

DX100 OPTIONS OPERATORS MANUAL

FOR TAUGHT LINE COORDINATES JOG FUNCTION
WELDING ANGLE DISPLAY FUNCTION

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: 157701-1CD
Revision: 0



MANUAL NO.
HW0485808



MANDATORY

- This manual explains the taught line coordinates jog function and welding angle display 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.

DX100

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.



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.



CAUTION

- Perform the following inspection procedures prior to conducting manipulator teaching. If problems are found, repair them immediately, and be sure that all other necessary processing has been performed.
 - Check for problems in manipulator movement.
 - Check for damage to insulation and sheathing of external wires.
- Always return the programming pendant to the hook on the cabinet of the DX100 after use.

The programming pendant can be damaged if it is left in the manipulator's work area, on the floor, or near fixtures.

- Read and understand the Explanation of Warning Labels in the DX100 Instructions before operating the manipulator:

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:

Equipment	Manual Designation
DX100 controller	DX100
DX100 programming pendant	Programming pendant
Cable between the manipulator and the controller	Manipulator cable

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

Equipment		Manual Designation
Programming Pendant	Character Keys	The keys which have characters printed on them are denoted with []. ex. [ENTER]
	Symbol Keys	The keys which have a symbol printed on them are not denoted with [] but depicted with a small picture. ex. page key  The cursor key is an exception, and a picture is not shown.
	Axis Keys Number Keys	"Axis Keys" and "Number Keys" are generic names for the keys for axis operation and number input.
	Keys pressed simultaneously	When two keys are to be pressed simultaneously, the keys are shown with a "+" sign between them, ex. [SHIFT]+[COORD]
	Displays	The menu displayed in the programming pendant is denoted with { }. ex. {JOB}

Description of the Operation Procedure

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

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	1	Taught Line Coordinates Jog Function
DX100	1.1	What is Taught Line Coordinates Jog Function?

1 Taught Line Coordinates Jog Function

1.1 What is Taught Line Coordinates Jog Function?

A taught line coordinate jog means a jog operation to adjust X, Y, Z axes and wire extrusion length toward the approaching direction, angle of the torch to the ground, rotation angle around the base Z axis, and torch angle on the taught line coordinate system along with a taught line, so as to edit and add positions easily for the job during a teaching or the job already completed teaching in the horizontal fillet welding work.

When the job is

NOP

MOVJ P001 VJ =100

MOVJ P002 VJ = 10

ARCON ASF#(1)

MOVL P003

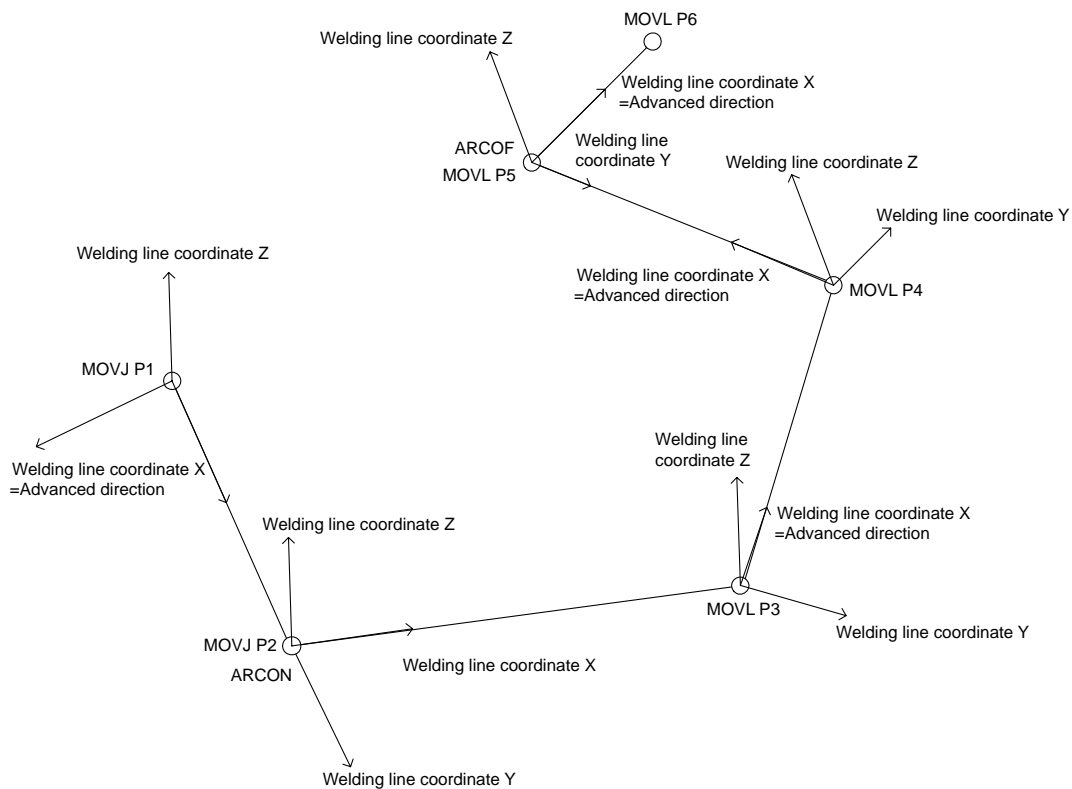
MOVL P004

MOVL P005

ARCOF

MOVL P006,

the coordinate direction of the jog motion changes along the taught line as the figure below. Therefore the modification of the motion can be done easily because the precise adjustment of the location can be confirmed intuitively by the STEP, FWD/BACK operations.



1.2 Selection and Operation of Taught Line Coordinate

Change the coordinate system of the jog operation to carry out a taught line coordinate jog as shown below.

1. Press the [Coordinate] and select the taught line coordinate system. Every time [Coordinate] is pressed, the coordinate is changed in the following order: Link -> Orthogonal -> Tool -> User -> Taught line coordinate. Confirm it in the status area.

When the original position is not registered, it cannot be selected as in the case of other orthogonal coordinate jog systems.

1.3 Limitation of Motion in Taught Line Coordinate System

In the motion of the taught line coordinate system, direction of the motion is determined by changing the taught line coordinate following the cursor position of the job. Therefore, the motion may be restricted in some cases listed below.

- A job is not selected
- There is no move instruction at more than two points in the job
- The first step is the step with the cursor
- Amount of movement is zero between the move instruction of the cursor position and one point before the move instruction
- The distance is short (3 mm) between the move instruction of the cursor position and one point before the move instruction
- The move instruction of the cursor position is MOVJ

	1	Taught Line Coordinates Jog Function
DX100	1.4	Motion Direction of Taught Line Coordinate System

In these cases, the following message is displayed.

"Teach line JOG move is in restricted mode. Posture change only."

The step with the cursor cannot be operated at the first step because the motion direction is determined by the step with the cursor and one before.

For example, in the case of

```

NOP
MOVL V=100 ← Cursor
MOVL V=100

```

the motion is in the restricted mode because there is no point before the MOVL.

In the motion restricted mode, only a posture can be controlled as indicated by the message.

1.4 Motion Direction of Taught Line Coordinate System

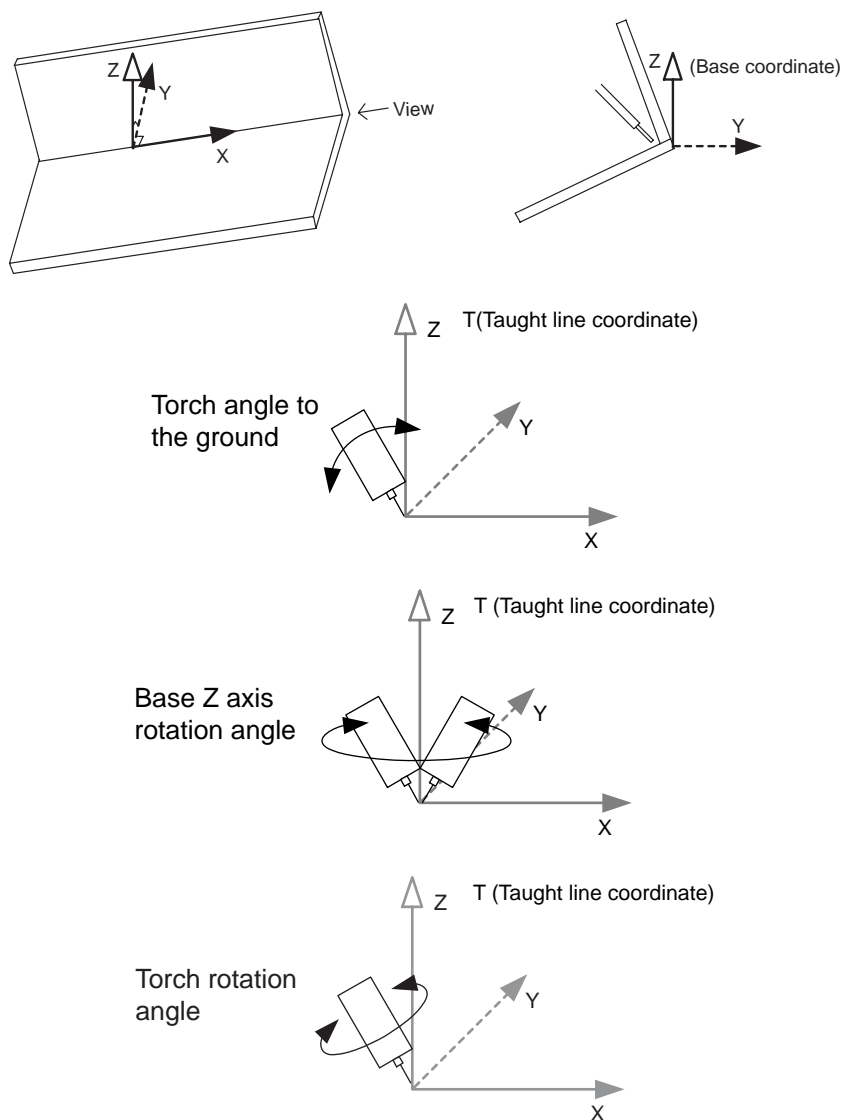
<When motion is normal>

Motion direction is as follows:

- X --- Movement direction (The direction should be a direction of the circle tangent in the middle of the circular track)
- Y --- The direction (+) in the robot coordinate system means the direction approaching to the welding line which is orthogonal to both movement direction and Z direction
- Z --- The direction (+) in the base coordinate system means Z axis and upper directions
- Shift+Z --- The direction (+) in the torch direction means approaching to the welding line, and (-) means the reverse direction of it
- TX --- Adjustment of the torch angle to the ground: When the torch moves vertically toward and away from the XY plane of the base coordinate, the direction (+) means the direction in which the torch moves away from the XY plane. (The torch angle to the ground can be set between 0° to 88°.)
- TY --- Adjustment of the rotation angle around the base Z axis: the direction (+) on the taught line coordinate means the higher rotation angle around the base Z axis
- TZ --- The rotation of the torch (the direction (+) in the right handed screw direction of the torch)

1 Taught Line Coordinates Jog Function

1.4 Motion Direction of Taught Line Coordinate System



<When motion is limited>

The X, Y, Z axes can not be operated, while the posture can be operated same as the normal motion.

The X, Y, Z axes can not be operated.

When performing an axis operation, the following message is displayed.
"Execute Test run or FWD operation before perform JOG operation."

- TX --- Adjustment of the torch angle to the ground: When the torch moves vertically toward and away from the XY plane of the base coordinate, the direction (+) means the direction in which the torch moves away from the XY plane. (The torch angle to the ground can be set between 0° to 88°.)
- TY --- Adjustment of the rotation angle around the base Z axis: the direction (+) on the taught line coordinate means the higher rotation angle around the base Z axis
- TZ --- The rotation of the torch (the direction (+) in the right handed screw direction of the torch)

1.5 Circular Interpolation Section

During the circular interpolation, the direction of the tangent vector of the circular arc is used as the direction of the X axis of the taught coordinate, not the straight line between the teaching points. To perform a jog operation on the taught line coordinate in the circular interpolation section, the PLAYBACK, TEST, FWD and BACK operations must be done beforehand. Create a taught line jog coordinate based on the tangent direction of the circle at the stopped position on the circular interpolation section and operate it.

The taught line coordinate jog operation cannot be performed when the cursor is moved after the operations such as PLAYBACK, TEST, FWD and BACK. However, when a jog operation on other than the taught line coordinate is performed after the PLAYBACK, TEST, FWD and BACK operations, the taught line coordinate jog operation can be performed by switching to the taught line coordinate.

The operation is possible even if the motion has deviated from the taught line when the hands are off a dead man's switch and the servo power is cut off after the PLAYBACK, TEST, FWD and BACK operations.

If the taught line jog operation is tried without PLAYBACK, TEST, FWD and BACK operations for the circular interpolation instructions, the operation cannot be done. Then the following message is displayed.

"Execute Test run or FWD operation before perform JOG operation."

1.6 Relation between Move Instructions and Motion

Relation between move instructions and motion is as follows.

Current position and status	Move instructions with cursor	Generation method of Coordinates (X direction towards the movement)
MOVL teaching position	MOVL	The X axis direction toward movement is determined by a vector from the point one step before to the move instruction with the cursor.
During FWD operation	MOVL	The X axis direction toward movement is determined by a vector from the point one step before to the move instruction with the cursor.
During FWD operation (During linear motion)	MOVC	The X axis direction toward movement is determined by a vector from the point one step before to the move instruction with the cursor.
During FWD operation (Circular motion)	MOVC	The X axis direction toward movement is determined by a tangent direction of a circle, which is obtained lastly by FWD, Test or Play operations.
During BACK operation Return to the previous point	MOVL, MOVS	The X axis direction toward movement is determined by a vector from the target point one step before to a move instruction with a cursor.
During BACK operation Return to the previous point (MOVC)	MOVC	The movement direction is determined by the tangent of a circle, which is obtained from the current position and target position (point of MOVC).

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1 Taught Line Coordinates Jog Function
 1.7 Motion in Coordinated Job

Current position and status	Move instructions with cursor	Generation method of Coordinates (X direction towards the movement)
During BACK operation Return to the previous point (except MOVC)	MOVC	The X axis direction toward movement is determined by a vector, which is obtained from a point with a cursor (point of MOVC) to the position of the next step of the cursor.
It is not on the taught track because a jog operation has been performed	MOVL, MOVS	The X axis direction toward movement is determined by a vector, which is obtained from a point from one step before to a target position with a cursor.
It is not on the taught track because a jog operation has been performed	MOVC	The X axis direction toward movement is determined by a vector, which is obtained from a point from one step before to a target position with a cursor.

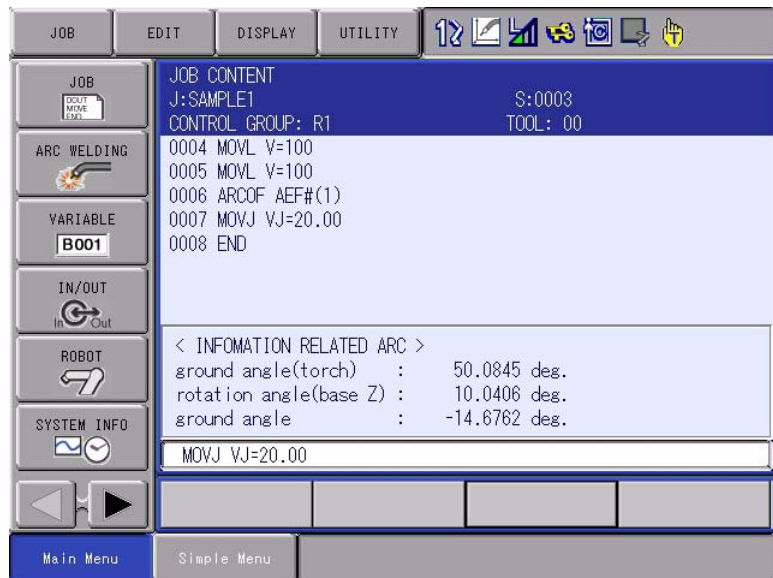
1.7 Motion in Coordinated Job

A jog operation on the taught line coordinate can be operated during the coordinated job motion.

According to the motion of the master side, the direction of the axis operation will be corrected to an appropriate direction.

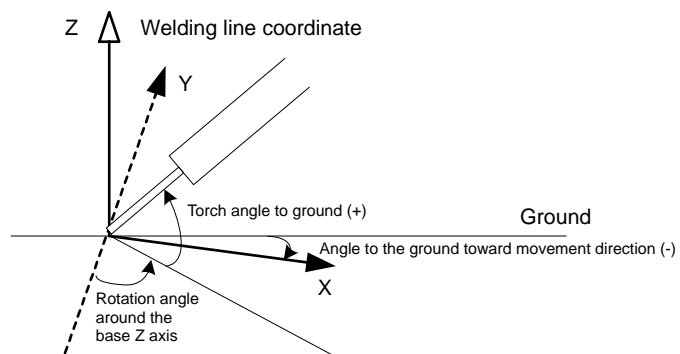
2 Welding Angle Display Function

The important items of welding conditions, such as torch angle to the ground, rotation angle around Z axis, angle to the ground toward movement direction, can be confirmed by values, not by welding posture during a teaching operation. These values are displayed in the lower part of the JOB CONTENT window when the taught coordinate jog is selected in the teaching mode, as shown in the figure below.



<Displayed angle>

Displayed angle is as follows.



* Restrictions

In the following cases, a value for each angle is not displayed. Instead, "---" is displayed for "ground angle (torch), rotation angle (base Z) and ground angle" respectively.

- (1) When the following operations are performed after taught line coordinate jog is operated.
 - When cursor is moved
 - When other job is selected
 - When the tool value is changed

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2 Welding Angle Display Function

The display will appear again when axes are operated or FWD and BACK operations are performed.

(2) When the following operations are performed

- When the original position is changed or cleared.
- When tool data, parameters, original position data are loaded.

During the restricted operation mode, "----" is displayed for ground angle (torch), rotation angle (base Z) and ground angle respectively.

When a taught line coordinate is selected by [COORD], "ground angle (torch), rotation angle (base Z) and ground angle" are displayed during the FWD/BACK and TEST operation.

DX100 OPTIONS OPERATORS MANUAL

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