

DX100 OPTIONS INSTRUCTIONS

FOR MULTISTEP PRESSURE 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: 159046-1CD

Revision: 0



MANDATORY

- This manual explains the multistep pressure 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.

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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 the front door of the DX100 and the programming pendant.

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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 DX100 cabinet 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 DX100	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 Multistep pressure function

The conventional DX100 spot welding instruction (SVSPOT/ SVSPOTMOV) was ended, and the motor gun was opened, when one welding completion signal was received. The multistep pressure function is an extension of the conventional welding command. It starts the power source multiple times (maximum of four times) during the first opening and closing operation of the motor gun, enabling high quality spot welding to be realized.

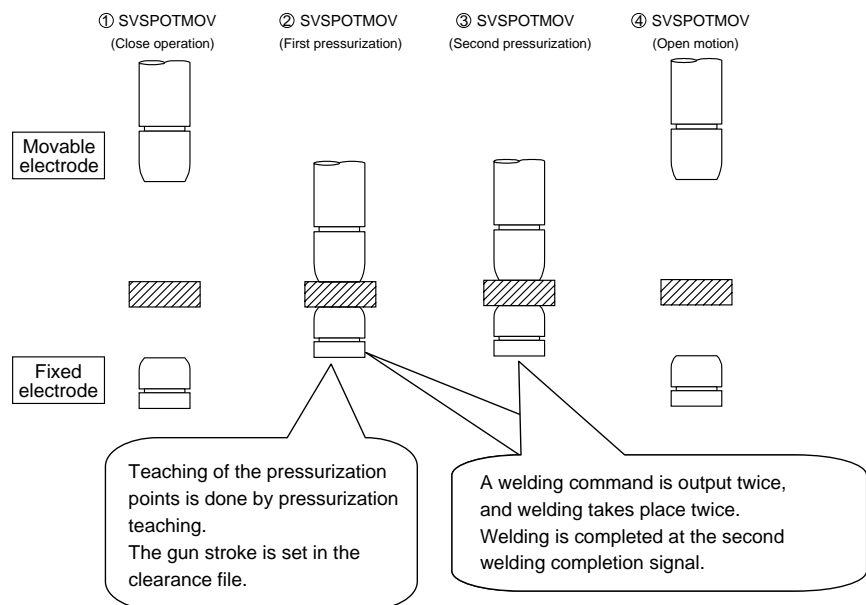
1.1 Features

The multistep pressure function has the functions and features indicated in the table below.

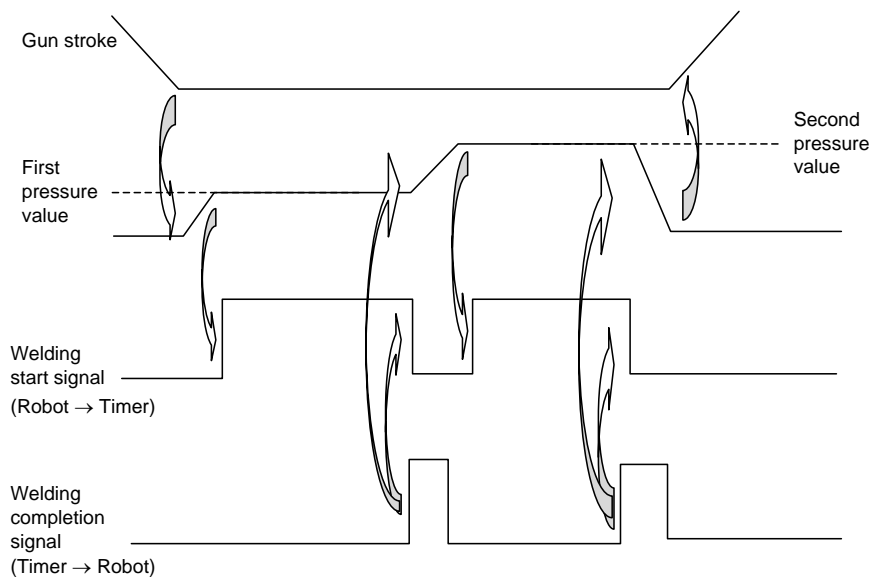
No.	Functions and Features	Advantages
1	It extends the SVSPOT/ SVSPOTMOV instruction, and permits multistage pressurization in up to four steps.	Higher quality spot welding can be realized.
2	The number of pressurization steps can be specified in the DETAIL EDIT window for the SVSPOT/ SVSPOTMOV instruction.	The number of pressurization steps can be varied between one and four times.
3	Multiple "END WAIT" settings can be made in the pressure file window.	The pressure value at each step of multistep pressurization can be set in detail.

The operation of the motor gun during multistep pressurization, and the relationship between the gun pressure and the signal are as shown in the figure below.

■ Motor gun operation (SVSPOTMOV, 2-Step pressure)



■ Relationship between the gun pressure and the signal



When the pressure reaches the first pressure value after the motor gun touched the workpiece, the welding start signal is output to the timer.

As soon as the first welding completion signal is input from the timer, the motor gun proceeds to the second pressure value.

After the second pressure value is reached, the second welding start signal is output.

As soon as the second welding completion signal is input from the timer, the motor gun stops pressurization, and then opens.

1.2 Restrictions

- ① The maximum number of multistep pressurizations in this function is the upper limit (four) of the number of pressurization settings in "Pressure file."
- ② The "welding conditions group output: WGO=" is common for one multistep pressurization welding operation.
(The welding conditions group output value in each welding condition output cannot be changed during multistep pressurization welding.)
- ③ When multistep pressurization welding is taking place, I/O output control of the power source start signal according to "WELD INST OUTPUT TYPE" and "OUTPUT TIMING (WST)" in the Power Source condition file is applied only to the first start signal output. The second and subsequent start signal outputs are assumed to level-output "WELDING COND (WTM)" and "WELDING COMMAND" at the same timing.
- ④ The execution timing for bending correction is the same as that of the current DX100.
(Bending correction does not take place during the second and subsequent pressurization welding phases.)
- ⑤ When the power source is restarted after being interrupted during multistep pressurization welding, the welding sequence from the first pressurization is reattempted.
- ⑥ The actual pressure values in the case where the pressure rises from the first pressure value to the Nth pressure value may differ from the corresponding values in the case where the pressure falls, due friction torque, for example, even when the set pressure values on the gun pressure window are the same.

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- 2.1 Setting the Functions of the Multistep Pressure Function

2 How to Use the Multistep Pressure Function

2.1 Setting the Functions of the Multistep Pressure Function

2.1.1 Pressure File Window

When the multistep pressure function is enabled, "END WAIT" can be set multiple times in the pressure file specified in the pressure file window.

The end condition between the first and fourth pressurization can be selected from the following table.

Pressure	Selectable END CONDITION
1ST PRESS	PRESS TIME, END WAIT
2ND PRESS	PRESS TIME, END WAIT, UNUSED
3RD PRESS	PRESS TIME, END WAIT, UNUSED
4TH PRESS	END WAIT, NOT USED

If "UNUSED" is selected, the subsequent pressurization operations will be ignored, and nothing will be displayed.

If "PRESS TIME" or "END WAIT" is selected, the pressurization operations for the subsequent steps will be displayed.

Select "END WAIT" as the end condition for the last step. If "DONE" is set while the "PRESS TIME" remains selected, "Error 2210: Illegal data setting" will occur.

Example: In case of 3-step pressure

GUN PRESSURE			
CONDITION NO.:		1/255	GROUP NO.:
			1/1
SETTING	DONE		
TOUCH SPEED	10%		
COMMENT			
	PRESS	END CONDITION	
TOUCH PRESS	1000	N	
1ST PRESS	1000	N	END WAIT
2ND PRESS	2000	N	END WAIT
3RD PRESS	3000	N	END WAIT
4TH PRESS	0	N	UNUSED

Cond. No.

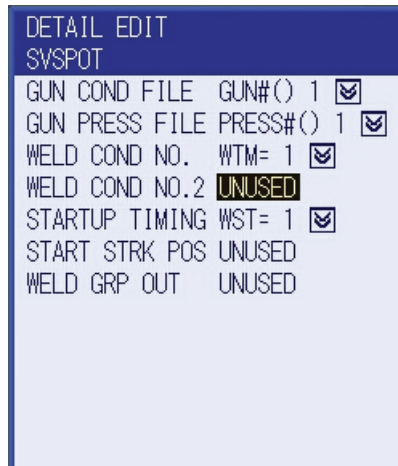
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2.1.2 DETAIL EDIT Window

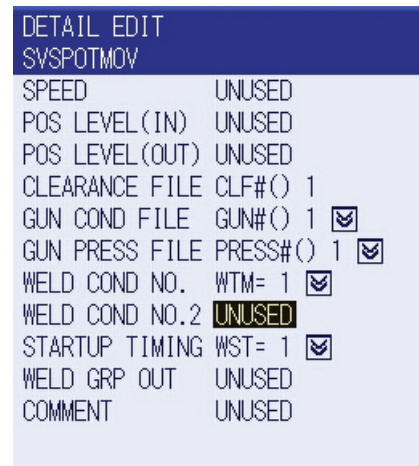
While the multistep pressure function is enabled, make a selection to enable the item for setting the number of welding to be displayed, using the DETAIL EDIT window for the SVSPOT/SVSPOTMOV instruction. As a result, the "WELD COND NO.." of the set number of steps will be set.

Example: In case switching from 1-step pressure to 2-step pressure

1. Open the DETAIL EDIT window of the SVSPOT instruction or the SVSPOTMOV instruction.
2. Move the cursor to "WELD COND NO. 2."

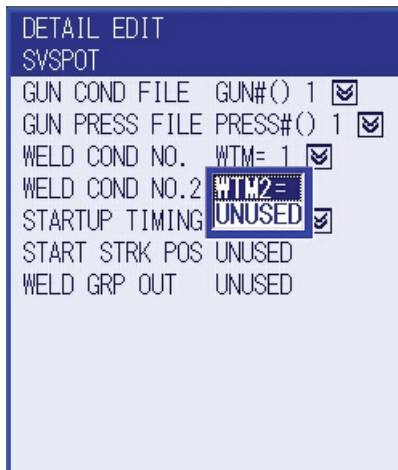


SVSPOT Instruction

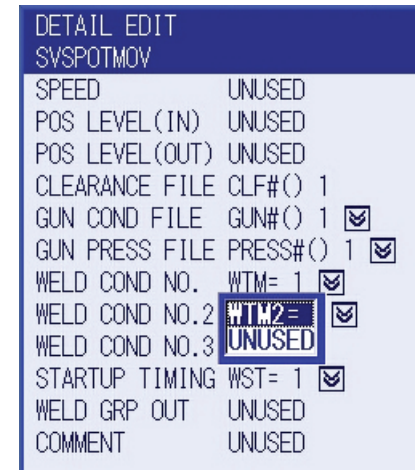


SVSPOTMOV Instruction

3. Press [SELECT], and the selection dialog box appears.



SVSPOT Instruction



SVSPOTMOV Instruction

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 2.1 Setting the Functions of the Multistep Pressure Function

4. Move the cursor to "WTM2=" and press [SELECT]. Then, it becomes possible to set the second step welding condition number, and select whether to use the third step welding condition number or not.

DETAIL EDIT	
SVSPOT	
GUN COND FILE	GUN#() 1 <input checked="" type="checkbox"/>
GUN PRESS FILE	PRESS#() 1 <input checked="" type="checkbox"/>
WELD COND NO.	WTM= 1 <input checked="" type="checkbox"/>
WELD COND NO.2	WTM2= 1 <input checked="" type="checkbox"/>
WELD COND NO.3	UNUSED
STARTUP TIMING	WST= 1 <input checked="" type="checkbox"/>
START STRK POS	UNUSED
WELD GRP OUT	UNUSED

SVSPOT Instruction

DETAIL EDIT	
SVSPOTMOV	
SPEED	UNUSED
POS LEVEL(IN)	UNUSED
POS LEVEL(OUT)	UNUSED
CLEARANCE FILE	CLF#() 1
GUN COND FILE	GUN#() 1 <input checked="" type="checkbox"/>
GUN PRESS FILE	PRESS#() 1 <input checked="" type="checkbox"/>
WELD COND NO.	WTM= 1 <input checked="" type="checkbox"/>
WELD COND NO.2	WTM2= 1 <input checked="" type="checkbox"/>
WELD COND NO.3	UNUSED
STARTUP TIMING	WST= 1 <input checked="" type="checkbox"/>
WELD GRP OUT	UNUSED
COMMENT	UNUSED

SVSPOTMOV Instruction

In addition, to switch from 2-step pressure to 1-step pressure, select "UNUSED" in 3. above.

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2.1.3 Details of the SVSPOT Instruction

The SVSPOT instruction that exists when the multistep pressure function is enabled consists of the following instruction configuration.
The motor gun opens as soon as welding for the last step is completed.

SVSPOT GUN#(1) PRESS#(1) WTM=1 (WTM2=2) (WTM3=3) (WTM4=4)
WST=1 BWS=0.0 WGO=1

GUN#():	Gun No.	
PRESS#():	Gun pressure file No.	...Can be omitted.
WTM:	Welding condition No. when applying pressure first step.	
WST:	Power source start-up timing when applying pressure first step.	
WTM2:	Welding condition No. when applying pressure second step.	...Can be omitted.
WTM3:	Welding condition No. when applying pressure third step.	...Can be omitted.
WTM4:	Welding condition No. when applying pressure fourth step.	...Can be omitted.
BWS:	Welding start stroke position	...Can be omitted.
WGO:	Welding conditions group output when applying pressure first step.	...Can be omitted.



CAUTION

Items between WTM2 and WTM4 may or may not be displayed depending upon the set value of "Number of welding steps" in the DETAIL EDIT window.

Also, while the SVSPOT instruction is being executed, if the number of welding steps in the instruction does not agree with the number of "END WAIT" in the pressure file, the following alarm will be displayed.

Alarm 4667 : DEFECTIVE GUN PRESSURE FILE

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2.1.4 Details of the SVSPOTMOV Instruction

The SVSPOTMOV instruction that exists when the multistep pressure function is enabled consists of the following instruction configuration.

The motor gun opens as soon as welding for the last step is completed.

SVSPOTMOV V=100 PLIN=1 PLOUT=1 CLF#(1) GUN#(1) PRESS#(1)
WTM=1 (WTM2=2) (WTM3=3) (WTM4=4) WST=1 WGO=1 ...

V:	Linear moving speed for clearance	
PLIN:	Position level at the clearance position before hit	
PLOUT:	Position level at the clearance position after hit	
CLF#():	Clearance file No.	
GUN#():	Gun No.	
PRESS#():	Gun pressure file No.	...Can be omitted.
WTM:	Welding condition No. when applying pressure first step.	
WTM2:	Welding condition No. when applying pressure second step.	...Can be omitted.
WTM3:	Welding condition No. when applying pressure third step.	...Can be omitted.
WTM4:	Welding condition No. when applying pressure fourth step.	...Can be omitted.
WST:	Power source start-up timing when applying pressure first step.	...Can be omitted.
WGO:	Welding conditions group output when applying pressure first step.	...Can be omitted.
// :	Comment	...Can be omitted.



CAUTION

Items between WTM2 and WTM4 may or may not be displayed depending upon the set value of "Number of welding steps" in the DETAIL EDIT window.

Also, while the SVSPOTMOV instruction is being executed, if the number of welding steps in the instruction does not agree with the number of "END WAIT" in the pressure file, the following alarm will be displayed.

Alarm 4667 : DEFECTIVE GUN PRESSURE FILE

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2.2 Corrective Action in the Event that a WELD COMPLETE SIGNAL ERROR Alarm Occurs

During multistep pressurization, a WELD COMPLETE SIGNAL ERROR alarm may occur. It occurs if the power source side has not turned OFF the welding completion signal when the DX100 reached the next pressure value and output a welding signal, after the welding completion signal from the power source was received. If this alarm is output, set the following parameters.

AxP66: Check the welding completion signal at the commencement of welding. (Welding completion signal OFF time Unit: sec)

Setting No.	Motion
0	If the welding completion signal was ON when starting spot welding, an alarm occurs.
1 to 60	If the welding completion signal is ON at the commencement of welding, an alarm will be output unless the signal is turned OFF, even after the lapse of set number of seconds.

Although the recommended value is 1 (sec), adjust the value according to the actual condition.



If a value other than 0 was set, processing to enable the system to wait for the welding completion signal to go OFF will take place, so the welding instruction execution time may sometimes be extended.

DX100 OPTIONS INSTRUCTIONS

FOR MULTISTEP PRESSURE FUNCTION

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