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 manuals above correspond to specific usage. Be sure to use the appropriate manual.
MANDATORY

• This manual explains the welding line shift 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 Instruction 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 when the emergency stop buttons on the front door of the DX100 and programming pendant are 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 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 persons are present in the P-point maximum envelope of the manipulator and that you are in a safe location before:
  – Turning ON the DX100 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 P-point maximum envelope of the manipulator during operation. Always press an emergency stop button immediately if there are problems. The emergency stop buttons are located on the right of the 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 supply 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 keys, 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></td>
</tr>
<tr>
<td>Character Keys</td>
<td>The keys which have characters printed on them are denoted with [ ]. ex. [ENTER]</td>
</tr>
<tr>
<td>Symbol 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></td>
<td>The cursor key is an exception, and a picture is not shown.</td>
</tr>
<tr>
<td>Axis Keys Numeric Keys</td>
<td>“Axis Keys” and “Numeric Keys” are generic names for the keys for axis operation and number input.</td>
</tr>
<tr>
<td>Keys pressed simultaneously</td>
<td>When two keys are to be pressed simultaneously, the keys are shown with a “+” sign between them, ex. [SHIFT]+[COORD]</td>
</tr>
<tr>
<td>Displays</td>
<td>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.
1 Outline ........................................................................................................................................ 1-1

2 Welding Line Coordinate Shift Section and Shift Direction ......................................................... 2-1
   2.1 Welding Line Coordinate Shift Section .............................................................................. 2-1
   2.2 Shift Direction ..................................................................................................................... 2-2
   2.3 When Welding Line Coordinate (Torch Direction) is Vertical to the Ground...................... 2-3
   2.4 Changing the Shift Amount ............................................................................................... 2-3
   2.5 Shift Amount Continuously Operation ............................................................................. 2-4

3 Welding Line Coordinate Shift Specification (Welding Start Condition File) .......................... 3-1
   3.1 Setting the Shift Amount .................................................................................................... 3-1

4 Welding Line Coordinate Shift Reset ......................................................................................... 4-1
   4.1 Welding Line Coordinate Shift Reset Operation ................................................................ 4-1
   4.2 Welding line coordinate shift cancel ................................................................................ 4-1
      4.2.1 Shift Cancel Operation .......................................................................................... 4-1

5 Welding Line Coordinate Shift Message Output ......................................................................... 5-1
   5.1 Welding Line Coordinate Shift Message ........................................................................... 5-1

6 Position Correction During the Shift (Shift Amount Delete Teaching) ..................................... 6-1

7 Precautions ................................................................................................................................ 7-1
1 Outline

This function is to shift the welding position easily by defining lower and upper plate directions as the welding line coordinates, which is an important operating condition for arc welding. As the welding position is shifted only the shift amount that is set in the welding start condition file on the coordinate of welding line coordinate shift, position correction can be finely done only by setting the condition file.

Since this function is to correct position as the welding condition, it is targeted at the position correction of 5 mm or less. For position correction in centimeters such as misalignment of work, use SFTON instruction or parallel shift JOB conversion function, etc.
2 Welding Line Coordinate Shift Section and Shift Direction

2.1 Welding Line Coordinate Shift Section

Welding line coordinate shift is executed for welding start point (registration step of ARCON instruction) and welding section (ARCON section). In this function, teaching position is shifted when the welding line coordinate shift in the welding start condition file which is referred to by ARCON instruction is effective. The shift operation will end when ARCOF instruction is executed or selecting {UTILITY} -{ARC SHIFT CANCEL} on the JOB CONTENT window.

Job:

MOVJ C0000
ARCON ASF#(1)
MOVL C0001
MOVL C0002
ARCOF

Shift one-step before the welding section.

Shift in the welding section.

Reset the shift by ARCOF instruction

... Teaching position

... Shift amount
2.2 Shift Direction

Shift to the direction of the welding line coordinate system defined as follows.

Welding line coordinate Y (lower plate direction)
- Direction that the torch direction is projected onto the base coordinate XY surface and the vector is inverted

Welding line coordinate Z (upper plate direction)
- +Z direction of the base coordinate
2.3 When Welding Line Coordinate (Torch Direction) is Vertical to the Ground

When the torch is vertical to the ground, welding line shift coordinate cannot be obtained. Therefore, use the previous welding line coordinate instead of the present welding line coordinate. If the torch is vertical to the ground last time as well, welding line shift coordinate cannot be obtained and the shift amount shall be zero. If the torch is temporarily vertical to the ground during playback operation (or test run, FWD/BACK operation) of the shifted teaching point, the shift cannot be conducted and an alarm “WELD LINE COORD SHIFT DISABLE” will occur.

2.4 Changing the Shift Amount

When changing the shift amount in the middle of the welding section, register ARCSET instruction and set the shift amount to be changed to the referred arc start condition file.
2.5 Shift Amount Continuously Operation

Welding line coordinate shift operation can also be performed as follows when reactivating after the servo power is OFF due to a cursor movement, BACK operation or dead man switch operation.

Set the position that subtracts the shift amount from the present position as a starting point and keep the shift amount.
3 Welding Line Coordinate Shift Specification (Welding Start Condition File)

3.1 Setting the Shift Amount

Set the shift amount at the window of “Others” tab in the welding start condition file. In the range of -5.0mm to 5.0mm can be inputted for both lower plate and upper plate direction.
4.1 Welding Line Coordinate Shift Reset Operation

When operating the following functions while executing the welding line coordinate shift, the welding line coordinate shift will stop.

① Execute ARCOF Instruction
② Select {UTILITY} -{ARC SHIFT CANCEL} on the JOB CONTENT window.
③ Execute SELECT JOB
④ When selecting the option to change the position at the present position (not subtracting the shift amount) for position correction from the dialog box at JOB edit. (Reset is invalid for the operations such as editing the JOB by other method or activating after the cursor movement.)

4.2 Welding line coordinate shift cancel

As described in the chapter 4.1 “Welding Line Coordinate Shift Reset Operation” at page 4-1, when operating the following function, the welding line coordinate shift control will be reset.

4.2.1 Shift Cancel Operation

Select {UTILITY} -{ARC SHIFT CANCEL} on the JOB CONTENT window. The confirmation dialog box appears, and then press [YES].
5 Welding Line Coordinate Shift Message Output

5.1 Welding Line Coordinate Shift Message

A message “Weld line coord shift mode.” will be displayed during the welding line coordinate shift.
6 Position Correction During the Shift (Shift Amount Delete Teaching)

When correcting the teaching position (select [Change] -> [Enter]) during the shift, the following dialog box will appear.

When YES is selected
Position correction is executed at the position where the shift amount is subtracted and a message "Registered the position that deleted shift." will be displayed.

When No is selected
Position correction is executed at the present position and a message "Registered the current position. And cancel the weld line coord shift." will be displayed. At this time, when pressing the [Cancel] button, the dialog will close and the position correction will be discontinued.
7 Precautions

The restrictions for the welding line shift function are as follows.

1. ARCON instruction should be used in the operating JOB. If only ARCON instruction is executed in the JOB to CALL, the welding start point (movement instruction just before ARCON instruction) cannot be shifted. This is because it is specified that ARCON instruction in the JOB is extracted and the previous point is shifted.

2. When changing the shift amount between ARCON and ARCOF section, it is necessary to have ARCSET instruction refer to the welding start condition file in which the shift function is effective. If using ARCON instruction in the section between ARCON and ARCOF, the shift can not be made correctly.

3. Even if the shift function of the welding condition file that is used at ARCSET instruction is forced to be disabled, the shift amount will be continued. When setting the amount to "0" by ARCSET, enable the shift function of the welding condition file that is to be used and set the shift amount to "0".

4. If the torch becomes vertical during a motion, an alarm “WELD LINE COORD SHIFT DISABLE” will occur and the motion will stop.

5. Do not teach the welding start point and the point which is one-point before the start point by the same point.

6. With the External reference point control function, the shift function can not be used.

7. When register IMOV instruction between ARCON and ARCOF section, shifts doubly (operates to the shifted position and to the additionally shifted position). Do not register IMOV instruction in the arc welding section.
DX100 OPTIONS
INSTRUCTIONS
FOR WELDING LINE SHIFT FUNCTION

HEAD OFFICE
2-1 Kurosaki-Shiroishi, Yahatanishi-ku, Kitakyusyu-shi, 806-0004, Japan
Phone +81-93-645-7745 Fax +81-93-645-7746

MOTOMAN INC. HEADQUARTERS
805 Liberty Lane, West Carrollton, OH 45449, U.S.A.
Phone +1-937-847-6200 Fax +1-937-847-6277

MOTOMAN ROBOTICS EUROPE AB
Franska Vagen 10, Box 4004, SE-390 04 Kalmar, Sweden
Phone +46-480-417800 Fax +46-480-417999

MOTOMAN ROBOTECH GmbH
Kammerfeld strasse 1, 85391 Allershausen, Germany
Phone +49-8166-90-100 Fax +49-8166-90-103

YASKAWA ELECTRIC KOREA CORPORATION
1F, Samyang Bldg. 89-1, Shinchun-dong, Donk-Ku, Daegu, Korea
Phone +82-53-382-7844 Fax +82-53-382-7845

YASKAWA ELECTRIC (SINGAPORE) PTE. LTD.
151 Lorong Chuan, #04-01, New Tech Park, Singapore 556741
Phone +65-6282-3003 Fax +65-6289-3003

YASKAWA ELECTRIC (MALAYSIA) SDN. BHD.
Unit 47-1 and 2, Jalan PJU 5/9, Dataran Sunway, Kota Damansara, 47810, Petaling Jaya Selangor, Malaysia
Phone +60-3614-08919 Fax +60-3614-08929

YASKAWA ELECTRIC (THAILAND) CO., LTD.
252/246, 4th Floor, Muang Thai-Phatra office Tower II Rechadapisek Road, Huaykwang Bangkok 10320, Thailand
Phone +66-2-693-2200 Fax +66-2-693-4200

SHOUGANG MOTOMAN ROBOT CO., LTD.
No.7,Yongchang-North Road, Beijing Economic and Technological and Development Area, Beijing 100076, China
Phone +86-10-6788-0541 Fax +86-10-6788-0542

MOTOMAN MOTHERSON ROBOTICS LTD.
Plot Number 195-196, First Floor, Imt Manesar -Sector 4, Gurgaon (Haryana),Pin-122050, India
Phone +91-124-475-8500 Fax +91-124-475-8542

YASKAWA ELECTRIC CORPORATION
YASKAWA

Specifications are subject to change without notice
for ongoing product modifications and improvements.
© Printed in Japan January 2010 10-1

MANUAL NO.
HW0485810