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

MOTOMAN INSTRUCTIONS

- MOTOMAN-
- INSTRUCTIONS
- DX100 INSTRUCTIONS
- DX100 OPERATOR’S MANUAL
- DX100 MAINTENANCE MANUAL

The DX100 operator’s manual above corresponds to specific usage. Be sure to use the appropriate manual.

Part Number: 159163-1CD
Revision: 0
MANDATORY

• This manual explains the group change function of the DX100 system. Read this manual carefully and be sure to understand its contents before handling the DX100.

• General items related to safety are listed in Chapter 1: Safety of the DX100 Instructions. To ensure correct and safe operation, carefully read the DX100 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 DX100.

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

• Before operating the manipulator, check that servo power is turned OFF pressing the emergency stop buttons on the front door of the DX100 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.

Fig. : 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.

Fig. : Release of Emergency Stop

• Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
  – 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 DX100.
  – 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 DX100 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 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>DX100 controller</td>
<td>DX100</td>
</tr>
<tr>
<td>DX100 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>The keys which have characters printed on them are denoted with [ ]. ex. [ENTER]</td>
</tr>
<tr>
<td>Character Keys</td>
<td>The keys which have a symbol printed on them are not denoted with [ ] but depicted with a small picture. ex. page key</td>
</tr>
<tr>
<td>Symbol Keys</td>
<td>The cursor key is an exception, and a picture is not shown.</td>
</tr>
<tr>
<td>Axis Keys</td>
<td>&quot;Axis Keys&quot; and &quot;Number Keys&quot; are generic names for the keys for axis operation and number input.</td>
</tr>
<tr>
<td>Number Keys</td>
<td>The menu displayed in the programming pendant is denoted with { }, ex. {JOB}</td>
</tr>
<tr>
<td>Keys pressed simultaneously</td>
<td>When two keys are to be pressed simultaneously, the keys are shown with a &quot;+&quot; sign between them, ex. [SHIFT]+[COORD]</td>
</tr>
<tr>
<td>Displays</td>
<td></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.
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Outline</td>
<td>1-1</td>
</tr>
<tr>
<td>2</td>
<td>Group Change Instruction</td>
<td>2-1</td>
</tr>
<tr>
<td>2.1</td>
<td>GRPCHG Instruction</td>
<td>2-1</td>
</tr>
<tr>
<td>2.2</td>
<td>Registration of Instruction</td>
<td>2-2</td>
</tr>
<tr>
<td>3</td>
<td>Signal Allocation</td>
<td>3-1</td>
</tr>
<tr>
<td>3.1</td>
<td>Hand Identification Signals</td>
<td>3-1</td>
</tr>
<tr>
<td>3.2</td>
<td>Identification Signals for ATC Chuck/Unchuck</td>
<td>3-2</td>
</tr>
<tr>
<td>4</td>
<td>Job Examples</td>
<td>4-1</td>
</tr>
<tr>
<td>5</td>
<td>Alarm Message</td>
<td>5-1</td>
</tr>
</tbody>
</table>
The group change function attaches/detaches a tool with multiple external axes, such as end effector, etc (hereinafter called “hand”).

The following explain how to replace the hand with external axes.

In the example below, the hand with two external axes is group S1, and the hand with three external axes is group S2.

When the manipulator moves with the hand: S1, the job control group is R1 + S1.

When the manipulator moves with the hand: S2, the job control group is R1 + S2.

Fig. 1-1: Example of Group Change
1 Outline

**Fig. 1-2: Hand Changed to S1 (R1+S1)**

![Diagram of Hand Changed to S1 (R1+S1)]

**Fig. 1-3: Hand Changed to S2 (R1+S2)**

![Diagram of Hand Changed to S2 (R1+S2)]
2 Group Change Instruction

To enable the group change function, execute the GRPCHG (Group Change) instruction.

The GRPCHG instruction can be registered as JOB of a single manipulator.

2.1 GRPCHG Instruction

GRPCHG   S1   ON

① Selects the group to be changed. The group can be selected among the groups for the group change.

② Specifies ON/OFF (attach/detach) status of the selected group.

ON : Turns ON the power supply of the specified motor.

OFF : Turns OFF the power supply of the specified motor.
2.2 Registration of Instruction

1. Move the cursor immediately before the line where the GRPCHG instruction is registered.

2. Press [INFORM LIST].
   - The INFORM LIST dialog box appears.

3. Select “DEVICE”.
   - The GRPCHG instruction appears.
4. Select “GRPCHG”.
   - The GRPCHG instruction appears in the input buffer line.

5. Modify numerical data.
   - <Registration with numerical data unchanged>
     Go on to the step 6 if the instruction in the input buffer line is registered with no change of the numerical data.

   - <Editing the additional items>
     If the additional items are modified, move the cursor to the instruction in the input buffer line and press [SELECT] to display the DETAIL EDIT window. After the settings, press [ENTER] and close the DETAIL EDIT window.
6. Press [ADD], then [ENTER].
   – The instruction displayed in the input buffer line is registered.
3 Signal Allocation

The GRPCHG instruction has to be executed with the manipulator holding the hand for change.

An alarm occurs if the hand which is not held by the manipulator is specified in the GRPCHG instruction.

Allocation of the following signals allows to identify the types and chuck/unchuck status of the hand.

3.1 Hand Identification Signals

The hand ID is identified by general input signals. Use the following parameters to specify which input signal is to be used.

- S4C537: GRP identification signal (Start) for R1
- S4C538: GRP identification signal (End) for R1
- S4C539: GRP identification signal (Start) for R2
- S4C540: GRP identification signal (End) for R2
- S4C541: GRP identification signal (Start) for R3
- S4C542: GRP identification signal (End) for R3
- S4C543: GRP identification signal (Start) for R4
- S4C544: GRP identification signal (End) for R4
- S4C545: GRP identification signal (Start) for R5
- S4C546: GRP identification signal (End) for R5
- S4C547: GRP identification signal (Start) for R6
- S4C548: GRP identification signal (End) for R6
- S4C549: GRP identification signal (Start) for R7
- S4C550: GRP identification signal (End) for R7
- S4C551: GRP identification signal (Start) for R8
- S4C552: GRP identification signal (End) for R8

<Example> When the GRP identification signals are allocated to IN10 (Start) to 13 (End) (At S4C537=10, S4C538=13)

<table>
<thead>
<tr>
<th>IN13</th>
<th>12</th>
<th>11</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

0: OFF, 1: ON
3.2 Identification Signals for ATC Chuck/Unchuck

General input signals identify the ATC chuck/unchuck status. Use the following parameters to specify which input signal is to be used.

- S4C553: For R1
- S4C554: For R2
- S4C555: For R3
- S4C556: For R4
- S4C557: For R5
- S4C558: For R6
- S4C559: For R7
- S4C560: For R8

<Example> When the ATC chuck/unchuck identification signal is allocated to IN14 (At S4C553=14)

<table>
<thead>
<tr>
<th>IN14</th>
<th>Identified as “unchuck”</th>
<th>Identified as “chuck”</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>0: OFF, 1: ON</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

0: OFF, 1: ON
The following describe the job examples for attaching and detaching of the hand.

**<Job for attaching the hand (S1)>**
Job name: HAND1-ON
Control group: R1

NOP
MOVJ : Moves to the position where the hand is attached.
TIMER T=0.2 : Timer for 0.2 seconds.
DOUT OT#(1) OFF : Outputs the ATC chuck signal.
WAIT IN#(14)=ON : Confirms the ATC chuck.
_GRPCHG S1 ON : Turns ON the hand servo power.

MOVJ : Attaches the hand and moves.

END

**<Job for detaching the hand (S1)>**
Job name: HAND1-OFF
Control group: R1

NOP
MOVJ : Moves to the position where the hand is detached.
TIMER T=0.2 : Timer for 0.2 seconds.
WAIT IN#(14)=ON : Confirms the ATC chuck.
_GRPCHG S1 OFF : Turns OFF the hand servo power.
DOUT OT#(1) ON : Outputs the ATC unchuck signal.
WAIT IN#(14)=OFF : Confirms the ATC unchuck.

MOVJ : Detaches the hand and moves the manipulator only.

END
## Alarm Message

<table>
<thead>
<tr>
<th>Alarm Number</th>
<th>Message</th>
<th>Sub Code</th>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>4629</td>
<td>GROUP CHANGE ERROR</td>
<td></td>
<td>The group change parameter was invalid.</td>
<td>Validate the group change parameter.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The GRPCHG instruction was executed while the external axis motor was servo ON.</td>
<td>The GRPCHG instruction cannot be executed for the group which is already in the servo ON status.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The GRPCHG instruction was executed in unchuck status.</td>
<td>Check the chuck/unchuck status, then execute the GRPCHG instruction in chuck status.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The group identification signal was not received.</td>
<td>After the group identification signal is received, execute the GRPCHG instruction in chuck status.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The specified control group number and the group identification number were unmatched.</td>
<td>Match the specified control group number with the group identification number.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The encoder PG power supply was OFF when the GRPCHG was ON.</td>
<td>(1) Reset the alarm, and then try again.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(2) Turn OFF the power, then back ON. If the error occurs again, contact your Yaskawa representative.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The encoder PG power supply was ON when the GRPCHG was OFF.</td>
<td>(1) Reset the alarm, and then try again.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(2) Turn OFF the power, then back ON. If the error occurs again, contact your Yaskawa representative.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The control group that corresponds to the received group identification signal did not exist.</td>
<td>(1) Reset the alarm, and then try again.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(2) Turn OFF the power, then back ON. If the error occurs again, contact your Yaskawa representative.</td>
</tr>
</tbody>
</table>
DX100 OPTIONS
INSTRUCTIONS
FOR GROUP CHANGE FUNCTION

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