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

Specifications subject to change without notice.

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

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Specifications subject to change without notice.
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.
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<td></td>
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</tr>
</tbody>
</table>
Chapter 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.

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
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.

CAUTION

Turn OFF the switch when applying no load.

Instantaneous power failure time setting

Emergency stop

Motor speed (FM terminal output) (AM terminal output)

Output stop

Middle speed (Low speed)

Forward (Reverse)

Frequency setting terminal2

Compensation input terminal1

Inverter demonstration machine

Inverter FR-A720

Instantaneous power failure time setting

Inverter reset

Inverter setup software

Exercise
3 DESCRIPTION OF THE DEMONSTRATION MACHINE

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.
3.2 Precautions for use

1. Set the maximum frequency to 60Hz. 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.

2. Set the acceleration/deceleration time to one second or longer. 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.

3. 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.
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.

Fig.4.1 External operation mode
4 OPERATION MODE

(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 start signal + Pu frequency setting signal
Operation setting with the Pu keys.

(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.

External start and stop signals (STF, STR) + Frequency setting by Pu
Operation setting with the Pu keys.

PIU

MCCB MC

Power supply

VRW REV

Fig.4.2 PU operation mode

External start and stop signals (STF, STR) + PU start, stop signals + External frequency setting signals
Operation setting with the PU keys.

R/L1 S/L2 T/L3

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

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

At power-ON (External operation mode)

PU operation mode
(output frequency monitor)

Parameter setting mode

PU Jog operation mode

Value change

Value change

Parameter write is completed!!

Parameter and a setting value flicker alternately.

Frequency setting has been written and completed!!

Parameter clear

All parameter clear

Faults history clear

Parameter Copy

Operation mode switchover

[Operation for displaying faults history]
Past eight faults can be displayed.
(The latest fault is ended by ".".)
When no fault history exists, is displayed.

Display the present setting

Parameter and a setting value flicker alternately.

Parameter write is completed!!

Output current monitor

Output voltage monitor
5.2 Parameter setting procedure

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

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

2. Press \( \Rightarrow \) to choose the PU operation mode.

3. Press \( \Rightarrow \) to choose the parameter setting mode.

4. Turn \( \Rightarrow \) until \( P \) \( \text{Pr. 1} \) appears.

5. Press \( \Rightarrow \) to read the present set value.
   "1200" (initial value) appears.

6. Turn \( \Rightarrow \) to change it to the set value "6000".

7. Press \( \Rightarrow \) to set.

PU indicator is lit.

Flicker \( \Rightarrow \) Parameter setting complete!!

- By turning \( \Rightarrow \), you can read another parameter.
- Press \( \Rightarrow \) to show the setting again.
- Press \( \Rightarrow \) twice to show the next parameter.
- Press \( \Rightarrow \) twice to return the monitor to frequency monitor.

\( \Rightarrow \) Good to know for checking an inverter

Push the setting dial \( \Rightarrow \) 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**

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

2. Press to choose the PU operation mode.

3. Press to choose the parameter setting mode.

4. Turn until (all parameter clear) appears.

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

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

7. Press to set.

---

**Display**

- PU indicator is lit.

- The parameter number read previously appears.

- Flicker --- Parameter setting complete!!

---

- Press to read another parameter.
- Press to show the setting again.
- Press twice to show the next parameter.
5.4 Parameter copy

Parameter settings can be copied to multiple inverters.

**Operation**

1. Connect the operation panel to the copy source inverter.
   - Connect it during a stop.
2. Press to choose the parameter setting mode.
3. Turn until \( \text{PCPY} \) (parameter copy) appears.
4. Press to read the present set value. \( \text{P} \) (initial value) appears.
5. Turn to change it to the setting value "1".
6. Press to copy the source parameters to the operation panel.

   About 30s later

   **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".
9. Press to write the parameters copied to the operation panel to the destination inverter.
10. When copy is completed, "2" and \( \text{PCPY} \) flicker.
11. After writing the parameter values to the copy destination inverter, always reset the inverter, e.g. switch power off once, before starting operation.
6.1 Appearance and names of the FR-PU07

Fig. 6.1 Outer appearance of FR-PU07

- **Front**
  - **POWER lamp**: Lit when the power turns ON.
  - **Monitor**: Liquid crystal display (16 characters x 4 lines with backlight)
  - **Help function**: Interactive parameter setting
  - **Trouble shooting guidance**: Monitor (frequency, current, power, etc.)
  - **ALARM lamp**: Lit to indicate an inverter alarm occurrence.
  - **Operation keys**

- **Bottom**
  - **Connector for PU cable**: Connects using the connection cable (FR-CB2).

- **Rear**
  - **Connector**: Connector to the inverter. Connects directly to PU connector of the inverter.

---

6.1 Appearance and names of the FR-PU07

---

12 6.1 Appearance and names of the 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.

<table>
<thead>
<tr>
<th>Step</th>
<th>Operation Procedure</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Press ( \text{PU} ). The frequency setting screen appears, and operation mode changes to PU operation mode. (You need not press ( \text{PU} ) when the parameter unit is already in the PU operation mode.)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Press ( \text{PRST} ). The parameter unit is in the parameter setting mode.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Press ( \text{P} ). Enter the desired parameter number.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Press ( \text{P} ). The present setting appears.</td>
<td></td>
</tr>
</tbody>
</table>
| 5    | (1) Direct setting \( \text{P} \) Enter the desired value.  
     (2) Step setting \( \text{P} \). Display "180" using \( \text{P} \). |
| 6    | Press \( \text{SET} \). The set value is changed. |
| 7    | Press \( \text{U} \) to display the next parameter. |

* If you entered an incorrect value, press \( \text{ESC} \) 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".)

<table>
<thead>
<tr>
<th>Step</th>
<th>Operation Procedure</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Press <strong>PU</strong>.</td>
<td><img src="freq_set.png" alt="Display" /></td>
</tr>
<tr>
<td></td>
<td>The frequency setting screen appears, and operation mode changes to PU operation mode. (You need not press <strong>PU</strong> when the parameter unit is already in the PU operation mode.)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Press <strong>Func</strong>.</td>
<td><img src="func_menu.png" alt="Display" /></td>
</tr>
<tr>
<td></td>
<td>The function menu is called.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Using <strong>△</strong>/**, move the cursor to &quot;4 Pr. Clear&quot;.</td>
<td><img src="func_menu.png" alt="Display" /></td>
</tr>
<tr>
<td>4</td>
<td>Press <strong>SET</strong>.</td>
<td><img src="param_menu.png" alt="Display" /></td>
</tr>
<tr>
<td></td>
<td>The parameter menu appears.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Select the &quot;Clear All&quot;.</td>
<td><img src="param_menu.png" alt="Display" /></td>
</tr>
<tr>
<td></td>
<td>Using <strong>△</strong>/**, move the cursor to &quot;2 Clear All&quot; and press the <strong>SET</strong>.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>&quot;Clear All&quot; is selected, and the confirmation screen for clearing execution is displayed.</td>
<td><img src="confirm_screen.png" alt="Display" /></td>
</tr>
<tr>
<td>7</td>
<td>Press <strong>SET</strong>.</td>
<td><img src="confirm_screen.png" alt="Display" /></td>
</tr>
<tr>
<td></td>
<td>The parameters are initialized. When canceling the initialization, press <strong>ESC</strong> on the confirmation screen.</td>
<td></td>
</tr>
</tbody>
</table>
### 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.

<table>
<thead>
<tr>
<th>Step</th>
<th>Operation Procedure</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Press</strong> <strong>PU</strong>, The frequency setting screen appears.</td>
<td><img src="image" alt="Freq Set SET 0.00Hz" /></td>
</tr>
<tr>
<td>2</td>
<td><strong>Press</strong> <strong>+</strong> and <strong>-</strong>. Enter 60Hz.</td>
<td><img src="image" alt="Freq Set SET 0.00Hz" /></td>
</tr>
<tr>
<td>3</td>
<td><strong>Press</strong> <strong>SET</strong>. The 60Hz setting is completed.</td>
<td><img src="image" alt="Freq Set SET 60.00Hz" /></td>
</tr>
<tr>
<td>4</td>
<td>Press <strong>STF FWD</strong> to perform forward or reverse rotation with the set frequency.</td>
<td>60.00Hz</td>
</tr>
<tr>
<td>5</td>
<td><strong>Press</strong> <strong>STOP</strong>. The motor is decelerated to a stop.</td>
<td>0.00Hz</td>
</tr>
</tbody>
</table>

* 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.
6.5 External operation

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

<table>
<thead>
<tr>
<th>Step</th>
<th>Operation Procedure</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Press Ext.</td>
<td>![Image of Ext. press]</td>
</tr>
<tr>
<td></td>
<td>The operation mode indicator indicates EXT, and the External operation mode is selected.</td>
<td>![Image of operation mode indicator]</td>
</tr>
<tr>
<td>2</td>
<td>Enter the external frequency command. Select the multi-speed signal or turn the frequency setting potentiometer.*</td>
<td>![Image of multi-speed setting]</td>
</tr>
<tr>
<td>3</td>
<td>Set the start switch (STF or STR) to ON. The operation command indication changes to &quot;STF&quot; or &quot;STR&quot; 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.</td>
<td>![Image of start switch]</td>
</tr>
<tr>
<td>4</td>
<td>Set the start switch (STF or STR) to OFF. The motor stops running.</td>
<td>![Image of motor stops]</td>
</tr>
</tbody>
</table>

* 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.

<table>
<thead>
<tr>
<th>Step</th>
<th>Operation Procedure</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Press [FUNC]. The function menu is called.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Make sure that the cursor is located at &quot;1 MONITOR&quot;. If not, move the cursor with ▲/▼.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Press [MONITOR]. The monitoring list is called.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Press ▲ or ▼ to move the cursor to the desired item. Hold down [STEP] and press ▲/▼ to shift one screen.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Press [OK]. The monitor screen selected by the cursor appears. Press [OK] to give the first priority to this monitor screen.</td>
<td></td>
</tr>
</tbody>
</table>

Good to know for checking an inverter

The monitoring list can be called only with pressing ▲ 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:

<table>
<thead>
<tr>
<th>Step</th>
<th>Operation Procedure</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Press [PU].</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The frequency setting screen appears, and operation mode changes to PU operation mode.</td>
<td>![Freq Set SET 0.00Hz C-400Hz]</td>
</tr>
<tr>
<td>2</td>
<td>Press [SET].</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The parameter unit is in the parameter setting mode.</td>
<td>![SETTING MODE 0-5:SET PR. NO., Select Open]</td>
</tr>
<tr>
<td>3</td>
<td>Enter [A] and press [SET].</td>
<td>![Go FM Tune 6 Run Inverter 0.00Hz]</td>
</tr>
<tr>
<td></td>
<td>The preset frequency is displayed.</td>
<td>![0~9:Ser Pr.NO. Select Oper]</td>
</tr>
<tr>
<td>4</td>
<td>Enter [A] and press [SET].</td>
<td>![Go FM Tune 6 Run Inverter 60Hz]</td>
</tr>
<tr>
<td></td>
<td>60Hz is set.</td>
<td>![Go FM Tune 6 Run Inverter 60Hz PU]</td>
</tr>
<tr>
<td>5</td>
<td>Press [SET].</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Forward rotation is performed at 60Hz. You need not connect the motor.</td>
<td>![Go FM Tune 6 Run Inverter 60Hz PU]</td>
</tr>
<tr>
<td>6</td>
<td>Using [↑/↓], adjust the meter pointer to a predetermined position.</td>
<td>![FM Tune]</td>
</tr>
<tr>
<td></td>
<td>The meter pointer moves. (It takes a long time before the pointer moves.)</td>
<td>![FM Tune]</td>
</tr>
<tr>
<td>7</td>
<td>Press [SET].</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Calibration is completed.</td>
<td>![Completed &lt;MONITOR&gt;]</td>
</tr>
<tr>
<td>8</td>
<td>Press [SET] to return to the main monitor screen.</td>
<td>![Complete]</td>
</tr>
</tbody>
</table>
### 6.8 Parameter copy

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

#### Instructions:

1. Connect the FR-PU07 to the copy source inverter.
2. Press **FUNC**. The function menu appears.
3. Select the "PRCpy set".
4. Select the copy area.
5. Select the "Read VFD".
6. Give a name.
7. Write to the copy area of FR-PU07.
8. Press **SET**.

#### Display:

- **Copy area 2**
- **Copy area 3**
- **Copy area 1**
- **Read VFD**
- **Write VFD**
- **Verifing**
- **Select Char**
- **READ: Decide Char**
- **WRITE: Decides Name**
- **Overwrite area 1**
- **WRITE: Executing**
- **ESC: Cancel**
- **Reading**
- **Completed**

#### Notes:

- Parameter settings of each inverter (three inverters in total) can be copied to the area 1, 2 or 3.
## HOW TO USE THE PARAMETER UNIT FR-PU07

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

<table>
<thead>
<tr>
<th>Step</th>
<th>Operation Procedure</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Connect the FR-PU07 to the copy destination inverter.</td>
<td>![Monitor Screen]</td>
</tr>
<tr>
<td>2</td>
<td>Press <strong>FNC</strong>. The function menu appears.</td>
<td>![Function Menu]</td>
</tr>
<tr>
<td>3</td>
<td>Select the “PRCpy set”. Using ▲▼, move the cursor to “12 PRCpy set” and press ****.</td>
<td>![Parameter Settings]</td>
</tr>
<tr>
<td>4</td>
<td>Select the copy area. Point the cursor to the copy area that stores the parameter settings to be written to the inverter, and press ****.</td>
<td>![Copy Area]</td>
</tr>
<tr>
<td>5</td>
<td>Select the “Write VFD”. Using ▲▼, point the cursor to “2 Write VFD” and press ****.</td>
<td>![Write VFD]</td>
</tr>
<tr>
<td>6</td>
<td>Writing the parameter settings is selected, and the confirmation screen for writing is displayed.</td>
<td>![Confirmation Screen]</td>
</tr>
<tr>
<td>7</td>
<td>Press ****. The parameter settings stored in the FR-PU07 are copied to the copy destination inverter.</td>
<td>![Parameter Copy]</td>
</tr>
<tr>
<td>8</td>
<td>Reset the inverter.</td>
<td></td>
</tr>
</tbody>
</table>
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 INVERTER SETUP SOFTWARE

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.

- **Inverter**
- **Converter**
- **RS-485 cable**
- **Serial port/USB connector**
- **Using USB connector**
- **GOT1000**
- **GOT RS-422 Communicative unit**
- **Multidrop link system**
- **Inverter**

**FR Configurator**

**Using USB connector**

**Converter**

**Serial port/USB connector**

**GOT1000**

**GOT RS-422 Communicative unit**

**Multidrop link system**

**Inverter**

---

*1: When using serial port of a personal computer, a commercially available converter is required.

*2: Connection cable
- 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
- Example: Diatrend Corp. DINV-U4

*4: Recommended USB cable for computer-inverter connection (For FR-E700)
- 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

*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.

---

<table>
<thead>
<tr>
<th>Product</th>
<th>Type</th>
<th>Maker</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Communication cable</td>
<td>SGLPEV-T (Cat5e/300m) 24AWG x 4P</td>
<td>Mitsubishi Cable Industries, Ltd.</td>
</tr>
<tr>
<td>2) RJ-45 connector</td>
<td>5-554720-3</td>
<td>Tyco Electronics</td>
</tr>
</tbody>
</table>
Connecting the demonstration machine

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

[Connection example of the USB cable and the USB connector]
7 INVERTER SETUP SOFTWARE

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.

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

*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.
(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 after inputting the system name. When is clicked, the screen proceeds to "Communication Setting".
INVERTER SETUP SOFTWARE

(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 . 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.
(c) Select inverter setting method between automatic recognition of the connected inverter, or manually model setting for this system.
When the automatic detection is selected
Click \( \text{detect} \) 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 \( \text{Start} \) to proceed to "Inverter Selection".
(d) Click **Save System Setting** to register the system setting, and then parameter setting becomes available.

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

Click **Done** 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 **Apply Model Setting** to apply the model setting to the system, then click **Finish**.

After the following message appears, click **Yes**.
8 EXERCISE

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)

(2) Check input and output signals (sequence check)

The signals assigned to the control circuit terminals and their ON/OFF statuses are displayed.

<table>
<thead>
<tr>
<th>Step</th>
<th>Operation Procedure</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Press [FNC]. The function menu is called.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Using [|] to move the cursor to &quot;10 Selectop&quot;. Hold down [|] and press [|] to shift one screen.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Press [|]. The signals assigned to the control circuit terminals and their ON-OFF states are displayed.</td>
<td></td>
</tr>
</tbody>
</table>

(3) Set the basic parameters

Examples:

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

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

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

(4) Calibrate the frequency meter
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.

<table>
<thead>
<tr>
<th>Operating condition</th>
<th>DC voltage Vdc (V)</th>
<th>Reference value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) When an inverter is at a stop</td>
<td>313V</td>
<td></td>
</tr>
<tr>
<td>2) During operation at 60Hz (without load)</td>
<td>303V</td>
<td></td>
</tr>
<tr>
<td>3) During operation at 60Hz (with 100% load)</td>
<td>290V</td>
<td></td>
</tr>
</tbody>
</table>

|---------------------|-----------------------------------------------|

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

(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.)

<table>
<thead>
<tr>
<th>Operating condition</th>
<th>DC voltage Vdc(V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Without load</td>
<td></td>
</tr>
<tr>
<td>2) With 100% load</td>
<td></td>
</tr>
</tbody>
</table>

|---------------------|-----------------------------------------------|

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.

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)

<table>
<thead>
<tr>
<th>Output frequency (Hz)</th>
<th>Monitored value 1) (V)</th>
<th>Monitored value 2) (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>0.00V</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Parameter setting</th>
<th>Pr. 24 = 6Hz</th>
<th>Pr. 6 = 10Hz</th>
<th>Pr. 25 = 20Hz</th>
<th>Pr. 5 = 30Hz</th>
<th>Pr. 26 = 40Hz</th>
<th>Pr. 27 = 50Hz</th>
<th>Pr. 4 = 60Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal input</td>
<td>RL</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td>RM</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td>RH</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Condition</th>
<th>Measured item</th>
<th>Output frequency (Hz)</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>No load</td>
<td>Pr. 0 = 6</td>
<td>Voltage (V)</td>
<td>V1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Current (A)</td>
<td>A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V/F</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pr. 0 = 12</td>
<td>Voltage (V)</td>
<td>V2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Current (A)</td>
<td>A2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V/F</td>
<td></td>
</tr>
<tr>
<td>90% load</td>
<td>Pr. 0 = 6</td>
<td>Voltage (V)</td>
<td>V3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Current (A)</td>
<td>A3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V/F</td>
<td></td>
</tr>
<tr>
<td>Energy-saving mode</td>
<td>Pr. 60 = 4</td>
<td>Voltage (V)</td>
<td>V4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Current (A)</td>
<td>A4</td>
</tr>
</tbody>
</table>
2) Operate at 2Hz under PU operation mode.
   Conditions: V/F control, Pr. 14 = 0 (Rated torque load), Pr. 19 = 200V, Pr. 60 = 0

<table>
<thead>
<tr>
<th>Torque boost setting</th>
<th>Load</th>
<th>Output current (A)</th>
<th>Output voltage (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pr. 0 = 6%</td>
<td>0%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Pr. 0 = 12%</td>
<td>0%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

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%.

<table>
<thead>
<tr>
<th>Torque boost setting</th>
<th>Load torque at motor stop (%)</th>
<th>Output current (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pr. 0 = 6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pr. 0 = 12%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Load (%)</th>
<th>Output current (A)</th>
<th>Output voltage (V)</th>
<th>Output frequency (Hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.
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 \(\text{STF} \), to start tuning.
1) In the PU operation mode, press \(\text{TUNE} \) or \(\text{STF} \) to start tuning.

After the tuning is completed, the display shows TUNE COMPLETION  or

Press \(\text{STOP PU} \) 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.
8.4 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. ...
   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.

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.

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.
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.

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
8.6 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

C.4 (operation panel FR-DU07)
```

Press  and  to display  and rotate the setting dial to display .
Press . Turn the setting dial to display , and press .

(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)
(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.
8.7 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.

(Note) The rated motor current is 10A.

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

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

![System configuration diagram]

USB cable

GX Developer communication

Personal computer

QX42
QY42P
Q64D
Q62DA
QY71
CQ24N
FR-A720-0.75K

X00 X3F
Y40 Y7F
X/Y80 to X/Y8F
X/Y90 to X/Y9F
X/YB0 to X/YBF

Power supply module

CPU module

No.1 Input module

Output module

Empty

X/Y80
X/Y8F
X/Y90
X/Y9F
X/YB0
X/YBF

A/D converter module

D/A converter module

MELSEC-Q

D/A OUTPUT
A/D INPUT

X3F X30 X2F X20
Y6F Y60 Y5F Y50 Y4F Y40
Y70 Y78
X0 X8
Y71 Y79
Y72 Y7A
X2 X2B
X3 X3C
X4 X3D
X5 X3E
X6 X3F
X7 X3G

ON
OFF

ON
OFF
(3) Wiring

● Connection of a computer to the inverter (1:1 connection)

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.

- Wiring of one RS-485 computer and one inverter

*1 Make connections in accordance with the manual of the computer used.
*2 For the inverter farthest from the computer, set the terminating resistor switch to ON (100Ω side).
APPENDICES

(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]

Switch Setting

<table>
<thead>
<tr>
<th>Item</th>
<th>ON</th>
<th>OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation setting</td>
<td>Digit</td>
<td>No</td>
</tr>
<tr>
<td>Phase</td>
<td>Even</td>
<td>Odd</td>
</tr>
<tr>
<td>Check Code</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Change</td>
<td>Enable</td>
<td>Disable</td>
</tr>
<tr>
<td>Communication rate setting</td>
<td>Connecting B/C</td>
<td>Connecting B/C</td>
</tr>
<tr>
<td>Station number setting</td>
<td>0 to 31</td>
<td>0 to 31</td>
</tr>
</tbody>
</table>

[Parameter] → [PLC parameter] → [PLC system]

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

(6) Sequence program
- RS-485 communication training for the inverter practical course appendix

Program: OUTPUT

Operation mode change (Network operation mode)
0 X0 X0BE CALLP P100

Operation mode change (External operation mode)
26 X1 X0BE CALLP P110

Speed change (60Hz)
48 X2 X0BE CALLP P120

M120

Speed change (30Hz)
63 X3 X0BE CALLP P121

M121

Speed change (0Hz)
77 X4 X0BE CALLP P122

M122

Forward rotation start
91 X5 X0BE CALLP P130

M130

Stop command
102 X6 X0BE CALLP P140

M140

Automatic speed change
113 X8 SET M150

123 M150 PLS M130

K5 T0

130 T0 PLS M121

K80 T1

137 T1 PLS M120

K100 T2
APPENDICES

Transmission from PLC

Transmission result judgment

Successfully completed

Ended abnormally

LED lit time processing

Appendix 1 Additional exercise
Operation mode change (Network operation mode)

Program: COMMAND

```
MOV H3005 D11
BMOV "0FB10000D9" D12
MOV H0A0D D17
MOV K2 D0
MOV K0 D1
MOV K7 D2
SET Y70
RET
```

Operation mode change (External operation mode)

```
MOV H3005 D11
BMOV "0FB10001DA" D12
MOV H0A0D D17
MOV K2 D0
MOV K0 D1
MOV K7 D2
SET Y70
RET
```
APPENDICES

Appendix 1 Additional exercise

Speed change (60Hz)
P120
SM400

MOV H3005 D11

MOV "0ED1770E9" D12

MOV H0A0D D17

MOV K2 D0

MOV K0 D1

MOV K7 D2

SET Y70

RET

Speed change (30Hz)
P121
SM400

MOV H3005 D11

MOV "0ED10BB806" D12

MOV H0A0D D17

MOV K2 D0

MOV K0 D1

MOV K7 D2

SET Y70

RET
APPENDICES

Speed change (Hz)

149

P122

SM400

MOV H3005 D11

MOV "0ED10000DA" D12

MOV H0A1D D17

MOV K2 D0

MOV K0 D1

MOV K7 D2

SET Y70

RET

181

Forward rotation start

180

P130

SM400

MOV H3005 D11

MOV "0FA1027A" D12

MOV H0A1D D16

MOV K2 D0

MOV K0 D1

MOV K6 D2

SET Y70

RET

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APPENDICES

Appendix 1 Additional exercise
APPENDICES

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

Program: INPUT

Transmission from the inverter

```
<table>
<thead>
<tr>
<th>X0A</th>
<th>X0B</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
```

```
MFMOV K0 D210 K50
```

```
MOVP K2 D200
```

```
MFMOV K0 D201 K2
```

```
MOVP K50 D203
```

```
G.INPUT U5A D200 D210 M200
```

Reception result judgment

```
M200 M201
```

```
PLS M200
```

```
PLS M201
```

<ON when the received data head is ACK>

```
D210 H3006
```

```
PLS M212
```

The number of received data

```
M210
```

```
BCD D202 K4Y40
```

```
M211
```

```
MOV K0 K4Y40
```

Successfully completed

```
Y74 T5 M211
```

```
M210
```

```
(Y74 )
```

```
(Y75 )
```

```
M211
```

```
Y76 T5 M212
```

```
(Y76 )
```

```
M212
```

```
Y78 T5 M210
```

```
(Y78 )
```

```
M211
```

```
Y78 T5 M210
```

```
(Y78 )
```

```
M211
```

```
Y78 T5 M212
```

```
(Y78 )
```

```
M212
```

```
K20
```

```
T5
```

```
END
```

APP. 11 Appendix 1 Additional exercise
### APPENDICES

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

<table>
<thead>
<tr>
<th>Command</th>
<th>Operation command (Format A)</th>
<th>Operation command (Format A)</th>
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</thead>
<tbody>
<tr>
<td>Control code</td>
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<td>Instruction code</td>
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<td>N</td>
<td>D</td>
</tr>
<tr>
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<td>00</td>
<td>00</td>
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<tr>
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<td>00</td>
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</table>

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<td>N</td>
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<tr>
<td>00</td>
<td>00</td>
</tr>
<tr>
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<table>
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<tbody>
<tr>
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<td>00</td>
</tr>
<tr>
<td>00</td>
<td>00</td>
</tr>
</tbody>
</table>

**Appendix 1 Additional exercise**
APPENDICES

(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