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

MOTOMAN INSTRUCTIONS
MOTOMAN-□□□ INSTRUCTIONS
DX200 INSTRUCTIONS
DX200 OPERATOR’S MANUAL (for each purpose)
DX200 MAINTENANCE MANUAL

The DX200 Operator’s manual above corresponds to specific usage. Be sure to use the appropriate manual.

Part Number: 165467-1CD
Revision: 1
MANDATORY

- This manual explains the Pendant Oscilloscope Function of the DX200 system and general operations. Read this manual carefully and be sure to understand its contents before handling the DX200.
- General items related to safety are listed in Chapter 1: Safety of the DX200 Instructions. To ensure correct and safe operation, carefully read the DX200 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.
We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems (ANSI/RIA R15.06-2012). You can obtain this document from the Robotic Industries Association (RIA) at the following address:

Robotic Industries Association
900 Victors Way
P.O. Box 3724
Ann Arbor, Michigan 48106
TEL: (734) 994-6088
FAX: (734) 994-3338
www.roboticsonline.com

Ultimately, well-trained personnel are the best safeguard against accidents and damage that can result from improper operation of the equipment. The customer is responsible for providing adequately trained personnel to operate, program, and maintain the equipment. NEVER ALLOW UN TRAINED PERSONNEL TO OPERATE, PROGRAM, OR REPAIR THE EQUIPMENT!

We recommend approved Yaskawa training courses for all personnel involved with the operation, programming, or repair of the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.
Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the DX200.

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

DANGER Indicates an imminent hazardous situation which, if not avoided, could result in death or serious injury to personnel.

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 “DANGER”, “WARNING” and “CAUTION”.


**WARNING**

- Before operating the manipulator, check that servo power is turned OFF pressing the emergency stop buttons on the front door of the DX200 and the programming pendant. 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 buttons do not function.

*Figure 1: Emergency Stop Button*

- Once the emergency stop button is released, clear the cell of all items which could interfere with the operation of the manipulator. Then turn the servo power ON.

  Injury may result from unintentional or unexpected manipulator motion.

*Figure 2: Release of Emergency Stop*

- Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
  - Be sure to use a lockout device to the safeguarding when going inside. Also, display the sign that the operation is being performed inside the safeguarding and make sure no one closes the safeguarding.
  - 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.

- Confirm that no person is present in the P-point maximum envelope of the manipulator and that you are in a safe location before:
  - Turning ON the power for the DX200.
  - Moving the manipulator with the programming pendant.
  - Running the system in the check mode.
  - Performing automatic operations.

  Injury may result if anyone enters the P-point maximum envelope of the manipulator during operation. Always press an emergency stop button immediately if there is a problem.

  The emergency stop buttons are located on the right of front door of the DX200 and the programming pendant.
Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product.
The MOTOMAN usually consists of the manipulator, the controller, the programming pendant, and the manipulator cables.

In this manual, the equipment is designated as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DX200 controller</td>
<td>DX200</td>
</tr>
<tr>
<td>DX200 programming pendant</td>
<td>Programming pendant</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator cable</td>
</tr>
</tbody>
</table>

Descriptions of the programming pendant, buttons, and displays are shown as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programming Pendant</td>
<td>Character Keys: The keys which have characters printed on them are denoted with [ ]. ex. [ENTER]</td>
</tr>
<tr>
<td></td>
<td>Symbol Keys:</td>
</tr>
<tr>
<td></td>
<td>Axis Keys: “Axis Keys” and “Number Keys” are generic names for the keys for axis operation and number input.</td>
</tr>
<tr>
<td></td>
<td>Number Keys:</td>
</tr>
<tr>
<td></td>
<td>Keys pressed simultaneously: When two keys are to be pressed simultaneously, the keys are shown with a “+” sign between them, ex. [SHIFT]+[COORD]</td>
</tr>
<tr>
<td></td>
<td>Displays: The menu displayed in the programming pendant is denoted with { }. ex. {JOB}</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.

Registered Trademark

In this manual, names of companies, corporations, or products are trademarks, registered trademarks, or brand names for each company or corporation. The indications of (R) and TM are omitted.

Customer Support Information

If you need assistance with any aspect of your Pendant Oscilloscope Function system, please contact Motoman Customer Support at the following 24-hour telephone number:

(937) 847-3200

For routine technical inquiries, you can also contact Motoman Customer Support at the following e-mail address:

techsupport@motoman.com

When using e-mail to contact Motoman Customer Support, please provide a detailed description of your issue, along with complete contact information. Please allow approximately 24 to 36 hours for a response to your inquiry.

Please use e-mail for routine inquiries only. If you have an urgent or emergency need for service, replacement parts, or information, you must contact Motoman Customer Support at the telephone number shown above.

Please have the following information ready before you call:

- System:
  Pendant Oscilloscope Function
- Robot:
- Primary Application:
- Controller:
  DX200
- Software Version:
  Access information on the Programming Pendant’s LCD display screen by selecting {MAIN MENU} - {SYSTEM INFO} - {VERSION}
- Robot Serial Number:
  Located on the robot data plate
- Robot Sales Order Number:
  Located on the DX200 controller data plate
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# Pendant Oscilloscope Function

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- 4.3.1 Channel Setting
- 4.3.2 Adjustment of Acquisition Time of Job Name and Step No.

## 4.4 Operation Function by Dedicated Input
- 4.4.1 Dedicated Input Signal
- 4.4.2 Dedicated Output Signal

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- 5.1 Division [div]: Unit for Measurement Screen Position
- 5.2 Reference Unit

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1 Overview

1.1 Pendant Oscilloscope Function

Pendant Oscilloscope Function (hereinafter referred to as “PP oscilloscope”) is the monitoring function of speed reference, torque reference, as well as of concurrent I/O signals of each robot axis on the Programming Pendant. The PP oscilloscope is configured by the software, which requires no special hardware equipment. By carrying out the PP oscilloscope function, the pendant oscilloscope application (hereinafter referred to as “PP oscilloscope application”) starts on the Programming Pendant.

Equipped with an integral display screen containing the waveform display window and the condition setting panel, the PP oscilloscope application enables to perform several processes from condition setting to measurement at a time. Other available functions include Trigger function that stops the data acquisition at a given condition, Measure and display function of maximum/minimum values after data acquisition, Zoom function that displays the waveform data in a magnified view, and data output function in a format available on the computer. Fig. 1-1 shows a typical display of PP oscilloscope.

Fig. 1-1: Display of PP Oscilloscope
1.2 Specification

Main specification of the PP oscilloscope is listed in Table 1-1 below:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement data type</td>
<td>Speed reference, Speed FB, Torque reference, Concurrent I/O signal, Register value</td>
<td>Number of channels that can be measured at the same time.</td>
</tr>
<tr>
<td>Maximum channel number</td>
<td>10 channels</td>
<td>Number of channels that can be measured at the same time.</td>
</tr>
<tr>
<td>Sampling time</td>
<td>4.0, 8.0, 16.0, 32.0, 64.0 [ms]</td>
<td>Indicates time interval for data sampling. Smaller values enable more detailed measurement data, but shorten the data record time due to much data volume.</td>
</tr>
<tr>
<td>Maximum data length</td>
<td>50 [s] to 100 [s]</td>
<td>Indicates data length that can be recorded at a measurement. Some setting of sampling time can limit the maximum data length available.</td>
</tr>
<tr>
<td>Waveform acquisition</td>
<td>Continuous mode Trigger mode</td>
<td>Selects the mode according to the Trigger state (valid/invalid):</td>
</tr>
<tr>
<td></td>
<td></td>
<td>○ Trigger Invalid: Continuous</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The Continuous mode displays the acquired data in a time-series order.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>○ Trigger Valid: Trigger</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The Trigger mode automatically stops the measurement and displays waveform when the trigger conditions are satisfied.</td>
</tr>
<tr>
<td>Trigger condition</td>
<td>○ Trigger for measurement waveform</td>
<td>Other than normal waveform triggers, alarm trigger is also included.</td>
</tr>
<tr>
<td></td>
<td>- Up trigger</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Down trigger</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Up&amp;Down trigger</td>
<td></td>
</tr>
<tr>
<td></td>
<td>○ Alarm trigger</td>
<td></td>
</tr>
<tr>
<td>Data saving format</td>
<td>☀ CSV</td>
<td>□ Saves the acquired data in CF or USB memory with the CSV (Comma Separated Value) format.</td>
</tr>
<tr>
<td></td>
<td>☀ JPG</td>
<td>□ Saves the displayed data on the screen in CF or USB memory with the JPG (Joint Photographic Experts Group) format.</td>
</tr>
</tbody>
</table>

1.3 Setup

The register value output function is applicable from version DN1.61.00A(--)00.

To activate the function, the optional parameters of the pendant oscilloscope function need to be effective (note that the user cannot change the parameter setting).

For the parameter setting other than specified above, contact a Yaskawa sales representative.
2 Setting and Operation for Data Measurement

This chapter describes setting and operation required for the measurement.

Basically the PP oscilloscope is operated by touching on the screen; for pull-down selection box or entry box, however, the Cursor Keys enable the cursor operation, and [SELECT], [ENTER] or [CANCEL] key enables selection, determination, or cancel, just as the normal operation on the pendant screens.

In performing numerical input using an entry box, first activate the parameter to a selective state by [SELECT] key, input numerical values by the Number Keys of the pendant, and press [ENTER] key to determine it. To cancel the input numerical values, press [CANCEL] key in the selective state.

2.1 Startup of Pendant Oscilloscope Function

The PP oscilloscope can be started up by the following step:

1. Select {ROBOT} from the menu in the left of screen.
2. Select {PENDANT OSCILLOSCOPE} from the expanded menu (see Fig. 2-1).

Fig. 2-1: PP Oscilloscope Startup Menu
### 2.2 Main Screen Configuration

Here explains the configuration of the Main screen.

The PP oscilloscope is displayed on the entire screen of Programming Pendant. The main screen has two types of modes; in-measurement and without not in-measurement (Waiting), in which functions or availability of some buttons are changed. Condition setting is only available in not in-measurement mode (Waiting).

#### 2.2.1 Main Screen (Not In-measurement Mode)

Main screen of not in-measurement mode (Waiting) is shown in Fig. 2-2 below with description.

**Fig. 2-2: Main Screen (Not In-measurement Mode)**

<table>
<thead>
<tr>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>① Waveform display area</td>
<td>Displays measured data waveform. When the data is not yet acquired soon after the startup or when the data is cleared, nothing is shown here. At the upper left of the area, measurement value obtained by the cursor measurement function is displayed.</td>
</tr>
<tr>
<td>② {MINIMIZE} button</td>
<td>Minimizes the PP oscilloscope application.</td>
</tr>
<tr>
<td>③ {CH} button</td>
<td>Opens the Channel Setting window. (For details of the Channel Setting window, refer to section 2.3.1 “Channel Setting Window” on page 2-4)</td>
</tr>
<tr>
<td>④ {START} button</td>
<td>Starts the data measurement.</td>
</tr>
<tr>
<td>⑤ {CLEAR} button</td>
<td>Deletes the displayed data waveform.</td>
</tr>
<tr>
<td>⑥ {CLOSE} button</td>
<td>Terminates the PP oscilloscope.</td>
</tr>
<tr>
<td>⑦ Condition setting panel</td>
<td>Enables to set various conditions. Touching the upper tab enables to open the setting screen corresponding to each parameter. (For details of each condition setting, refer to section 2.3.2 “CH Display Setting Panel” on page 2-8 to section 2.3.4 “Trigger Setting Panel” on page 2-11.)</td>
</tr>
<tr>
<td>⑧ Maximum display value</td>
<td>Displays values and units at the uppermost of waveform display area by each channel.</td>
</tr>
<tr>
<td>⑨ Minimum display value</td>
<td>Displays values and units at the lowermost of waveform display area by each channel.</td>
</tr>
<tr>
<td>⑩ Reference unit</td>
<td>Displays the reference unit by each channel. For details of the reference unit, refer to section 5.2 “Reference Unit” on page 5-2.</td>
</tr>
</tbody>
</table>

On the Main screen, information by channels is displayed in each specific color; for example in Fig. 2-2, information on CH3 is displayed in green, where the reference unit is 50%/div, the maximum display value is 450%, and the minimum display value is -50%.
2.2.2 Main Screen (In-measurement Mode)

Main screen of In-measurement mode is shown in Fig. 2-3. In this mode, the states of some buttons are changed. Here describes such buttons:

Fig. 2-3: Main Screen (In-measurement Mode)

<table>
<thead>
<tr>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>① (STOP) button</td>
<td>Switched from the (START) button, stops the data measurement.</td>
</tr>
<tr>
<td>② (CLEAR) button</td>
<td>In measurement mode, the button operation is disabled.</td>
</tr>
<tr>
<td>③ (CLOSE) button</td>
<td>In measurement mode, the button operation is disabled.</td>
</tr>
<tr>
<td>④ Condition setting panel</td>
<td>In measurement mode, the operation on tab is disabled.</td>
</tr>
</tbody>
</table>

Soon after switching the buttons (START) / (STOP), button operation is not available for a certain period of time to avoid continuous pressing of the buttons.

When the buttons (START) / (STOP) are disabled, wait until the operation becomes available.
2.3 Setting Measurement Conditions

Here describes how to set the measurement conditions on the channel setting window and the condition setting panel.

2.3.1 Channel Setting Window

Pressing the {CH} button on the Main screen opens the channel setting window. Fig. 2-4 shows the typical display example of the channel setting window. On this window, data type for measurement at each channel, measurement target axis, and measurement interval of each data can be set.

Fig. 2-4: Channel Setting Window

- **Sampling time**
  
  Sets the sampling interval of the data to be acquired. Settable options are 4.0, 8.0, 16.0, 32.0, and 64.0 [ms], each of which corresponds to the sampling frequencies of 250, 125, 62.5, 31.25, and 15.625 [Hz], respectively.

- **Measurement valid/invalid check box**
  
  Requires setting for each channel, where the channel with a check mark becomes valid for measurement.

  When the multiple channels are to be valid, the channel numbers are not necessarily to be sequential.

  The more the channels are available, the more the process is overloaded, and it affect the data updating speed in the waveform display area; it is recommended that unnecessary channels, if any, should be set to invalid.
Setting and Operation for Data Measurement

2.3 Setting Measurement Conditions

Target

Requires setting for each channel, where the setting of output signal type is available.

Servo: Enables to select the servo CPU signals at the option \(\bullet\).

I/O signal: Enables to input the concurrent I/O signal at the option \(\bullet\).

Register: Enables to input the register number at the option \(\bullet\).

Signal selection

Requires setting for each channel.

When \{Servo\} is selected at the option \(\bullet\): Select speed reference, speed feedback, or torque reference.

When \{I/O signal\} is selected at the option \(\bullet\): Input signal number of concurrent I/O. For the details of concurrent I/O, refer to “DX200 Concurrent I/O Instruction Manual (165294-1CD).”

When \{Register\} is selected at the option \(\bullet\): Input register number. Insert the numerical value between M000 and M999.

Axis selection

Set the target axis for data acquisition. (Only when Servo is selected at option \(\bullet\) Target)

One servo board (SRDA-EAXA21A) can connect up to 9 motors. Furthermore, up to 8 servo boards can be connected to a system. This means that the maximum axis configuration on a system allows simultaneous connection of 72 axes of motors.

The PP oscilloscope specifies the measurement target axis by the unique number of physical connection among these 72 axes. This is called as “physical axis connection”.

Under the basic system configuration of a servo board, the physical axes 1 to 6 are occupied by robot axis, and external axes are connected to the physical axes 7, 8, and 9. When every servo board is added, the number of physical axis is represented by offsetting each +9. This relationship is shown in the following table Table 2-1:

Table 2-1: Relationship between the number of servo board and the physical axis number  (Sheet 1 of 2)

<table>
<thead>
<tr>
<th>No. of servo board</th>
<th>Physical axis number of the board</th>
</tr>
</thead>
<tbody>
<tr>
<td>SV#1</td>
<td>1 to 9</td>
</tr>
<tr>
<td>SV#2</td>
<td>10 to 18</td>
</tr>
<tr>
<td>SV#3</td>
<td>19 to 27</td>
</tr>
</tbody>
</table>
2. Setting and Operation for Data Measurement
2.3 Setting Measurement Conditions

Table 2-1: Relationship between the number of servo board and the physical axis number (Sheet 2 of 2)

<table>
<thead>
<tr>
<th>No. of servo board</th>
<th>Physical axis number of the board</th>
</tr>
</thead>
<tbody>
<tr>
<td>SV#4</td>
<td>28 to 36</td>
</tr>
<tr>
<td>SV#5</td>
<td>37 to 45</td>
</tr>
<tr>
<td>SV#6</td>
<td>46 to 54</td>
</tr>
<tr>
<td>SV#7</td>
<td>55 to 63</td>
</tr>
<tr>
<td>SV#8</td>
<td>64 to 72</td>
</tr>
</tbody>
</table>

The following example shows the typical specification of physical axis number in the main system configuration.

Example:

○ Normal 6-axis robot, R1 to R8

<table>
<thead>
<tr>
<th>Target axis</th>
<th>S</th>
<th>L</th>
<th>U</th>
<th>R</th>
<th>B</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axis selection No. (R1)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Axis selection No. (R2)</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>Axis selection No. (R3)</td>
<td>19</td>
<td>20</td>
<td>21</td>
<td>22</td>
<td>23</td>
<td>24</td>
</tr>
<tr>
<td>Axis selection No. (R4)</td>
<td>28</td>
<td>29</td>
<td>30</td>
<td>31</td>
<td>32</td>
<td>33</td>
</tr>
<tr>
<td>Axis selection No. (R5)</td>
<td>37</td>
<td>38</td>
<td>39</td>
<td>40</td>
<td>41</td>
<td>42</td>
</tr>
<tr>
<td>Axis selection No. (R6)</td>
<td>46</td>
<td>47</td>
<td>48</td>
<td>49</td>
<td>50</td>
<td>51</td>
</tr>
<tr>
<td>Axis selection No. (R7)</td>
<td>55</td>
<td>56</td>
<td>57</td>
<td>58</td>
<td>59</td>
<td>60</td>
</tr>
<tr>
<td>Axis selection No. (R8)</td>
<td>64</td>
<td>65</td>
<td>66</td>
<td>67</td>
<td>68</td>
<td>69</td>
</tr>
</tbody>
</table>

○ 7-axis single-arm robot (such as SIA), R1 to R8

<table>
<thead>
<tr>
<th>Target axis</th>
<th>S</th>
<th>L</th>
<th>U</th>
<th>R</th>
<th>B</th>
<th>T</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axis selection No. (R1)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Axis selection No. (R2)</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>Axis selection No. (R3)</td>
<td>19</td>
<td>20</td>
<td>21</td>
<td>22</td>
<td>23</td>
<td>24</td>
<td>25</td>
</tr>
<tr>
<td>Axis selection No. (R4)</td>
<td>28</td>
<td>29</td>
<td>30</td>
<td>31</td>
<td>32</td>
<td>33</td>
<td>34</td>
</tr>
<tr>
<td>Axis selection No. (R5)</td>
<td>37</td>
<td>38</td>
<td>39</td>
<td>40</td>
<td>41</td>
<td>42</td>
<td>43</td>
</tr>
<tr>
<td>Axis selection No. (R6)</td>
<td>46</td>
<td>47</td>
<td>48</td>
<td>49</td>
<td>50</td>
<td>51</td>
<td>52</td>
</tr>
<tr>
<td>Axis selection No. (R7)</td>
<td>55</td>
<td>56</td>
<td>57</td>
<td>58</td>
<td>59</td>
<td>60</td>
<td>61</td>
</tr>
<tr>
<td>Axis selection No. (R8)</td>
<td>64</td>
<td>65</td>
<td>66</td>
<td>67</td>
<td>68</td>
<td>69</td>
<td>70</td>
</tr>
</tbody>
</table>
2 Setting and Operation for Data Measurement

2.3 Setting Measurement Conditions

○7-axis dual-arm robot (such as SDA)

<table>
<thead>
<tr>
<th>Target axis</th>
<th>S</th>
<th>L</th>
<th>U</th>
<th>R</th>
<th>B</th>
<th>T</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axis selection No. (R1)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Axis selection No. (R2)</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>Target axis</td>
<td>EX1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Axis selection No. (S1)</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EX1 in this table corresponds to the waist axis (external axis) of dual-arm robot.

○Normal 6-axis robot + external axis, R1 to R8 (R1 + S1 [3-axis] setting)

<table>
<thead>
<tr>
<th>Target axis</th>
<th>S</th>
<th>L</th>
<th>U</th>
<th>R</th>
<th>B</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axis selection No. (R1)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Target axis</td>
<td>EX1</td>
<td>EX2</td>
<td>EX3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Axis selection No. (S1)</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

○7-axis robot + external axis (R1 + S1 [1-axis] + S2 [1-axis] setting)

<table>
<thead>
<tr>
<th>Target axis</th>
<th>S</th>
<th>L</th>
<th>U</th>
<th>R</th>
<th>B</th>
<th>T</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axis selection No. (R1)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Target axis</td>
<td>EX1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Axis selection No. (S1)</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Axis selection No. (S2)</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

© {OK} button

Closes the window with the change given on the channel setting window reflected. When there is a measured waveform at the waveform display area, the waveform data is cleared.

When no change has been given after the channel setting window is opened, this button acts just as the {CANCEL} button.

© {CANCEL} button

Closes the window without reflecting the change given on the channel setting window. The waveform data is not cleared.
2.3.2 CH Display Setting Panel

With the data measurement stopped, select (touch) the {ChCondition} tab on the condition setting panel. Fig. 2-5 shows the typical display example of the CH display setting panel.

**Fig. 2-5: ChCondition Setting Panel**

This panel allows the setting of panel display targeted to the channels validated in the channel setting window.

**Channel**
Select the target channel for setting operation. Upon the channels set here, the setting change given to the following options 2 to 5 is reflected.

Note that the invalid channels are disabled (in which the radio button is inoperable), and cannot be selected.

**Display**
Enables to select either to display {ON} or hide {OFF} the waveform data of target channel. The data is internally stored even when the data is measured with the Display {OFF}, and the corresponding waveform data is displayed when Display {ON} is selected.

**Invert**
Enables to select either to invert the waveform data of target channel or not. Selecting Invert {ON} inverts the display of waveform data in a waveform display area between positive and negative. Selecting Invert {OFF} returns to the original state.
Setting and Operation for Data Measurement

2.3 Setting Measurement Conditions

**Position**

Sets the zero position of target channel. Specify the zero point within the range of -5.0 to 5.0 [div] in the vertical axis of waveform display area.

On the extreme left of waveform display area, a marker is provided showing a zero point for each channel in which the current zero point can be confirmed (see *Fig. 2-6*).

*Fig. 2-6: Zero Point Marker*

**Unit (rpm/div, %/div, U/div)**

Selects the reference unit of target channel in the vertical axis scale. (For description of the unit, refer to *section 5.2 “Reference Unit” on page 5-2.*

Displayed unit and its selection depend on the signal output by the target channel.

Speed reference, Speed FB:
- Unit [rpm/div]: selectable among 250, 500, 1000, and 2000

Torque reference:
- Unit [%/div]: selectable among 33, 50, 66, and 100

Concurrent I/O signal:
- Unit [U/div]: selectable among 0.2, 0.5, 1.0, 2.0, 5.0, and 10.0

Register:
- Unit [-/div]: selectable among 1, 2, 5, 10, 20, 50, 100, 200, 500, 1000, 2000, 3277, 5000, 6554, 10000, 13107, 20000, 32768, 50000 and 65535.
2.3 Setting Measurement Conditions

2.3.3 TimeScale Setting Panel

With the data measurement stopped, touch {TimeScale} tab on the condition setting panel. Fig. 2-7 shows the typical display example of TimeScale setting panel.

**Fig. 2-7: TimeScale Setting Panel**

![TimeScale Setting Panel](image)

\( ms/\text{div} \)

Sets the time for the horizontal axis of the waveform display area. The value selected here should be the time width [ms] per division of horizontal axis. Since there are 10 divisions in the entire horizontal axis, the eventual data length is 10 times of the specified value.

Selectable range of ms/div depends on the combination of sampling time set on the Channel Setting window:

- With the sampling time of 4 [ms]:
  Up to 5000 [ms/div] (data length: 50 [s])

- With the sampling time of 8 [ms] or more:
  Up to 10000 [ms/div] (data length: 100 [s])
2.3.4 Trigger Setting Panel

With the data measurement stopped, select (touch) {Trigger} tab on the condition setting panel. Fig. 2-8 shows the typical display example of Trigger setting panel.

This panel allows the setting of trigger function.

Fig. 2-8: Trigger Setting Panel

The trigger function is the function to automatically stop the measurement and display the waveform at the point where a certain condition is satisfied during the data measurement.

As trigger conditions, three options are available: when the target channel data exceeds or falls below the specified value (trigger level), or when any alarm occurs.

The data stop position is determined by Pre-trigger. The measurement result is displayed so that the position satisfying the trigger conditions becomes the Pre-trigger position. For example in Fig. 2-9, the data length is 10 [s] and the specified Pre-trigger is 3 [div] in horizontal axis. This allows the setting where the data before the trigger is acquired for 3 seconds, and the data after the trigger is acquired for 7 seconds.

Fig. 2-9: Outline of Trigger Function

© CH

Select the channel as trigger target. Only the valid channel is selectable.
2 Setting and Operation for Data Measurement
2.3 Setting Measurement Conditions

ο TrgType (Trigger type)

Select the trigger type to use. Selectable options are Up, Down, Up&Down, and Alarm.

When selecting Alarm, some of the setting parameters of Trigger Conditions are changed.

Table 2-2: Characteristics of Trigger Type

<table>
<thead>
<tr>
<th>Trigger type</th>
<th>Trigger condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up</td>
<td>When the trigger target channel data exceeds the trigger level</td>
</tr>
<tr>
<td>Down</td>
<td>When the trigger target channel data falls below the trigger level</td>
</tr>
<tr>
<td>Up&amp;Down</td>
<td>When the trigger target channel data is either over or below the trigger level</td>
</tr>
<tr>
<td>Alarm</td>
<td>When the alarm assigned to alarm number occurs</td>
</tr>
</tbody>
</table>

ο PreTrg (Pre-trigger)

Specify the pre-trigger position by the horizontal axis division (0 to 10.0).

Current pre-trigger position is shown by a marker on the upper part of the waveform display area (see Fig. 2-10).

Fig. 2-10: Pre-trigger Marker
2.3 Setting Measurement Conditions

**Level**

Specify the trigger level by the vertical division (-10.0 to +10.0). The current trigger level is shown by a marker on the left of the waveform display area (see Fig. 2-11). The marker shape depends on the selected trigger type.

*Fig. 2-11: Trigger Level Marker*

The value specified here is regarded as a position with the zero point of trigger target channel as reference. When the trigger level is specified as 2.5 [div] with the channel zero position of -2.0 [div] (in vertical axis), the displayed position of trigger level on the waveform display area is 0.5 [div] (in vertical axis). (See the example of Fig. 2-9.)

**TriggerMode**

Switches the valid/invalid state of trigger. According to this setting, the waveform data acquisition mode is switched.

- **Invalid**: Continuous mode
  
  When the waveform data measurement is started, the acquired data is continuously displayed in a time-series order.
  
- **Valid**: Trigger mode
  
  The measurement is automatically stopped when the trigger conditions are satisfied, and the waveform is displayed.

○When {Alarm} is selected as TrigType:

When {Alarm} is selected as the trigger type, the only condition for the trigger is when the target alarm specified here by the number occurs. The alarm trigger does not depend on the channel setting, so the settings of {CH} or {Level} are not referred.
Fig. 2-12 shows the typical display example when the option {Alarm} is selected as TrigType.

Fig. 2-12: Trigger Setting Panel (Alarm Trigger)

<table>
<thead>
<tr>
<th>ChCondition</th>
<th>TimeScale</th>
<th>Trigger</th>
<th>Zoom</th>
<th>Measure</th>
<th>Save</th>
<th>Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH: 4</td>
<td></td>
<td>TrigType: Alarm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PreTrg(div): 5.0</td>
<td>AlarmNo: 4328</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TriggerMode</td>
<td>OFF</td>
<td>ON</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

© AlarmNo

Selecting {Alarm} as the trigger type switches {Level} turns to an entry box of {AlarmNo}. Input a valid alarm number here. When a nonexistent alarm number is specified, an error occurs when the measurement starts.

For details of alarm number, refer to "DX200 Maintenance manual (165293-1CD)".

Major alarms, when occur, may contain abnormal data transmission between the controller hardware, and a normal operation of pendant oscilloscope cannot be guaranteed.

It is recommended that the target alarm number as the alarm trigger should be Minor or User alarms rather than Major alarms.
2.4 Starting and Ending Measurement

Here describes the step of actual data measurement. Ensure to start the measurement after completing the condition setting described in section 2.3 “Setting Measurement Conditions” on page 2-4.

2.4.1 Continuous Mode

The Continuous mode is the mode in which the measurement data is always displayed and updated in the time-series order. Follow the steps below:

1. Select OFF for (TriggerMode) on the Trigger setting panel.
2. Start the measurement by the (START) button. The data measurement starts, and the data is displayed in the time-series order on the waveform display area, and updated in series.
3. When the time passes longer than the specified data length from the measurement start, the data is discarded from the oldest one, and the new data is updated in series (see Fig. 2-13).
4. When the target waveform data is displayed on the waveform display area, press the (STOP) button to stop the measurement.

**Fig. 2-13: Continuous Mode**

Continuous mode enables to display the measurement data in time-series order, but it does not necessarily assure the real-time display. The data contain a delay to a certain extent, and the delay can be extended as the measured data is large in volume.

The following setting changes help for the challenging of real-time display:

- Trying smaller number of available channels
- Trying longer sampling time
- Trying shorter data length
2.4 Starting and Ending Measurement

2.4.2 Trigger Mode

The Trigger mode automatically stops the measurement when the trigger condition is satisfied, and displays the waveform on the screen. Follow the step below:

1. Set the trigger conditions on the Trigger setting panel.
2. Select ON for \{TriggerMode\}.
3. Start the measurement by the \{START\} button. This starts the data measurement, and the waveform display area is turned to the waiting state, and holds the state until the trigger condition is satisfied. On the screen, a message "Waiting for trigger..." is displayed (see Fig. 2-14). To cancel the measurement during this state, press the \{STOP\} button.

Fig. 2-14: Display of Trigger Mode “Waiting for trigger”

4. When the trigger condition is satisfied, “Triggered” is displayed on the screen (see Fig. 2-15). To collect the waveform data later than the trigger position, the condition is held for as long as 100 seconds according to the setting of data length and pre-trigger. To cancel the measurement during this state, press the \{STOP\} button.

Fig. 2-15: Display of Trigger Mode “Triggered”

5. When all the waveform data for an entire window is acquired, the measurement automatically ends and the waveform is displayed.
2.5 Termination and Minimization of Pendant Oscilloscope Function

2.5.1 Termination of PP Oscilloscope

Pressing the {CLOSE} button on the Main screen terminates the PP oscilloscope. Each condition setting parameter is automatically saved, and the setting at the termination will be reflected at the next startup.

2.5.2 Minimizing PP Oscilloscope Application

Pressing the {MINIMIZE} button on the Main screen can minimize the PP oscilloscope application. Minimizing means the PP oscilloscope changes to the background process with running. When minimized PP oscilloscope disappears just as the system termination does, but the waveform measurement process is continued. This is useful when the operations on the other system screens are necessary with the waveform data measurement continued.

When an alarm or an error occurs on the controller, the PP oscilloscope application is forcefully minimized to display the alarm preferentially.

When the PP oscilloscope application is minimized during the data measurement, the following message is displayed on the message area of the Pendant System screen: “Measuring the pendant oscilloscope data.” (See Fig. 2-16).

Fig. 2-16: Message Display during the data measurement

Minimized PP oscilloscope application can be returned to the original state by selecting {Pendant Oscilloscope} from the menu as in the startup operation.
3 Saving and Loading the Measurement Data

This chapter describes the saving and loading of the measurement data.

3.1 SaveMode Setting Panel

With the data measurement stopped, select (touch) {Save} tab in the
condition setting panel. Fig. 3-1 shows the typical example of SaveMode
setting on the panel.

Fig. 3-1: SaveMode Setting Panel

- **SaveMode**
  Enables to select Manual/Auto of the saving mode. In selecting the
  automatic saving mode (Auto), ensure to perform the setting with the
  external CF or USB memory inserted to the Programming Pendant.

- **{HardCopy} button**
  Pressing the button enables to save the hard copy of the screen in CF
  or USB memory.

- **{SaveCSV} button**
  It is available only when {Manual} is selected for the SaveMode option.
  Pressing the button enables saving the measurement data into CF or
  USB memory.

3.1.1 Data File Name and Save Destination

The measurement data is saved in the CSV (Comma Separated Value)
file format.

The file is automatically given a file name consisting of the time, date and
the year when the save operation starts (yyyymmdd_hhmss.csv).

As the CSV file destination, a folder of the following address is
automatically created in the external CF or USB memory of the pendant,
and the data is saved in the folder:

¥PP_OSCILLOSCOPE¥csv¥user¥

The hard copy data of the screen is saved in the JPG (Joint Photographic
Experts Group) format.
The file is automatically given a file name consisting of the time, date and the year when the save operation starts (yyymmd_hhmmss.jpg). The JPG file is saved in the root folder in the external CF or USB memory of the pendant.

When both CF and USB memory are inserted, USB memory is given priority for the data storage destination.

### 3.1.2 CSV File

The CSV file contains the setting parameters shown in Table 3-1. The CSV file can be used for file output of waveform data, as well as for backup of the current setting status.

The setting parameters of TP oscilloscope are automatically saved to the pendant when {OK} is pressed on the Channel Setting window or {CLOSE} on the Main screen. However, at system software version-up, these parameters are initialized. Use the CSV file for backup as necessary.

### Table 3-1: Parameters to Save for CSV Files

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sampling time</td>
<td>As left</td>
</tr>
<tr>
<td>Timescale setting (data length)</td>
<td>As left</td>
</tr>
<tr>
<td>Channel setting</td>
<td>Valid/Invalid</td>
</tr>
<tr>
<td></td>
<td>Target</td>
</tr>
<tr>
<td></td>
<td>Signal</td>
</tr>
<tr>
<td></td>
<td>Target axis</td>
</tr>
<tr>
<td>Channel display setting</td>
<td>Zero point position</td>
</tr>
<tr>
<td></td>
<td>Reference unit</td>
</tr>
<tr>
<td></td>
<td>Display ON/OFF</td>
</tr>
<tr>
<td></td>
<td>Invert ON/OFF</td>
</tr>
<tr>
<td>Trigger setting</td>
<td>Target channel</td>
</tr>
<tr>
<td></td>
<td>Trigger type</td>
</tr>
<tr>
<td></td>
<td>Trigger level</td>
</tr>
<tr>
<td></td>
<td>Pre-trigger</td>
</tr>
<tr>
<td></td>
<td>Alarm number</td>
</tr>
<tr>
<td></td>
<td>Valid/Invalid</td>
</tr>
<tr>
<td>Waveform data</td>
<td>Waveform data of available channel(s)</td>
</tr>
</tbody>
</table>
3.2 Load Panel

With the data measurement stopped, select (touch) {Load} tab on the condition setting panel. Fig. 3-2 shows the typical example of the Load panel.

Fig. 3-2: Load Panel

The Load panel loads the CSV file previously saved to recreate the waveform and setting parameters (those in Table 3-1) at that time.

The current setting parameters are overwritten by the loaded CSV file data when the data is loaded.

① Pull-down box for file selection

Select the file to load. The pull-down menu displays the file name stored in the folder of the following address in the external CF or USB memory of the Programming Pendant:

¥PP_OSCILLOSCOPE¥csv¥user¥

When both CF and USB memory are inserted, USB memory is given priority.

When a file other than that saved in the PP oscilloscope is included in the above folder, it may appear on the list, but it will cause an error when it is loaded.

② {LoadCSV} button

After selecting the file to load, touch the {LoadCSV} button. A message, “Overwrite current setting. OK?” appears. Selecting {OK} starts the data loading.
4 Other Functions

4.1 Zoom Function

With the data measurement stopped, select (touch) {Zoom} tab on the condition setting panel. Fig. 4-1 shows the typical example of the Zoom function setting panel.

This panel enables to set and perform the zoom function.

Fig. 4-1: Zoom Function Setting Panel

The Zoom function is the function to enlarge the specified range within the waveform display area to the timescale direction.

Set the range to enlarge as in Fig. 4-2, to perform the Zoom function.

Fig. 4-2: Outline of Zoom Function

- Center

Specify the center position in the zoom range by the division (0 to 10.0) in the horizontal axis. The center position is not shown in the actual screen. It is the center between two width lines.

When pressing [SHIFT] key + Cursor with {Zoom} tab opened, the center position may move to right and left at 0.05[div]. And when keep pressing [SHIFT] key + Cursor, the center position may move at high speed.
4 Other Functions

4.1 Zoom Function

① Width

Specify the size of zoom range by width, with the center position specified in the Center. The width is shown in the waveform display area by a white line.

In case the width of the range to be zoomed extended outside the waveform display area, the center position is automatically adjusted so that the width fits inside the range.

② {Zoom} button

Touching this button after setting of Center and Width zooms the specified range.

4.1.1 During Execution of Zoom Function

When the Zoom function is performed, the currently displayed waveform disappears, and the data in the zoom range is enlarged and displayed on the waveform display area. Although the waveform before zoomed temporarily disappears, it is retained inside the system; once canceling the zoom function returns to the original state.

While the zoom function is performed, the {Zoom} button is switched to the {ZoomCancel} button.

NOTE

While the zoom function is performed, operations of the {START} button and the {CH} button, and of the panels as tab switch setting become unavailable. To enable these operations, touch the {ZoomCancel} button.
4.2 Cursor Measurement Function

With the data measurement stopped, select (touch) the {Measure} tab on the condition setting panel. Fig. 4-3 shows the typical example of the Measure panel.

**Fig. 4-3: Measure Panel and Cursor Display (with Vertical Cursor)**

The cursor measurement function is the function to read the data within the range selected by two cursors, calculate the values corresponding to the specified measurement parameters, and display the result.

**CursorType**

Select the cursor type either from Horizontal or Vertical. Select the type according to the usage. The {OFF} option makes the function unavailable.

**CH**

Specify the channel to which the cursor measurement is targeted. The channel specified as unavailable in the Channel Setting window cannot be selected.

**Cursor1, Cursor2**

When the vertical cursor is selected in ①, specify the cursor position in the horizontal division (0 to 10.0).

When the horizontal cursor is selected in ①, specify it in the vertical division (-5.0 to 5.0).

The area enclosed by Cursor1 and Cursor2 becomes the target area of cursor measurement. Even when the positions of Cursor1 and Cursor2 are switched, the target area is always the area inside these two lines.
4 Other Functions
4.2 Cursor Measurement Function

The cursor is displayed by a white broken line on the waveform display area.
When there is no target channel data within the specified cursor range, a part of the measurement parameters is not calculated. When this happens, the result is shown in hyphens (“-“).

CursorMode

When pressing [SHIFT] key + Cursor with {Zoom} tab opened, the center position may move 0.05[div] to right and left. And when keep pressing [SHIFT] key + Cursor, the position may move at high speed.

When Horizontal cursor type is selected at \( \text{Cursor} \) on the display, the cursor moves horizontally, and it moves vertically when Vertical cursor type is selected.

Only the cursor 1 moves along the key input when “Cursor 1” is selected and only cursor 2 moves when “Cursor 2” is selected. Also, both cursor 1 and 2 moves when “1 and 2” is selected.
4.2.1 Cursor Measurement Parameters

○ For horizontal cursor

With the cursor measurement valid, the measurement parameters and the calculation result are automatically displayed at the upper left of waveform display area. The type of measurement parameters in the horizontal cursor is shown in Table 4-1.

**Table 4-1: Measurement Parameters of Horizontal Cursors**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cursor1</td>
<td>Value of measurement target channel at the Cursor1</td>
</tr>
<tr>
<td>Cursor2</td>
<td>Value of measurement target channel at the Cursor2</td>
</tr>
<tr>
<td>MAX</td>
<td>Maximum value of measurement target channel between Cursor1 and Cursor2</td>
</tr>
<tr>
<td>MIN</td>
<td>Minimum value of measurement target channel between Cursor1 and Cursor2</td>
</tr>
<tr>
<td>P-P</td>
<td>(Peak to Peak: difference of MAX and MIN)</td>
</tr>
<tr>
<td></td>
<td>Absolute value of the result obtained by: MAX-MIN</td>
</tr>
</tbody>
</table>

○ For vertical cursor

With the cursor measurement valid, the measurement parameters and the calculation result are automatically displayed at the upper left of waveform display area. The type of measurement parameters in the vertical cursor is shown in Table 4-2.

**Table 4-2: Measurement Parameters of Vertical Cursors**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>Time width between Cursor1 and Cursor2</td>
</tr>
<tr>
<td>Cursor1</td>
<td>Value of measurement target channel at the Cursor1</td>
</tr>
<tr>
<td>Cursor2</td>
<td>Value of measurement target channel at the Cursor2</td>
</tr>
<tr>
<td>MAX</td>
<td>Maximum value of measurement target channel between Cursor1 and Cursor2</td>
</tr>
<tr>
<td>MIN</td>
<td>Minimum value of measurement target channel between Cursor1 and Cursor2</td>
</tr>
<tr>
<td>P-P</td>
<td>(Peak to Peak: difference of MAX and MIN)</td>
</tr>
<tr>
<td></td>
<td>Absolute value of the result obtained by: MAX-MIN</td>
</tr>
<tr>
<td>RMS</td>
<td>(RMS: Root Mean Square)</td>
</tr>
<tr>
<td></td>
<td>Data between Cursor1 and Cursor2; calculated actual value of the measurement target channel</td>
</tr>
</tbody>
</table>
4.3  Job Step No. Saving Function

When “1” is set to S2C1242, the job step No. saving function is enabled.

In this function, the job name and the step No. which are under execution at the time are added to the waveform data of the CSV file, and the waveform data and the job step No. are related and saved.

**NOTE**
The job step No. saving function is available in the version DN1.61.00A(--)00 and the later.

**Fig. 4-4: Example for Adding Items to Be Saved in CSV File (Job Name and Step No.)**

<table>
<thead>
<tr>
<th>Time, ms</th>
<th>CH1, rpm</th>
<th>CH2, %</th>
<th>Job Name, Step Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>0.000000</td>
<td>1.178869</td>
<td>“TESTJOB”, 1</td>
</tr>
<tr>
<td>4.0</td>
<td>0.000000</td>
<td>1.483749</td>
<td>“TESTJOB”, 1</td>
</tr>
<tr>
<td>8.0</td>
<td>0.000000</td>
<td>1.483749</td>
<td>“TESTJOB”, 1</td>
</tr>
<tr>
<td>12.0</td>
<td>0.000000</td>
<td>1.483749</td>
<td>“TESTJOB”, 1</td>
</tr>
</tbody>
</table>

The job name and the step No. are saved only when the play mode executes a job and when the teach mode executes a trial run or a NEXT operation. In a JOG operation or an IO jog operation, the job name and the step No. are not saved.

**Table 4-3: Conditions that Job Name and Step No. Are Saved**

<table>
<thead>
<tr>
<th>Operation</th>
<th>Saved/not</th>
</tr>
</thead>
<tbody>
<tr>
<td>Playback</td>
<td>Saved</td>
</tr>
<tr>
<td>Trial run</td>
<td>Saved</td>
</tr>
<tr>
<td>Interlock + NEXT</td>
<td>Saved</td>
</tr>
<tr>
<td>NEXT</td>
<td>Saved</td>
</tr>
<tr>
<td>NEXT for P variable</td>
<td>Not</td>
</tr>
<tr>
<td>IO jog</td>
<td>Not</td>
</tr>
<tr>
<td>Jog operation</td>
<td>Not</td>
</tr>
</tbody>
</table>

**NOTE**
The job name and the step No. are assigned to the position instruction. On the other hand, the waveform data interprets the position instruction and acquires data when the motor operates actually. Therefore, deviations of acquisition timing for a certain time occurs between both data.

Be careful when referring to the data which is close to the switching point of the step No.
4.3.1 Channel Setting

Only one control group can be specified at one measurement time as the control group which is targeted to acquire the job name and the step No. The setting can be performed in Channel Setting screen of the PP oscilloscope (Fig. 4-5).

When the job including a control group which is set in this item works, the job name and the step No. are saved.

Fig. 4-5: Adding Items to "ControlGroup" of Channel Setting Screen

4.3.2 Adjustment of Acquisition Time of Job Name and Step No.

When the job cursor reaches END or when the other job is called (when the assignment of the job name and the step No. to the targeted control group are stopped), the job name and the step No. which are output lastly can be kept recording for a certain time.

This can be performed when assignment of the job name and the step No. are interrupted because of the deviation of the waveform against the instruction.

S4C1039 can adjust this addition time (unit: msec, default value: 500 msec).

Fig. 4-6: Example for Acquisition Time of Job Name and Step No.
4 Other Functions

4.4 Operation Function by Dedicated Input

When "1" is set to S2C1244, the signal operation function is enabled. This function makes the following operations performed on the programming pendant executable externally by the dedicated input signals.

- Starting PP oscilloscope
- Starting measurement
- Saving CSV file

Also, the PP oscilloscope status is output to the dedicated output signal, and it can be externally referred.

**NOTE**: The operation function by dedicated input is available in the version DN1.61.00A(--)-00 and the later.

**NOTE**: This function aims to start measurement externally without operating and referring to the programming pendant. Therefore, it has no dedicated input signal to stop measurement. For stopping measurement, use the trigger mode.

### 4.4.1 Dedicated Input Signal

<table>
<thead>
<tr>
<th></th>
<th>40767</th>
<th>40766</th>
<th>40765</th>
<th>40764</th>
<th>40763</th>
<th>40762</th>
<th>40761</th>
<th>40760</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIN#608</td>
<td>OSC</td>
<td>OSC</td>
<td>OSC</td>
<td>OSC</td>
<td>OSC</td>
<td>OSC</td>
<td>OSC</td>
<td>OSC</td>
</tr>
<tr>
<td>SIN#607</td>
<td>SAVE</td>
<td>MEAS</td>
<td>START</td>
<td>OSC</td>
<td>OSC</td>
<td>OSC</td>
<td>OSC</td>
<td>OSC</td>
</tr>
<tr>
<td>SIN#606</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SIN#605</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SIN#604</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SIN#603</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SIN#602</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SIN#601</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 40760: Starting Pendant Oscilloscope

Starts PP oscilloscope.

When PP oscilloscope is in minimized status, it is released.

This signal performs the same operation as the operation when pressing (Robot) → (Pendant oscilloscope) from the main menu.

**NOTE**: When it is in one of the following status, pendant oscilloscope cannot be started even if this signal is turned ON.

- An error exists.
- Other external application is running.

After releasing the status, turn ON this signal.
4. Other Functions
4.4 Operation Function by Dedicated Input

- **40761: Pendant Oscilloscope Starting Measurement**
  Starts measurement. This signal performs the same operation as the operation when pressing [START] of PP oscilloscope.

- **40762: Pendant Oscilloscope Saving CSV File**
  Saves the measured data to the CSV file. This signal performs the same operation as the operation when pressing [Save CSV] of PP oscilloscope.

The measurement start requesting signal (40761) and the CSV file saving requesting signal (40762) are monitored only when the signal acceptance ready (51172) is ON. In order to accept the request surely, put a requesting signal with the following procedure.

- After the signal acceptance ready (51172) is turned ON, wait for 1 second, and then put the signal.
- After putting the signal, ON status should be maintained for 1 second or longer.
4.4 Operation Function by Dedicated Input

4.4.2 Dedicated Output Signal
Displays PP oscilloscope operation status. When PP oscilloscope is not running, all signals are OFF.

- **50903**: Pendant Oscilloscope Under Measurement
  Notifies that measurement is currently performed.
  ![State](State)
  Only this signal varies regardless of S2C1244 setting.

- **51170**: Pendant Oscilloscope Running
  Notifies that PP oscilloscope is running.
  ![State](State)
  This signal is turned ON even if PP oscilloscope is in minimized status.

- **51171**: Pendant Oscilloscope Minimized
  Notifies that PP oscilloscope is in minimized status.
  ![State](State)

PP oscilloscope is minimized by the following factors:
- The (MINIMIZE) button is pressed.
- An alarm or an error occurs.

The minimized status can be cancelled by selecting (Pendant oscilloscope) from the main menu or using the start requesting signal (40760).
### 51172: Pendant Oscilloscope IO Acceptance Ready

Notifies that PP oscilloscope is monitoring the start request (40761) and the CSV file saving request (40762).

- Only when the following conditions are satisfied, this signal is turned ON.
  - Measurement CH settings are completed.
  - Not under measurement.
  - Not under saving the CSV file.
  - Not in the minimized status.
  - Not under zooming (section 4.1.1 “During Execution of Zoom Function” on page 4-2).

### 51173: Pendant Oscilloscope Measurement Error

Notifies that the measurement failed to start when the {START} button or the start requesting signal (40761) tried to start measurement.

Check that there are no errors in the measurement conditions. This signal is turned OFF when newly starting measurement.

### 51174: Pendant Oscilloscope CSV File Under Saving

Notifies that the CSV file is under saving.

### 51175: Pendant Oscilloscope CSV File Error in Saving

Notifies that saving is failed when starting saving with the {Save CSV} button or the CSV file saving requesting signal (40762). Check the condition of the external storage device.

This signal is turned OFF when newly starting saving.

When requesting saving in the condition that the measurement is never performed after starting PP oscilloscope, saving is not performed but this signal is not turned ON.
5 Supplementary Explanation

Here explains some of the terms used in this manual.

5.1 Division [div]: Unit for Measurement Screen Position

The PP oscilloscope includes the operation that specifies the various positions (or range) in the waveform display area, such as specifying zero point of measurement channel, specifying cursor range, or zoom range. To specify these positions, unit of “division [div]” is used. Here describes the details.

The waveform display area is represented in a range of 10 vertical grids and 10 horizontal grids. The cell consisted of a vertical grid and a horizontal grid is called as Division [div], both for vertical axis and horizontal axis. The vertical axis is divided into 10 cells, 5 for the upper part and 5 for the lower part. The center is regarded as 0 [div], and the maximum value in the upmost position is 5 [div], whereas the minimum value in the bottom position is -5 [div]. For the horizontal axis, the left end position is regarded as 0 [div], and the right end position is 10 [div]. The outline is shown in Fig. 5-1.

For example, in specifying 3 [div], if it is given to the vertical axis, it shows the location ① in Fig. 5-1, whereas if it is given to the horizontal axis, it shows the location ②.

Fig. 5-1: Illustration of Division in Waveform Display Area
5.2 Reference Unit

Here describes the reference unit.

The data of measurement target has each unit, as shown in Table 5-1.

Table 5-1: Unit of Data

<table>
<thead>
<tr>
<th>Data type</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed reference</td>
<td>[rpm] Rotating speed of target axis motor in a minute</td>
</tr>
<tr>
<td>Speed feedback</td>
<td>[rpm] Actual rotating speed of target axis motor in one minute</td>
</tr>
<tr>
<td>Torque reference</td>
<td>[%] Current torque reference value when the target axis motor rated torque is converted as 100%</td>
</tr>
<tr>
<td>Concurrent I/O</td>
<td>No unit, for it is just an ON/OFF signal. To differentiate from other signal data, [U] (unit) is used for expediency. OFF: 0 U is output ON: 1.0 U is output</td>
</tr>
<tr>
<td>Register</td>
<td>No unit, for it is just an register value. Register value is output without changed. Example: When the vertical scale is 100[-/div] and the target register value is 200, the output of 2 divisions is given.</td>
</tr>
</tbody>
</table>

When the speed reference is selected as a measurement signal of the target channel, the initial value of the reference unit is 1000 [rpm/div]. This means that the speed is 1000 [rpm] when the output of vertical 1 [div] is given from the target channel zero position. From this relationship, the outline of waveform data output on the waveform display area can be grasped.

Example: with the setting of 1000 [rpm/div]:

- Output of 2.0 [div]: 2000 [rpm]
- Output of -3.3 [div]: -3300 [rpm]

Since the reference unit can be changed in the (ChCondition) tab, the waveform display scale in the vertical direction can be changed accordingly.

Example: with the actual output of 1000 [rpm]:

- Setting of 1000 [rpm/div]: Output of 1 division
- Setting of 500 [rpm/div]: Output of 2 divisions
6 Error Messages

The pendant oscilloscope can output the messages for confirming the operation or notifying the process completion. Especially when the data acquisition error or abnormal setting should occur, the application outputs error messages such as shown in Fig. 6-1 to notify the problem.

When any error message is displayed, first check the content, touch {OK} to clear the message, and follow necessary countermeasures.

Fig. 6-1: Example of Error Message

Table 6-1 shows the list of error messages and the countermeasure.

Table 6-1: Error Messages and Countermeasures of PP Oscilloscope

<table>
<thead>
<tr>
<th>Error messages</th>
<th>Countermeasures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input the value between ** and <strong>. The value to ** decimal places can be input. Input the numeric value. (</strong>: numerical value)</td>
<td>The input value is out of the limitation of input box. Retry inputting a correct value according to the error message. This error can occur in all of the input boxes.</td>
</tr>
<tr>
<td>The specified number for the alarm trigger is not correct. Review the setting.</td>
<td>A non-existent number is specified as the alarm number of alarm trigger. Retry setting a correct number.</td>
</tr>
<tr>
<td>Any trigger can be detected with this setting. Review the trigger level setting.</td>
<td>The trigger level is out of the waveform display area due to excessively large trigger level or channels zero position. Check the trigger level setting.</td>
</tr>
<tr>
<td>The axis number which doesn't exist in the system has been specified. Review the channel setting.</td>
<td>The axis number which does not exist in the system is specified to either of axes in the channel setting window. Set the correct number.</td>
</tr>
<tr>
<td>Input correct I/O number.</td>
<td>The concurrent I/O number which does not exist is specified. Set the correct number.</td>
</tr>
<tr>
<td>Processing time insufficient. Set slower sampling time or decrease the number of available channels.</td>
<td>Process time for data acquisition is not enough for the volume of measurement data. Set a slower sampling time, or decrease the available channel number.</td>
</tr>
</tbody>
</table>
6 Error Messages

Table 6-1: Error Messages and Countermeasures of PP Oscilloscope
(Sheet 2 of 2)

<table>
<thead>
<tr>
<th>Error messages</th>
<th>Countermeasures</th>
</tr>
</thead>
</table>
| The acceptable delaying range of graph drawing exceeded. Implement any of the following countermeasures.  
  - Set slower sampling time.  
  - Decrease the number of available channels.  
  - Set shorter value for Time Scale setting. (Shorten the data length.)       | Process time for graph drawing is not enough for the volume of measurement data.  
                                                                                  | Set a slower sampling time, decrease the available channel number, or set shorter timescale value.          |
| No corresponding data exists within the zoom range.                           | There is no measurement data within the zoom range currently specified. Set the zoom range again.           |
| Cannot recognize Flash Memory. Setting for SaveMode is switched from Auto to Manual. | Insert CF or USB memory and set SaveMode again.                                                            |
| Cannot recognize Flash Memory. SaveMode is switched from Auto to Manual.      | Flash memory could not be recognized at data save. Insert CF or USB memory and retry data saving manually. |
| Failed in saving CSV file. Perform manual saving if necessary.                | An error has occurred in flash memory. Try CF or USB memory insertion again or replacement, and retry data saving manually. |
| Not enough disk space. Make room for the file to perform manual saving.       | Assure enough disk space for CF or USB memory.                                                              |
| File format is not correct.                                                   | The file to load has not been matched with the data format of PP oscilloscope. Check if the file has been correctly saved. |
| Failed in loading CSV file.                                                   | The file to load has been found not to be the correct file for the PP oscilloscope. The file cannot be loaded. |
| File not specified.                                                           | Specify the file to load.                                                                                    |
| Specified file not exist.                                                     | The specified file does not exist on the CF or USB memory.                                                   |
| Failed in starting measurement.                                               | An error has occurred at measurement start, and the measurement cannot be started. Retry the measurement. If the alarm persists, terminate the pendant oscilloscope application, and restart the application. |
| Failed in obtaining measured value.** Measurement is canceled. (**: numerical value) | An error was found in the acquired measurement data. The system is forcefully turned into the measurement stop condition. Retry the measurement. If the alarm persists, terminate the pendant oscilloscope application, and restart the application. |
| Failed in completing measurement.                                             | The measurement process has not been correctly completed. Terminate the pendant oscilloscope application, and restart the application. |