FS100 OPTIONS
INSTRUCTIONS
FOR ETHERNET FUNCTION

Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.

MOTOMAN INSTRUCTIONS
FS100 INSTRUCTIONS
FS100 OPERATOR’S MANUAL
FS100 MAINTENANCE MANUAL

Part Number: 160769-1CD
Revision: 0
MANDATORY

- This manual explains the Ethernet function of the FS100 system and general operations. Read this manual carefully and be sure to understand its contents before handling the FS100.
- General items related to safety are listed in Chapter 1: Safety of the FS100 Instructions. To ensure correct and safe operation, carefully read the FS100 Instructions before reading this manual.

CAUTION

- Some drawings in this manual are shown with the protective covers or shields removed for clarity. Be sure all covers and shields are replaced before operating this product.
- The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.
- YASKAWA may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications.
- If such modification is made, the manual number will also be revised.
- If your copy of the manual is damaged or lost, contact a YASKAWA representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.
- YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product's warranty.
Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the FS100.

In this manual, the Notes for Safe Operation are classified as “WARNING”, “CAUTION”, “MANDATORY”, or “PROHIBITED”.

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury to personnel and damage to equipment. It may also be used to alert against unsafe practices.

MANDATORY

Always be sure to follow explicitly the items listed under this heading.

PROHIBITED

Must never be performed.

Even items described as “CAUTION” may result in a serious accident in some situations.

At any rate, be sure to follow these important items.

To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as “CAUTION” and “WARNING”.

NOTE
WARNING

- Confirm that no person is present in the manipulator’s operating range and that you are in a safe location before:
  - Turning ON the FS100 power.
  - Moving the manipulator with the programming pendant.
  - Running the system in the check mode.
  - Performing automatic operations.

Injury may result if anyone enters the manipulator’s operating range during operation. Always press the emergency stop button immediately if there is a problem. The emergency stop button is located on the right of the programming pendant.

- Observe the following precautions when performing teaching operations within the manipulator’s operating range:
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Keep in mind the emergency response measures against the manipulator’s unexpected motion toward you.
  - Ensure that you have a safe place to retreat in case of emergency.

Improper or unintended manipulator operation may result in injury.

- Before operating the manipulator, check that servo power is turned OFF when the emergency stop button on the programming pendant is pressed.
  When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.

Injury or damage to machinery may result if the emergency stop circuit cannot stop the manipulator during an emergency. The manipulator should not be used if the emergency stop button does not function.

Fig. : Emergency Stop Button

- In the case of not using the programming pendant, be sure to supply the emergency stop button on the equipment. Then before operating the manipulator, check to be sure that the servo power is turned OFF by pressing the emergency stop button.
  Connect the external emergency stop button to the 5-6 pin and 16-17 pin of the robot system signal connector (CN2).

- Upon shipment of the FS100, this signal is connected by a jumper cable in the dummy connector. To use the signal, make sure to supply a new connector, and then input it.

If the signal is input with the jumper cable connected, it does not function, which may result in personal injury or equipment damage.
Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product.

The MOTOMAN usually consists of the manipulator, the FS100 controller, manipulator cables, the FS100 programming pendant (optional), and the FS100 programming pendant dummy connector (optional).

In this manual, the equipment is designated as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS100 controller</td>
<td>FS100</td>
</tr>
<tr>
<td>FS100 programming pendant</td>
<td>Programming pendant</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator Cable</td>
</tr>
<tr>
<td>FS100 programming pendant dummy connector</td>
<td>Programming pendant dummy connector</td>
</tr>
</tbody>
</table>
Descriptions of the programming pendant keys, buttons, displays and keyboard of the PC are shown as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programming Pendant</td>
<td><strong>Character Keys</strong> The keys which have characters printed on them are denoted with [ ].</td>
</tr>
<tr>
<td></td>
<td>e.g. [ENTER]</td>
</tr>
<tr>
<td></td>
<td><strong>Symbol Keys</strong> The keys which have a symbol printed on them are not denoted with [ ] but depicted with a small picture.</td>
</tr>
<tr>
<td></td>
<td>e.g. PAGE key</td>
</tr>
<tr>
<td></td>
<td>The cursor key is an exception, and a picture is not shown.</td>
</tr>
<tr>
<td></td>
<td><strong>Axis Keys</strong> <strong>Numeric Keys</strong> “Axis keys” and “Numeric keys” are generic names for the keys for axis operation and number input.</td>
</tr>
<tr>
<td></td>
<td><strong>Keys Pressed Simultaneously</strong> When two keys are to be pressed simultaneously, the keys are shown with a “+” sign between them.</td>
</tr>
<tr>
<td></td>
<td>e.g. SHIFT key + COORD key</td>
</tr>
<tr>
<td></td>
<td><strong>Mode Key</strong> Three kinds of modes that can be selected by the mode key are denoted as follows: <strong>REMOTE</strong>, <strong>PLAY</strong>, or <strong>TEACH</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Button</strong> Three buttons on the upper side of the programming pendant are denoted as follows: <strong>HOLD</strong> button</td>
</tr>
<tr>
<td></td>
<td>START button</td>
</tr>
<tr>
<td></td>
<td>EMERGENCY STOP button</td>
</tr>
<tr>
<td></td>
<td><strong>Displays</strong> The menu displayed in the programming pendant is denoted with { }.</td>
</tr>
<tr>
<td></td>
<td>e.g. {JOB}</td>
</tr>
<tr>
<td></td>
<td><strong>PC Keyboard</strong> The name of the key is denoted. e.g. Ctrl key on the keyboard</td>
</tr>
</tbody>
</table>

**Description of the Operation Procedure**

In the explanation of the operation procedure, the expression “Select • • •” means that the cursor is moved to the object item and the SELECT key is pressed, or that the item is directly selected by touching the screen.

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Data transmission function of the FS100 is achieved by data exchange between the data transmission function which is the FS100 application, and the MOTOCOM32 which is the application of the personal computer. For the data transmission, Ethernet can be optionally used as a medium instead of RS-232C which is used as a standard. The FS100 data transmission function in case of using Ethernet for the transmission medium is peculiarly called the Ethernet function.

This instruction manual explains the settings and relevant information required in use of the Ethernet function.

1.1 Features

1.1.1 High-Speed Transmission

The Ethernet function with Ethernet (10/100 Mbps) for the transmission medium enables a faster transmission compared to RS-232C (max. 9600 bps).

1.1.2 Communication Station Switchable with Software

unlike RS-232C which requires a device to physically switch the stations, the Ethernet function can switch the communication station easily by changing the destination for connection with a software. (Note, however, that it is unable to communicate with one or more station simultaneously.)

1.1.3 Easy Setup

The FS100 is provided with the Ethernet connector RJ-45 for data transmission as standard equipment. Therefore, the Ethernet function can be used without adding any extra hardware.
2 Ethernet Cable Connections

Connect the Ethernet cable (shielded cable; category 5 or more) to the CN2 RJ-45 LAN connector which is located on the front face of the main CPU board inside the CPU rack.

NOTE
There are two RJ-45 connectors at the front face of the main CPU board, and CN2 on the upper side is the one for the Ethernet function. Do not touch CN3 on the lower side since it is exclusively used for the programming pendant.

Fig. 2-1: Front View of CPU Rack (Without Cover)
3 Ethernet Function Settings

Perform the setting procedures below to make the FS100 Ethernet function available.

3.1 Transmission Function Settings

Set the parameters to enable the transmission function.

(The customers should not change the parameter settings themselves: contact your Yaskawa representative.)

3.2 Ethernet Function Settings

Set the parameters to enable the Ethernet function.

(The customers should not change the parameter settings themselves: contact your Yaskawa representative.)
3.3 Ethernet Communication Settings

3.3.1 Setting Procedure

Perform the following procedures for Ethernet communications.

- Perform the Ethernet communication settings in the management mode.
- In the operation mode and the editing mode, the settings are for reference only.

1. Turn ON the power supply again while pressing [MAIN MENU] simultaneously.
   - The maintenance mode window appears.

2. Select {SYSTEM} under the main menu.
   - The sub menu appears.
3. Select {SECURITY}.
   - The Security setting window appears.

4. Set the security mode to the “MANAGEMENT MODE”.
   - Security mode is set to “MANAGEMENT MODE”.

5. Select {SYSTEM} under the main menu.
   - The sub menu appears.
6. Select {SETUP}.
   – The SETUP window appears.

   ![SETUP Window]

7. Select {DETAIL} of {NETWORK}.
   – The network function setting window appears.

   ![NETWORK Window]

8. Set the controller name and domain name.
   – Set the controller name and domain name as appropriate.
   – Refer to chapter 3.3.2 “Description of Setting Items (Network Function Setting Window)” at page 3-6 for further details of each item.

9. Select the communication parameter to be changed.
   – When directly entering, virtual keyboard is enabled for entry.

10. Input the new communication parameter value.
    – When directly entering, use virtual keyboard or numeric keys for entry.
11. Press [ENTER].
   – The confirmation dialog box appears.

12. Select {YES}.
   – If the Ethernet communication settings are correct, select {YES}.
   – The function selection window appears.

13. Turn ON the power supply again.
   – The normal operation mode starts.
3.3.2 Description of Setting Items (Network Function Setting Window)

3.3.2.1 CONTROLLER NAME

NOTE

CONTROLLER NAME is not used in communication.

Set the controller name assigned for the FS100.
Enter using one-byte alphanumeric characters, hyphen (-) and underscore (_).
Then, be sure to include at least an alphabetic character.

3.3.2.2 DOMAIN NAME

Set the domain name to which FS100 belongs to.
Enter using one-byte alphanumeric characters, hyphen (-), underscore (_), and period (.).
3.4 Setting Confirmation

Settings made in the Ethernet communication setting can also be confirmed while in normal operation.

Display and confirm in the following procedures.

1. Set the security mode to the “MANAGEMENT MODE”.
2. Select {SYSTEM INFO} under the main menu.
   - The sub menu appears.
3. Select {NETWORK SERVICE}.
   - The NETWORK SERVICES window appears.

3.5 Command Remote Setting

Since the Ethernet function applies the data transmission function, it is required to set the command remote available if the Ethernet function is to be used as a host control function.

Refer to “FS100 OPTIONS INSTRUCTIONS FOR DATA TRANSMISSION FUNCTION” for the details of command remote and the setting method to enable it.
3.6 Server (Host PC) Setting

Since the Ethernet function uses the data transmission function, if it is used as the DCI function or the stand-alone function, the IP address of communication destination must be registered as the server (host PC).

For details of the DCI function and the stand-alone function, refer to "FS100 Options Instructions for Data Transmission Function (RE-CKI-A459)".

3.6.1 Setting Procedure

Perform the setting of the server (host PC) as described below.

1. Turn ON the power supply again while pressing [MAIN MENU] simultaneously.
   – The maintenance mode window appears.
2. Select (SYSTEM) under the main menu.
   – The sub menu appears.
3. Select (SECURITY).
   – The Security setting window appears.
4. Set the security mode to the “MANAGEMENT MODE”.
   – Security mode is set to “MANAGEMENT MODE”.
5. Select (SYSTEM) under the main menu.
   – The sub menu appears.
6. Select (SETUP).
   – The SETUP window appears.
7. Select (OPTION FUNCTION).
   – The OPTION FUNCTION window appears.
8. Select “Ethernet FUNCTION”.
   – The Ethernet FUNCTION window appears.

9. Select “SERVER (HOST PC)” and set the IP address of communication destination.
   – The set IP address is shown.

10. Press [ENTER].
    – The confirmation dialog box appears.

11. Select {YES}.
    – The OPTION FUNCTION window appears.

12. Turn ON the power supply again.
    – The normal operation mode starts.
4 Specifications

4.1 Ethernet Specifications

4.1.1 Ethernet Specifications

<table>
<thead>
<tr>
<th>Applicable Standard</th>
<th>IEEE 802.3 10Base-T/100Base-TX compliant</th>
</tr>
</thead>
</table>

Baud Rate

- 10 Mbps/100 Mbps (Automatically recognized when the power is turned on.)
- (It is the transmission speed of signals, and not of the actual data. The actual data transfer rate is rather slow, since it depends on the processing speed and the transmission line status inside each communication station.)

4.1.2 Protocol Version

*IPv4

* IPv6 is not supported.

4.1.3 Connector Specifications

Connector CN2 (RJ-45 8-pin modular jack)

4.1.4 Pin Assignment

<table>
<thead>
<tr>
<th>No.</th>
<th>Signal Name</th>
<th>I/O</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TD+</td>
<td>IO</td>
<td>Send data + side</td>
</tr>
<tr>
<td>2</td>
<td>TD-</td>
<td>IO</td>
<td>Send data - side</td>
</tr>
<tr>
<td>3</td>
<td>RD+</td>
<td>IO</td>
<td>Receive data + side</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>RD-</td>
<td>IO</td>
<td>Receive data - side</td>
</tr>
<tr>
<td>7</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

4.1.5 LED Specifications

<table>
<thead>
<tr>
<th>LED</th>
<th>Status</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>RIGHT (Yellow)</td>
<td>Lit</td>
<td>Link</td>
</tr>
<tr>
<td></td>
<td>Blink</td>
<td>Active</td>
</tr>
<tr>
<td>LEFT (Green)</td>
<td>Lit</td>
<td>100 MBps</td>
</tr>
<tr>
<td></td>
<td>Unlit</td>
<td>10 MBps</td>
</tr>
</tbody>
</table>
4.1.6 Cable Specifications

Use the following Ethernet cable.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable Type</td>
<td>Shielded, category 5 or more</td>
</tr>
<tr>
<td>Maximum Cable Length</td>
<td>100 m</td>
</tr>
</tbody>
</table>
4.2 Restrictions

4.2.1 Restrictions on Data Transmission Function

Refer to “FS100 OPTIONS INSTRUCTIONS FOR DATA TRANSMISSION FUNCTION” for the details of the data transmission function.

4.2.2 Operation with External Memory Devices

The external memory Devices and the data transmission function (Ethernet function is included.) work exclusively. Therefore, data transmission function cannot be executed when the external memory devices are in processing status, or external memory devices cannot process data when the data transmission function is being executed.

4.2.3 Remote Mode

With the remote mode, the data transmission function switches the external access wait state and the external access state. The host control function becomes available and the external access enters in a wait status when the remote is turned ON. When the remote is turned OFF, the external access is enabled and the DCI or stand-alone functions become available. The host control function and the DCI/stan-alone functions cannot be used simultaneously since the remote ON status and the remote OFF status work exclusively.

4.2.4 Concurrent Communication

Communication with more than one station is not available with the data transmission function.

4.2.5 Restrictions on Communication Port

The Ethernet function occupies 10000 to 10008 of the UDP ports. Therefore, do not transmit the packets that use the UDP ports occupied by the Ethernet function to the FS100 and the host computer which are executing the Ethernet communications.
5 Troubleshooting

In case of communication failure, try the following check items.

5.1 Cable Connection Check

• Check that the cable is securely connected to the CN2 connector on the main CPU board.
  • Check that the LED of the CN2 (yellow LED on the right) is lit or blinks.

• Check that the cable connector of the hub side is properly connected.
  • Check that the power supply for the hub is ON.

• Check the cable type.
  • In case of connecting the cable to the hub which cannot auto-detect MDI/MDI-X connection, check if the cable used is a straight cable.
  • In case of directly connecting the FS100 and host computer, check if the cable used is a crossing cable.

• Check the baud rates of the hub and the host computer.
  • FS100 automatically recognizes 10/100 Mbps when the power is turned on.
  Consequently, changing communication speed after turning on the power causes normal communication to be impossible.
  Before starting FS100, confirm that the other end of the cable connection (HUB or host computer) is normally operating.
5.2 Connection Check with Lower Protocol

In the TCP/IP network, it is possible to check if the IP packets are transmitted to the destinations using a ping command from a host computer.

Start the command prompt in the Windows 2000/XP, then input the IP address after entering "ping". If the communication is successfully done, the window displays as follows:

```
C:\> ping 10.0.0.2

Pinging 10.0.0.2 with 32 bytes of data:

Reply from 10.0.0.2: bytes=32 time<10ms TTL=255
Reply from 10.0.0.2: bytes=32 time<10ms TTL=255
Reply from 10.0.0.2: bytes=32 time<10ms TTL=255
Reply from 10.0.0.2: bytes=32 time<10ms TTL=255

Ping statistics for 10.0.0.2:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
  Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```
In case of a communication failure, the window displays as shown below. In this case, check the cable connections, network settings of the host computer, the Ethernet communication settings of the FS100 once again.

```bash
C:\> ping 10.0.0.2

Pinging 10.0.0.2 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 10.0.0.2:
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

5.3 Connection Check with MOTOCOM

The Ethernet communication settings are completed when the connection check with lower protocol is finished. For the further connection check, use the MOTOCOM referring to “FS100 OPTIONS INSTRUCTIONS FOR DATA TRANSMISSION FUNCTION” and “MOTOCOM32 OPERATION MANUAL”.

5-3
Specifications are subject to change without notice for ongoing product modifications and improvements.