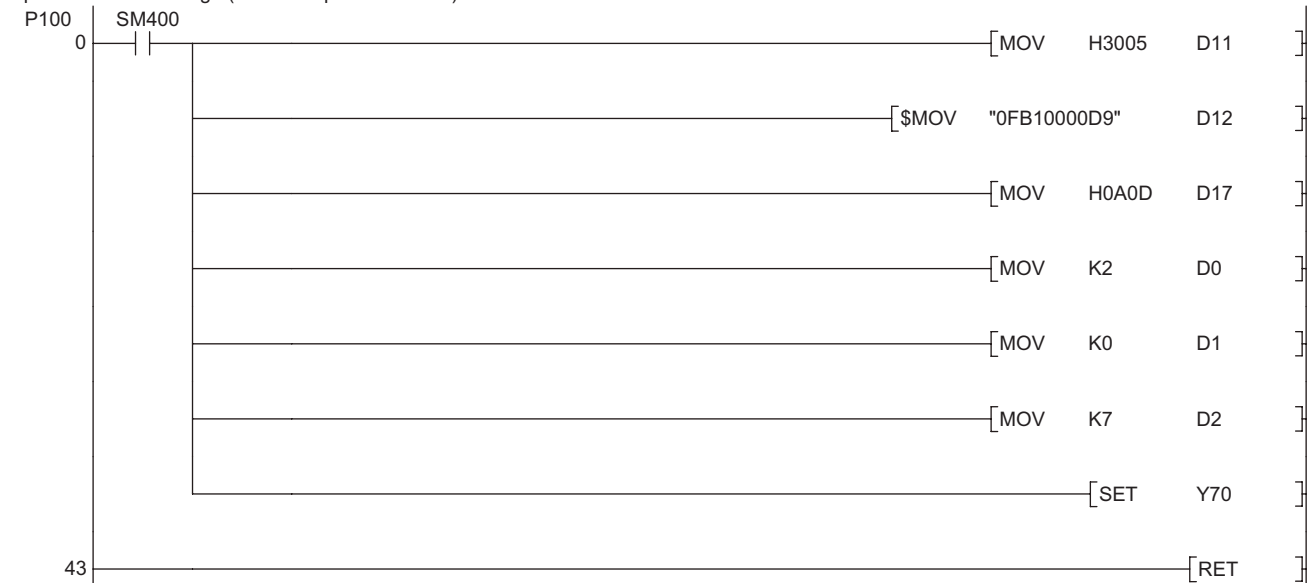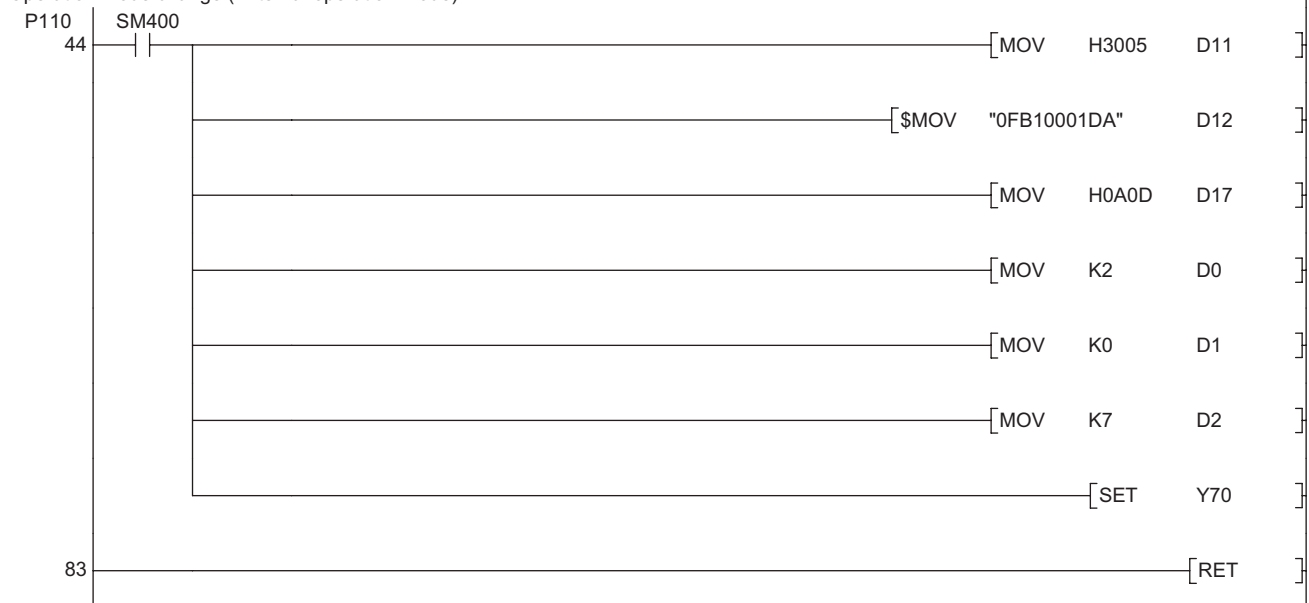
APPENDICES

Speed change (60Hz)

```
P120   SM400
 84 ────┤├──────────────────────────────────────────[MOV    H3005    D11  ]

                                            ────[$MOV   "0ED11770E9"   D12  ]

                                              ────[MOV    H0A0D    D17  ]

                                               ────[MOV    K2       D0   ]

                                               ────[MOV    K0       D1   ]

                                               ────[MOV    K7       D2   ]

                                                 ────[SET    Y70  ]

115 ──────────────────────────────────────────────────────[RET  ]
```

Speed change (30Hz)

```
P121   SM400
116 ────┤├──────────────────────────────────────────[MOV    H3005    D11  ]

                                            ────[$MOV   "0ED10BB806"   D12  ]

                                              ────[MOV    H0A0D    D17  ]

                                               ────[MOV    K2       D0   ]

                                               ────[MOV    K0       D1   ]

                                               ────[MOV    K7       D2   ]

                                                 ────[SET    Y70  ]

148 ──────────────────────────────────────────────────────[RET  ]
```

Appendix 1 Additional exercise **APP- 8**

Speed change (0Hz)

```
P122   SM400
 149   ─┤ ├──────────────────────────────────────[MOV    H3005        D11 ]

                                        [$MOV   "0ED10000DA"  D12 ]

                                        [MOV    H0A0D        D17 ]

                                        [MOV    K2           D0  ]

                                        [MOV    K0           D1  ]

                                        [MOV    K7           D2  ]

                                               [SET    Y70  ]

 180   ────────────────────────────────────────────────[RET ]
```

Forward rotation start

```
P130   SM400
 181   ─┤ ├──────────────────────────────────────[MOV    H3005        D11 ]

                                        [$MOV   "0FA1027A"   D12 ]

                                        [MOV    H0A0D        D16 ]

                                        [MOV    K2           D0  ]

                                        [MOV    K0           D1  ]

                                        [MOV    K6           D2  ]

                                               [SET    Y70  ]

 207   ────────────────────────────────────────────────[RET ]
```

APPENDICES

Stop command

```
P140   SM400                                                    ─[MOV    H3005      D11  ]─
208  ──┤├──┬──────────────────────────────────────────────
          │                                             ─[$MOV   "0FA18080"  D12  ]─
          │
          ├──────────────────────────────────────────────  ─[MOV    H0A0D      D16  ]─
          │
          ├──────────────────────────────────────────────  ─[MOV    K2         D0   ]─
          │
          ├──────────────────────────────────────────────  ─[MOV    K0         D1   ]─
          │
          ├──────────────────────────────────────────────  ─[MOV    K6         D2   ]─
          │
          ├──────────────────────────────────────────────────  ─[SET    Y70  ]─
          │
          └──────────────────────────────────────────────────  ─[RST    M150 ]─

235  ──────────────────────────────────────────────────────────  ─[RET  ]─

236  ──────────────────────────────────────────────────────────  ─[END  ]─
```

APPENDICES

• RS-485 communication training for the inverter practical course appendix
  Program: INPUT

Transmission from the inverter

```
        X0AA   X0BE
0   ────┤ ├────┤ ├──┬─────────────────────────────────[FMOVP  K0      D210    K50  ]
                    │
        X0AB        │
    ────┤ ├─────────┤
                    ├─────────────────────────────────[MOVP   K2      D200  ]
                    │
                    ├─────────────────────────────────[FMOVP  K0      D201    K2  ]
                    │
                    ├─────────────────────────────────[MOVP   K50     D203  ]
                    │
                    └────────────────────[G.INPUT U0A    D200    D210    M200  ]
```

Reception result judgment

```
        M200   M201
36  ────┤ ├────┤/├──────────────────────────────────────[PLS    M210  ]

               M201
           ────┤ ├──────────────────────────────────────[PLS    M211  ]

                                    <ON when the received data head is ACK>

           ┌─ =    D210    H3006 ─┐─────────────────────[PLS    M212  ]
```

The number of received data

```
        M210
76  ────┤ ├────────────────────────────────────────[BCD    D202    K4Y40  ]

        M211
88  ────┤ ├────────────────────────────────────────[MOV    K0      K4Y40  ]
```

Successfully completed

```
        Y74    T5     M211
91  ────┤ ├────┤/├────┤/├──────────────────────────────────────(Y74  )
          │
        M210│
    ────┤ ├─┘
```

Ended abnormally

```
        Y75    T5     M210
102 ────┤ ├────┤/├────┤/├──────────────────────────────────────(Y75  )
          │
        M211│
    ────┤ ├─┘
```

Y76 is ON when the received data is free of error

```
        Y76    T5
113 ────┤ ├────┤/├──────────────────────────────────────(Y76  )
          │
        M212│
    ────┤ ├─┘
```

LED lit time processing

```
        Y74    M200                                      K20
136 ────┤ ├────┤/├──────────────────────────────────────(T5   )
          │
        Y75│
    ────┤ ├┤
          │
        Y76│
    ────┤ ├┘
```

```
154 ──────────────────────────────────────────────────[END  ]
```

APPENDICES

Overview of commands (Refer to the Instruction Manual of the Inverter for the details.)

Operation mode change (Network operation mode)

Operation command (Format A)	E N Q	0	0	F	B	1	0	0	0	0	D	9	C R	L F
ASCII	05	30	30	46	42	31	30	30	30	30	44	39	0D	0A

Control code / Station number / Instruction code / Waiting time / Data / Sum check / Control code / Control code

30+30+46+42+31+30+30+30+30=1 D9
→1 [D9]

Speed change (60Hz)

Operation command (Format A)	E N Q	0	0	E	D	1	1	7	7	0	E	9	C R	L F
ASCII	05	30	30	45	44	31	31	37	37	30	45	39	0D	0A

Control code / Station number / Instruction code / Waiting time / Data / Sum check / Control code / Control code

30+30+45+44+31+31+37+37+30=1 E9
→1 [E9]

Operation mode change (External operation mode)

Operation command (Format A)	E N Q	0	0	F	B	1	0	0	0	1	D	A	C R	L F
ASCII	05	30	30	46	42	31	30	30	30	31	44	39	0D	0A

Control code / Station number / Instruction code / Waiting time / Data / Sum check / Control code / Control code

30+30+46+42+31+30+30+30+31=1 DA
→1 [DA]

Speed change (30Hz)

Operation command (Format A)	E N Q	0	0	E	D	1	0	B	B	8	0	6	C R	L F
ASCII	05	30	30	45	44	31	30	42	42	38	30	36	0D	0A

Control code / Station number / Instruction code / Waiting time / Data / Sum check / Control code / Control code

30+30+45+44+31+30+42+42+38=206
→2 [06]

Speed change (0Hz)

Operation command (Format A)	E N Q	0	0	E	D	1	0	0	0	0	D	A	C R	L F
ASCII	05	30	30	45	44	31	30	30	30	30	44	41	0D	0A

Control code / Station number / Instruction code / Waiting time / Data / Sum check / Control code / Control code

30+30+45+44+31+30+30+30+30=1 DA
→1 [DA]

Stop

Operation command (Format A')	E N Q	0	0	F	A	1	8	0	8	0	C R	L F
ASCII	05	30	30	46	41	31	38	30	38	30	0D	0A

Control code / Station number / Instruction code / Waiting time / Data / Sum check / Control code / Control code

30+30+46+41+31+38+30=180
→1 [80]

Start

Operation command (Format A')	E N Q	0	0	F	A	1	0	2	7	A	C R	L F
ASCII	05	30	30	46	41	31	30	32	37	41	0D	0A

Control code / Station number / Instruction code / Waiting time / Data / Sum check / Control code / Control code

30+30+46+41+31+30+32=17A
→1 [7A]

(7) Operation check

Start the operation check under External operation mode.

1) To switch to the Network operation mode, turn ON X0.

2) To switch back to the External operation mode, turn ON X1.

3) To determine a speed command, turn ON one of X2, X3, and X4.
   (X2 for 60Hz, X3 for 30Hz, X4 for 0Hz)

4) To start and accelerate/decelerate to the speed set by X2, X3, or X4, turn ON X5

5) To immediately stop outputs (0Hz), turn ON X6

6) To execute automatic operation of the sequence program, turn ON X8

INVERTER SCHOOL TEXT
INVERTER PRACTICAL COURSE
(DEMONSTRATION MACHINE OPERATING INSTRUCTION)

MITSUBISHI ELECTRIC CORPORATION

When exported from Japan, this manual does not require application to the Ministry of Economy, Trade and Industry for service transaction permission.

MODEL	INV SOUSA EIBUN
MODEL CODE	1A2-P45

Specifications subject to change without notice.