FS100 OPTIONS
INSTRUCTIONS
FOR I/O TRACE FUNCTION

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

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

Part Number: 159651-1CD
Revision: 0
MANDATORY

• This manual explains the details on I/O trace function of the FS100. 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.

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

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

**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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FS100

Contents

1 I/O Trace Function ................................................................. 1-1
2 Basic Specifications ................................................................. 2-1
3 Setup of I/O Trace ................................................................. 3-1
   3.1 Window ........................................................................ 3-1
   3.2 Operation Procedure ..................................................... 3-2
   3.3 System I/O Signal ......................................................... 3-3
      3.3.1 System Input Signal .............................................. 3-3
      3.3.2 System Output Signal ............................................ 3-3
4 I/O Trace Log Data ............................................................... 4-1
   4.1 Window ........................................................................ 4-1
   4.2 Operation Procedure ..................................................... 4-2
5 External Memory ................................................................. 5-1
   5.1 Operation Procedure ..................................................... 5-1
   5.2 Data Format ................................................................. 5-2
6 I/O TraceViewer (Optional) .................................................... 6-1
1 I/O Trace Function

I/O trace function is a function that can trace the signal status used by the robot controller after synchronizing it to the concurrent I/O scanning without using any measuring devices.

The trace log data can be saved in CSV format and utilize it in variety of situations depending on the purpose of use. For example, when setting up the system or a failure occurred, problems can be easily analyzed to find their solutions by using the log data traced by this function and thus the time to solve the problem is reduced.

Also, by using the PC software IO TraceViewer, the waveform of the saved log data can be displayed and analyze it without any difficulty.

Fig. 1-1: System Configuration
2 Basic Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trace cycle</td>
<td>1 msec (Synchronized to concurrent I/O cycle)</td>
</tr>
<tr>
<td>Trace target</td>
<td>Concurrent I/O number</td>
</tr>
<tr>
<td></td>
<td>·User input (#00010 to #01287)</td>
</tr>
<tr>
<td></td>
<td>·User output (#10010 to #11287)</td>
</tr>
<tr>
<td></td>
<td>·External input (#20010 to #21287)</td>
</tr>
<tr>
<td></td>
<td>·External output (#30010 to #31287)</td>
</tr>
<tr>
<td></td>
<td>·System input (#40010 to #41607)</td>
</tr>
<tr>
<td></td>
<td>·System output (#50010 to #52007)</td>
</tr>
<tr>
<td></td>
<td>·Interface panel input (#60010 to #60647)</td>
</tr>
<tr>
<td></td>
<td>·Auxiliary relay (#70010 to #79997)</td>
</tr>
<tr>
<td></td>
<td>·Control status (#80010 to #80647)</td>
</tr>
<tr>
<td></td>
<td>·Pseudo Input (#82010 to #82207)</td>
</tr>
<tr>
<td></td>
<td>·Network Input (#25010 to #26287)</td>
</tr>
<tr>
<td></td>
<td>·Network output (#35010 to #36287)</td>
</tr>
<tr>
<td>Number of trace signal</td>
<td>16 signals at maximum</td>
</tr>
<tr>
<td>Trigger</td>
<td>Edge (up and down)</td>
</tr>
<tr>
<td>Pre-trigger</td>
<td>Specify the triggering point of the trace log data (0% to 100%)</td>
</tr>
<tr>
<td></td>
<td>0% : Save the log data for 10 sec from the trigger point.</td>
</tr>
<tr>
<td></td>
<td>50% : Save the log data for 10 sec from 5sec previous to the trigger point.</td>
</tr>
<tr>
<td></td>
<td>100%: Save the log data for 10 sec from 10 sec previous to the trigger point.</td>
</tr>
<tr>
<td>Amount of log data</td>
<td>Save the log data for 10sec including the trigger point.</td>
</tr>
<tr>
<td>Trace start/end operation</td>
<td>Can be operated by the programming pendant or a specific input signal (#40600)</td>
</tr>
<tr>
<td>Tracing status</td>
<td>Can be verified with the programming pendant or a specific input signal (#50900)</td>
</tr>
</tbody>
</table>

NOTE
The trace log data is cleared with ON/OFF button. Please backup the necessary trace log data to the external memory device before turning OFF the control power supply.
### 3 Setup of I/O Trace

#### 3.1 Window

- **A. TRACE STOP/START**
  
  Displays the tracing status

- **B. No. 1 to 16**
  
  Up to 16 tracing conditions can be set

- **C. SIGNAL**
  
  Set the concurrent I/O signal (#0xxxxx to #9xxxxx)
  
  The tracing condition is cleared when “0” is input

- **D. SIGNAL STATUS**
  
  Show the signal status. ●: Signal is ON ○: Signal is OFF

- **E. TRIGGER**
  
  Set “VALID” or “INVALID” of the trigger condition

- **F. EDGE**
  
  Set “UP” or “DOWN” of the trigger condition edge

- **G. DETECT**
  
  Show the trigger detecting status
  
  ●: Trigger is detected ○: Trigger is undetected

- **H. NAME**
  
  Can set the signal name with up to 16 letters

- **I. COMMENT**
  
  Can set the I/O trace comment with up to 32 letters
3.2 Operation Procedure

1. Change the security mode to management mode. (I/O TRACE menu is not displayed under the operation/edit mode.)

2. Select (IN/OUT) under the main menu.

3. Select (I/O TRACE).
   - I/O TRACE SETUP window appears.

4. Set the trace signal.
   - Move the cursor to (SIGNAL) part and press [SELECT] key to input the concurrent I/O signal logical number.
   - Input “0” to clear the tracing condition.

5. Set the trigger condition.
   - Move the cursor to (TRIGGER) part and press [SELECT] key to alternate (VALID) and (INVALID).
   - While the trigger is valid, move the cursor to (EDGE) and press [SELECT] key to alternate (UP) and (IDOWN).

6. Set the signal name.
   - Move the cursor to (SIGNAL) and press [SELECT] key to input its name with up to 16 letters.
3.3 System I/O Signal

3.3.1 System Input Signal

- **#40600 I/O tracing start**
  
  Tracing operation starts when this signal is turned ON and stops when it is turned OFF.

**NOTE**

When the tracing operation is started with the programming pendant, complete it with the programming pendant.

Also, when the tracing operation is started with system input signal, again complete it with the system input signal.

In case the trigger is detected, the tracing operation completes automatically.

3.3.2 System Output Signal

- **#50900 While in I/O tracing mode**

  This number shows the tracing status. The signal is turned ON when it is in a tracing state, and it is in an out-of-tracing state when the signal is turned OFF.
4 I/O Trace Log Data

4.1 Window

A. TRACE
   Display the tracing condition No. from which a trigger is detected.
   "***" is displayed when the trigger is undetected.

B. TRIGGER L
   Display the line from which a trigger is detected.
   "****" is displayed when the trigger is undetected.

C. Log data line No.
   Display the line No. of the log data.

D. Log data
   Display the data of logged 16 signal
   "0" means the signal is in OFF state and "1" means it is in ON state.
   The signal numbers from No.1 to No.16 are shown from right to left of the line.

Example) The signal No. 1 and 15 are in ON state.
       0100_0000_0000_0001
4.2 Operation Procedure

1. Change the security to management mode. ([I/O TRACE LOG] menu is not displayed under the operation/edit mode.)

2. Select [IN/OUT] under the main menu.

3. Select [I/O TRACE LOG].

   – I/O TRACE LOG window appears.

4. Search the line number.

   – Move the cursor to a line number part, input a desired line number and press [SELECT] key to search the line.
5. Search the trigger number.

- Move the cursor to the log data part and press [SELECT] key to search the desired trigger line.

<table>
<thead>
<tr>
<th>I/O TRACE LOG</th>
<th>TRIGGER</th>
<th>01</th>
</tr>
</thead>
<tbody>
<tr>
<td>00001</td>
<td>0000_0000_0000_0001</td>
<td></td>
</tr>
<tr>
<td>00002</td>
<td>0000_0000_0001_0001</td>
<td></td>
</tr>
<tr>
<td>00003</td>
<td>0000_0000_0000_0001</td>
<td></td>
</tr>
<tr>
<td>00004</td>
<td>0000_0000_0000_0001</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DATA</th>
<th>EDIT</th>
<th>DISPLAY</th>
<th>UTILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5 External Memory

5.1 Operation Procedure

1. Select {FD/PC CARD} under the main menu.
2. Select {SAVE}.
3. Select {SISTEM DATA}.
   – System data window appears.
   ![System Data Window]

4. Select “I/O TRACE DATA” on the window.
   – “★” mark is displayed.
   – Press [ENTER] key to display the confirmation dialog box.
     Select [YES] to save the data.
5. Select [LOAD] or [VERIFY] to load or verify the I/O trace data.
   – Note that the security should be in the management mode when
     loading the data.
   – No log data other than I/O trace setup data can be loaded.
5.2 Data Format

Following is the examples of output file data when I/O trace data is output to the external memory.

+ File name: IOTRACE.DAT

<table>
<thead>
<tr>
<th>//IOTRACE</th>
<th>//IOTRACE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;Comment, up to 32 letters&gt;</td>
</tr>
<tr>
<td>1) 1) //COMMENT Robot I/O Report</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>&lt;Pre-trigger&gt;</td>
</tr>
<tr>
<td>80025,1,0.EXESP</td>
<td>&lt;Signal 1&gt;, &lt;Trigger 1&gt;, &lt;Edge 1&gt;, &lt;Signal name 1&gt;</td>
</tr>
<tr>
<td>40066,0,0.EXSVOFF2</td>
<td>&lt;Signal 2&gt;, &lt;Trigger 2&gt;, &lt;Edge 2&gt;, &lt;Signal name 2&gt;</td>
</tr>
<tr>
<td>40067,0,0.EXHOLD</td>
<td>&lt;Signal 3&gt;, &lt;Trigger 3&gt;, &lt;Edge 3&gt;, &lt;Signal name 3&gt;</td>
</tr>
<tr>
<td>40040,0,1,EACH SELECT</td>
<td>&lt;Signal 4&gt;, &lt;Trigger 4&gt;, &lt;Edge 4&gt;, &lt;Signal name 4&gt;</td>
</tr>
<tr>
<td>70016,0,1,4 ms pulse 0,0,0,0,1</td>
<td>&lt;Signal 5&gt;, &lt;Trigger 5&gt;, &lt;Edge 5&gt;, &lt;Signal name 5&gt;</td>
</tr>
<tr>
<td>0,0,1,</td>
<td>&lt;Signal 6&gt;, &lt;Trigger 6&gt;, &lt;Edge 6&gt;, &lt;Signal name 6&gt;</td>
</tr>
<tr>
<td>0,0,1,</td>
<td>&lt;Signal 7&gt;, &lt;Trigger 7&gt;, &lt;Edge 7&gt;, &lt;Signal name 7&gt;</td>
</tr>
<tr>
<td>0,0,1,</td>
<td>&lt;Signal 8&gt;, &lt;Trigger 8&gt;, &lt;Edge 8&gt;, &lt;Signal name 8&gt;</td>
</tr>
<tr>
<td>0,0,1,</td>
<td>&lt;Signal 9&gt;, &lt;Trigger 9&gt;, &lt;Edge 9&gt;, &lt;Signal name 9&gt;</td>
</tr>
<tr>
<td>0,0,1,</td>
<td>&lt;Signal 10&gt;, &lt;Trigger 10&gt;, &lt;Edge 10&gt;, &lt;Signal name 10&gt;</td>
</tr>
<tr>
<td>0,0,1,</td>
<td>&lt;Signal 11&gt;, &lt;Trigger 11&gt;, &lt;Edge 11&gt;, &lt;Signal name 11&gt;</td>
</tr>
<tr>
<td>0,0,1,</td>
<td>&lt;Signal 12&gt;, &lt;Trigger 12&gt;, &lt;Edge 12&gt;, &lt;Signal name 12&gt;</td>
</tr>
<tr>
<td>0,0,1,</td>
<td>&lt;Signal 13&gt;, &lt;Trigger 13&gt;, &lt;Edge 13&gt;, &lt;Signal name 13&gt;</td>
</tr>
<tr>
<td>0,0,1,</td>
<td>&lt;Signal 14&gt;, &lt;Trigger 14&gt;, &lt;Edge 14&gt;, &lt;Signal name 14&gt;</td>
</tr>
<tr>
<td>0,0,1,</td>
<td>&lt;Signal 15&gt;, &lt;Trigger 15&gt;, &lt;Edge 15&gt;, &lt;Signal name 15&gt;</td>
</tr>
<tr>
<td>0,0,1,</td>
<td>&lt;Signal 16&gt;, &lt;Trigger 16&gt;, &lt;Edge 16&gt;, &lt;Signal name 16&gt;</td>
</tr>
</tbody>
</table>

| 2) 4                              | <Signal 1 log 1>, <Signal 2 log 1>, <Signal 3 log 1>, ... <Signal 16 log 1> |
| 1,1250                            | <Signal 1 log 2>, <Signal 2 log 2>, <Signal 3 log 2>, ... <Signal 16 log 2> |
| 1,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0 | <Signal 1 log 3>, <Signal 2 log 3>, <Signal 3 log 3>, ... <Signal 16 log 3> |
| 1,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0 | <Signal 1 log 4>, <Signal 2 log 4>, <Signal 3 log 4>, ... <Signal 16 log 4> |
| 1,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0 | <Signal 1 log 5>, <Signal 2 log 5>, <Signal 3 log 5>, ... <Signal 16 log 5> |
| 0,1,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0 | <Signal 1 log 9999>, <Signal 2 log 9999>, <Signal 3 log 9999>, ... <Signal 16 log 9999> |
| 0,1,1,0,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0 | <Signal 1 log 10000>, <Signal 2 log 10000>, <Signal 3 log 10000>, ... <Signal 16 log 10000> |

1 Data 1: I/O trace setup data
2 Data 2: I/O trace log data
6 I/O TraceViewer (Optional)

By using the PC software, IO TraceViewer, the wave shape of the saved I/O trace log data (IOTRACE.DAT) can be displayed.

A. **Comment**
   The comment of the I/O trace setup window/IOTRACE.DAT is displayed.

B. **Trigger information**
   The information of the I/O trace log data/IOTRACE.DAT is displayed.

C. **Waveform**
   The log of the I/O trace log data/IOTRACE.DAT is displayed in a waveform.
   Also, the setting of the waveform display can be changed with “Wave Form Style” on the window.
6 I/O TraceViewer (Optional)

D. **Signal name**
   The item displayed in this part can be changed to signal number, relay number or signal name.

- **Signal number**
  Displays the signal number.

- **Relay number**
  Displays I/O trace setup window/IOTRACE.DAT relay number.

- **Signal name**
  Display I/O setup window/IOTRACE.DAT signal name.

E. **Measure**
   The time between the two points can be measured.
Specifications are subject to change without notice for ongoing product modifications and improvements.