DX100 OPERATOR'S MANUAL

FOR SPOT WELDING USING AIR GUN

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

MOTOMAN INSTRUCTIONS

MOTOMAN
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.

Do not submit this electronic data to the customer.

THIS MATERIAL IS FOR STUDY PURPOSE ONLY. YOU MUST READ THE MANUAL WHICH ENCLOSED WITH A ROBOT.





- This manual explains the various components of the DX100 system and general operations. Read this manual carefully and be sure to understand its contents before handling the DX100.
- General items related to safety are listed in Section 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.



Always be sure to follow explicitly the items listed under this heading.



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 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. 1-1: 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.

Fig. 1-2: 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.
 - 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.



- 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 P-point maximum envelope of the manipulator, on the floor, or near fixtures.

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

Definition of Terms Used Often in This Manual

The MOTOMAN manipulator is the YASKAWA industrial robot product.

The MOTOMAN usually consists of 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

Descriptions of the programming pendant keys, 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 Numeric Keys	"Axis Keys" and "Numeric 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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1.1 DX100 Overview

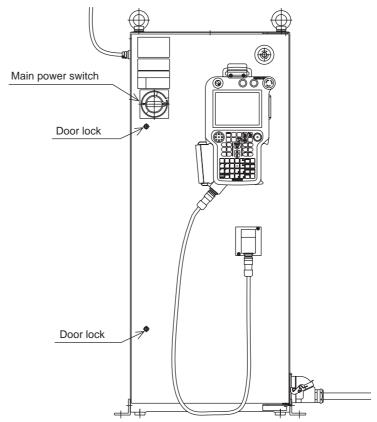
1 Introduction

1.1 DX100 Overview

The main power switch and the door lock are located on the front of the DX100 controller. The emergency stop button is installed in the upper right corner of the cabinet door and the programming pendant hangs from a hook below the button.

For information on setup, installation, and connection of the DX100 system, refer to the "DX100 INSTRUCTIONS."

Fig. 1-1: DX100 Front View



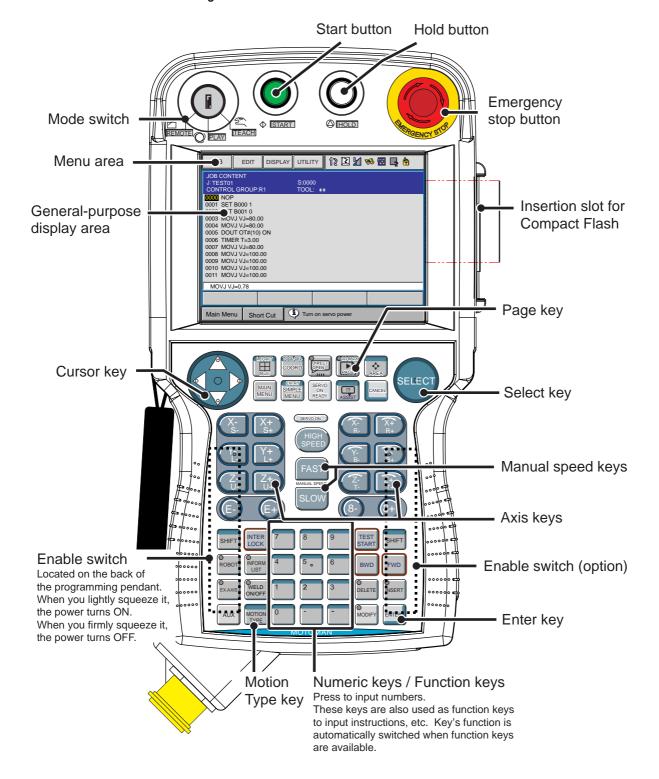
1.2 Programming Pendant

1.2 Programming Pendant

1.2.1 Programming Pendant Overview

The programming pendant is equipped with the keys and buttons used to conduct manipulator teaching operations and to edit jobs.

Fig. 1-2: PP Overview



1 Introduction

1.2 **Programming Pendant**

1.2.2 Key Description

1.2.2.1 Character Keys

The keys which have characters printed on them are denoted with []. For is shown as [ENTER]. example,

The Numeric keys have additional functions along with their number values. Dual function keys are used in the context of the operation being performed. For example: $\frac{1}{100}$ may be described in the text as [1] or [TIMER].

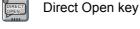
1.2.2.2 Symbol Keys

The keys which have a symbol printed on them are not denoted with [] but depicted with a small picture, with the exception of the cursor key, which is not shown with a picture.



Cursor

Emergency Stop button





1.2.2.3 Axis Keys and Numeric Keys

The keys pictured in the following are referred to as the axis keys and Numeric keys when described.



Axis Keys Numeric Keys

1.2.2.4 Keys Pressed Simultaneously

When two keys are to be pressed simultaneously, the keys are shown with a "+" sign between them, such as [SHIFT]+[COORD].

1.2 Programming Pendant

1.2.3 Programming Pendant Keys

Starts the manipulator motion in playback [START] operation. • The lamp on this button is lit during the play operation. The lamp also lights when the playback operation is started by the system input START signal. The lamp turns OFF when the playback operation is stopped by alarm occurrence, HOLD signal, or mode change. [HOLD] Holds the manipulator motion. · This button is enabled in any mode. • The lamp on this button is lit only while the button is being pressed. Although the lamp turns OFF when the button is released, the manipulator stays stopped until a START command is input. The HOLD lamp automatically lights in the following cases to indicate that the system is in HOLD status. The start and axis operations are disabled while the lamp is lit. 1. The HOLD signal of system input is ON. 2. The HOLD request is being sent from an external device in remote mode. 3. In the HOLD status caused by an error occurred in working process such as wire sticking at arc welding. **E.STOP Button** Turns OFF the servo power. When the servo power is turned OFF, the SERVO ON LED on the programing pendant will extinguish. An emergency stop message is displayed on the [MODE] Selects the Play mode, Teach mode, or Remote mode. PLAY: Play Mode The playback of taught job is enabled. The START signal from an external device is disabled. TEACH: Teach Mode The axis operation and edition from the programming pendant are enabled. The START signal from an external device is disabled. REMOTE: Remote Mode The operation by external signals is enabled.

[START] is invalid during the remote mode.

1

Introduction Programming Pendant 1.2

Enable Switch	Turns ON the servo power. The Enable switch is active only when the SERVO ON LED is blinking, the safety plug is ON, and the Mode Switch is set to "TEACH." When this switch is lightly squeezed, the power turns ON. When firmly squeezed, the power turns OFF.
[SELECT]	Works as described below. • Selects menu items in the main menu area and
SELECT	 the pull-down menu area. Makes the selected item ready to be set in the general-purpose display area. Displays multiple messages in the message area.
Cursor	Moves the cursor in the direction of the arrow. The size of the cursor and the range/place
	where the cursor can move will vary depending on the window. • If the UP cursor button is pressed when the cursor is on the first line, the cursor will move to the last line of the job. Conversely, if the cursor is on the last line of the job and the DOWN cursor button is pressed, the cursor will jump to the first line of the job. [SHIFT] + UP Scrolls the screen upward. [SHIFT] + DOWN Scrolls the screen downward. [SHIFT] + RIGHT Scrolls the screen to the right. [SHIFT] + LEFT Scrolls the screen to the left.
[MAIN MENU] MAIN MENU	Displays the main menu. If this button is pressed while the main menu is displayed, the main menu disappears. [MAIN MENU] + UP Increases the brightness of the screen. [MAIN MENU] + DOWN Decreases the brightness of the screen.
[SIMPLE MENU] ENTRY SIMPLE MENU	Displays the simple menu. If this button is pressed while the simple menu is displayed, the simple menu disappears.

1.2 Programming Pendant

[SERVO ON READY]



Enables the servo power supply to be turned ON.

Press this button to enable the servo power supply to be turned ON if the servo power supply is shut OFF by the emergency stop or overrun signal.

When this button is pressed:

- In the play mode, the servo power supply is turned ON if the safeguarding is securely closed.
- In the teach mode, the SERVO ON lamp flashes and the servo power supply is turned ON when the Enable switch is ON.
- The SERVO ON lamp is lit while the servo power is ON.

[ASSIST]



Displays the menu to assist the operation for the currently displayed window.

Pressing this button with [SHIFT] or [INTERLOCK] displays the help guidance for the operation.

- [SHIFT] + [ASSIST]

 The function list of key combinations with [SHIFT] appears.
- [INTERLOCK] + [ASSIST]

 The function list of key combinations with

 [INTERLOCK] appears.

[CANCEL]



Cancels the current status.

- Deletes the sub menu in the main menu area and the pull-down menu area.
- Cancels the input data or the input status in the general-purpose display area.
- Cancels the multiple views in the message area.
- · Cancels the occurred error.

[MULTI]

Works for the multi mode.



If this button is pressed when the multi mode is ON, the active window switches.

[SHIFT] + [MULTI]

Switches between the multi-window display and the single-window display when the multi mode is ON.

[COORD]



Select the operation coordinate system when the manipulator is operated manually.

- Five coordinate systems (joint, cartesian, cylindrical, tool and user) can be used. Each time this key is pressed, the coordinate system is switched in the following order: "JOINT"→"WLD/CYL"→"TOOL"→"USER"
- The selected coordinate system is displayed on the status display area.

[SHIFT] + [COORD]

The coordinate number can be changed when the "TOOL" or "USER" coordinate system is selected.

1.2 Programming Pendant

[DIRECT OPEN] Displays the content related to the current line. • To display the content of a CALL job or condition DIRECT file, move the cursor to the next line and press [DIRECT OPEN]. The file will be displayed for the selected line. Display content will vary depending on the type of instruction used in the job. Example: For a CALL instruction, the content of the called job will be displayed. For a work instruction, the content of the condition file will be displayed. For Input/output instructions, the input/output condition will be displayed. The lamp on this button is lit while the direct open is ON. Press this button while the lamp is lit to return to the previous window. [PAGE] Displays the next page. The page can be switched only when the lamp on this button is lit. [SHIFT] + [PAGE] Switches to the previous page. [AREA] Moves the cursor in the following order: "Menu Area"→"General-Purpose Display Area"→"Message Area"→"Main Menu Area". If no item is displayed, the cursor does not move. [SHIFT] + [AREA] The language can be switched when the bilingual function is valid. (Bilingual function is optional.) [AREA] + DOWN Moves the cursor from the general-purpose display area to the operation button when the operation button is displayed. [AREA] + UP Moves the cursor to the general-purpose display area when the cursor is on the operation button. [SHIFT] Changes the functions of other keys by pressing Can be used with [MAIN MENU], [ASSIST], [COORD]. [AREA], [MOTION TYPE], cursor key or Numeric key to SHIFT access alternate functions. Refer to the description of each key for the alternate [SHIFT] functions. [INTERLOCK] Changes the functions of other keys by pressing together. Can be used with [ASSIST], [MULTI], [TEST START], **INTER** [FWD], or Numeric key (Numeric key customize **LOCK** function). Refer to the description of each key for the alternate [INTERLOCK] functions.

1.2 Programming Pendant

[INFORM LIST]	Displays instruction lists of commands available for job editing.
[ROBOT]	Enables the robot axis operation.
ROBOT	[ROBOT] is active for the system where multiple manipulators are controlled by one DX100 or the system with external axes.
[EX. AXIS]	Enables the external axis (base axis or station axis) operation.
EX.AXIS	[EX.AXIS] is active for the system with external axes.
[MOTION TYPE]	Selects the interpolation type for playback
MOTION TYPE	operation. The selected interpolation type is shown in the status display area on the screen.
	Each time this key is pressed, the interpolation
	type changes in the following order:
	"MOVJ"→" MOVL"→"MOVC"→"MOVS"
	[SHIFT] + [MOTION TYPE] The interpolation mode changes in the following order: "STANDARD"→" EXTERNAL REFERENCE POINT"*→" CONVEYOR"*
	Interpolation type can be changed in any mode.
	*: These modes are purchased options.
[TEST START] TEST START	Moves the manipulator through taught steps in a continuous motion when [TEST START] and [INTERLOCK] are simultaneously pressed. The manipulator can be moved to check the path of taught steps. Operation stops immediately when this key is released. • The manipulator operates according to the currently selected operation cycle: "AUTO," "1CYCLE," or "STEP."
	The manipulator operates at the taught speed. However, if the taught speed exceeds the maximum teaching speed, the operation proceeds at the maximum teaching speed.

1 Introduction

1.2 Programming Pendant

[FWD] Moves the manipulator through the taught steps while this key is pressed. Only move instructions are executed (one **FWD** instruction at a time, no welding instructions). [INTERLOCK] + [FWD] All instructions are executed. [REFP] + [FWD] Moves to the reference point of the cursor line. See chapter 3.3.1.3 "Moving to Reference Point" at page 3-26. The manipulator operates at the selected manual speed. Make sure that the selected manual speed is the desired one before starting operation. Moves the manipulator through the taught steps in [BWD] the reverse direction while this key is pressed. Only move instructions are executed (no weld **BWD** commands). The manipulator operates at the selected manual speed. Make sure that the selected manual speed is the desired one before starting operation. [DELETE] Deletes the registered instruction. Deletion completes when [ENTER] is pressed while this key lamp is lit. DELETE [INSERT] Inserts a new instruction. • Insertion completes when [ENTER] is pressed while this key lamp is lit. **INSERT** [MODIFY] Modifies the taught position data or instruction. · Modification completes when [ENTER] is pressed while this key lamp is lit. **MODIFY** [ENTER] Registers instructions, data, current position of the manipulator, etc. • When [ENTER] is pressed, the instruction or **ENTER** data displayed in the input buffer line moves to the cursor position to complete a registration, insertion, or modification.

1.2 Programming Pendant

MANUAL SPEED keys



Sets the speed for manual operation. This speed is also valid for operations with [FWD] and [BWD].

 There are four speed levels (slow, medium, fast, and inching). The speed changes as described below. The selected speed is displayed on the status area.

Each time [FAST] is pressed, manual speed changes in the following order:

"INCH"→" SLOW"→"MED"→"FST".

Each time [SLOW] is pressed, manual speed changes in the following order:

"FST"→"MED"→"SLOW"→"INCH"

[HIGH SPEED]



Makes the manipulator move at high speed while this button and one of the axis keys are pressed simultaneously during manual operation. No need to change the setting of speed.

• The speed for [HIGH SPEED] is specified in advance.

Axis Key



Moves specified axes on manipulator.

- The manipulator axes only move while the key is pressed.
- Multiple axes can be operated simultaneously by pressing two or more keys at the same time.

The manipulator operates in the selected coordinate system at the selected manual speed. Make sure that the selected coordinate system and the manual speed are the desired ones before starting the axis operation.

Numeric Key



Enters the number or symbol when the ">" prompt appears on the input line.

• "." is the decimal point. "-" is a minus sign or hyphen.

The Numeric keys are also used as function keys. Refer to the explanation of each function for details.

DX100

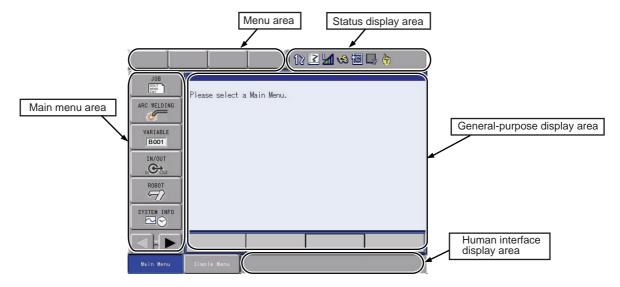
1.2 Programming Pendant

1.2.4 Programming Pendant Display

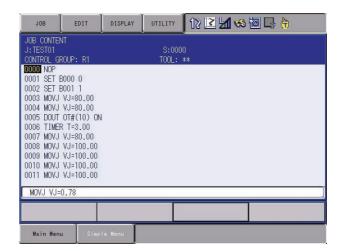
The programming pendant display is a 5.7 inch color display. Alphanumeric characters can be used.

1.2.4.1 Five Display Areas

The general-purpose display area, menu area, human interface display area, and main menu area among the following five areas can be moved by pressing [AREA], or can be selected by directly touching the screen.



Each window displayed during operations is provided with its name on the upper left of the general-purpose display area.



1.2 Programming Pendant

1.2.4.2 General-purpose Display Area

On the general-purpose display area, various settings and contents such as jobs and characteristics files can be displayed and edited.

The operation buttons are also displayed at the bottom of the window according to the window contents.

- To move the cursor to the operation button, press [AREA] + DOWN cursor key.
- To move the cursor to the general-purpose display area, press [AREA] + UP cursor key or press [CANCEL].
- To move the cursor between the operation buttons, use the RIGHT or LEFT cursor key.
- To execute the operation button, move the cursor to the button and press [SELECT].

EXECUTE : Continues operation with the displayed contents.

CANCEL : Cancels the displayed contents and returns to the previous window.

COMPLETE : Completes the setting operation displayed on the general-purpose display

area.

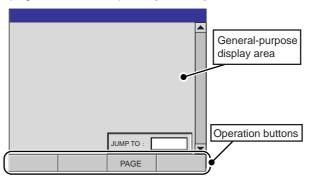
STOP : Stops operation when loading, saving, or verifying with an external memory

device.

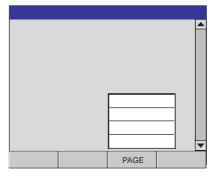
RELEASE : Releases the overrun and shock sensor function.
RESET : Resets an alarm. (Cannot reset major alarms.)

PAGE : Jumps to the appropriate page if the page can be switched.

• When the page can be switched by specifying the page number, the following input box appears when "DIRECT PAGE" is selected. Directly type the desired page number and press [ENTER].



When the page can be switched by selecting an item, the following selection list appears when "DIRECT PAGE" is selected. Select a desired item using the UP and DOWN cursor key and press [ENTER].



1.2 **Programming Pendant**

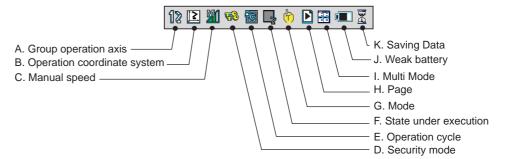
1.2.4.3 Main Menu Area

Each menu and submenu are displayed in the main menu area. Press [MAIN MENU] or touch {Main Menu} on the left bottom of the window to display the main menu.



1.2.4.4 Status Display Area

The Status Display area shows controller status. The displayed information will vary depending on the controller mode (Play/Teach).



A. Control Group

Displays the active control group for systems equipped with station axes or several robot axes.



1 Introduction

1.2 Programming Pendant

B. Operation Coordinate System

Displays the selected coordinate system. Switched by pressing [COORD].



: Joint Coordinates



: Cartesian Coordinates



: Cylindrical Coordinates



: Tool Coordinates



: User Coordinates

C. Manual Speed

Displays the selected speed. For details, refer to *chapter 2.2.0.5* "Select Manual Speed" at page 2-4.



: Inching



: Low Speed



: Medium Speed



: High Speed

D. Security Mode



: Operation Mode



: Edit Mode



: Management Mode

E. Operation Cycle

Displays the present operation cycle.



: Step



Cycle



: Continuous

1 Introduction

1.2 Programming Pendant

F. State Under Execution

Displays the present system status (STOP, HOLD, ESTOP, ALARM, or RUN).



: Stop Status



: Hold Status



: Emergency Stop Status



: Alarm Status



: Operating Status

G. Mode



: Teach mode



: Play mode

H. Page



: Displayed when the page can be switched.

I. Multi Mode



: Displayed when the multi window mode is set.

J. Weak Battery of Memory



: Displayed when the battery of memory is weak.

K. Saving Data



: Displayed while saving the data.

1.2 **Programming Pendant**

1.2.4.5 Human Interface Display Area

An error(s) or a message(s) is displayed in the human interface display area.



When an error is displayed, operations cannot be performed until the error is canceled. Press [CANCEL] to allow for operations.

When two or more errors occur, appears in the message display area. Activate the message display area and press [SELECT] to view the list of current errors.



To close the error list, select "CLOSE" or press [CANCEL].

1.2.4.6 Menu Area

The menu area is used to edit a job, manage jobs, and execute various utilities.



1.2 Programming Pendant

1.2.5 Screen Descriptions

• The menu displayed in the programming pendant is denoted with { }.



The above menu items are denoted with {DATA}, {EDIT}, {DISPLAY}, AND {UTILITY}.

• The window can be displayed according to the view desired.

Fig. 1-3: Full Window View

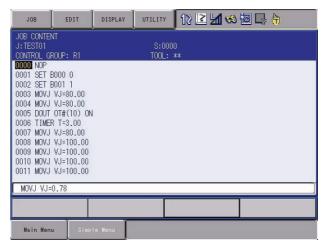


Fig. 1-4: Upper Window View



Fig. 1-5: Middle Window View

```
| 0001 SET B000 0
| 0002 SET B001 1
| 0003 MOVJ VJ=80.00
| 0004 MOVJ VJ=80.00
| 0005 DOUT OT#(10) ON
| 0006 TIMER T=3.00
| 0007 MOVJ VJ=80.00
| 0008 MOVJ VJ=100.00
| 0008 MOVJ VJ=100.00
| 0010 MOVJ VJ=100.00
| 0010 MOVJ VJ=100.00
```

Fig. 1-6: Lower Window View



1 Introduction

DX100

1.2 Programming Pendant

1.2.6 Character Input Operation

Move the cursor to the data for which characters are to be input, and press [SELECT] to display the software keypad.

1.2.6.1 Character Input

To input characters, the software keypad is shown on the programming pendant display.

There are three types of software keypads: the alphanumeric keypads each for upper-case and lower-case characters and the symbol keypad. To switch between the alphanumeric keypads and the symbol keypad, touch the button tab on the screen or press [PAGE]. To switch the alphanumeric keypads between upper-case and lower-case characters, touch "CapsLock OFF" or "CapsLock ON."

1.2.6.2 Operation

Keypad	Button on the Programming Pendant	Explanation
Cursor		Moves the cursor (focus).
[SELECT]	SELECT	Selects a character.
[CANCEL]	CANCEL	Clears all the characters being typed. Pressing this second time cancels the software keypad.
[ENTER]	ENTER	Enters the input characters.
Button Tab	GO BAGK PAGE	Switches the keypads displayed on the programming pendant.
	MAIN MENU	Closes the software keypad.
Numeric Keys	0	Enters numbers.
	to 9	

1.2 Programming Pendant

1.2.6.3 Alphanumeric Input

Number input is performed with the Numeric keys or on the following alphanumeric input window. Numbers include 0 to 9, the decimal point (.), and the minus sign/hyphen (-).

Note however, that the decimal point cannot be used in job names.

Press the page key to display the alphanumeric input window. Move the cursor to the desired letter and press [SELECT] to enter the letter.

Fig. 1-7: For Numbers and Upper-case Characters

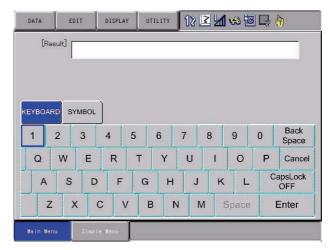
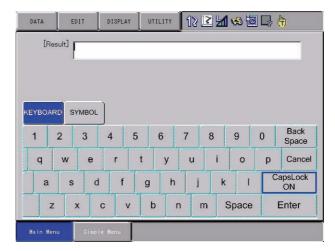


Fig. 1-8: For Numbers and Lower-case Characters



DX100	Introduction Programming Pendant
5,1100	 1 rogianiming romanic

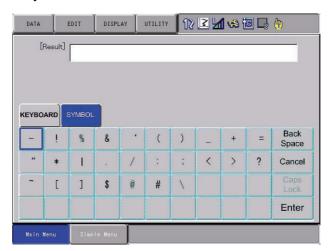
1.2.6.4 Symbol Input

Press the page key to display the symbol input window.

Move the cursor to the desired symbol and press [SELECT] to enter the symbol. $\label{eq:symbol} % \begin{subarray}{ll} \end{subarray} % \begin{$

Note that only some symbols are available for naming jobs.

Fig. 1-9: For Symbols



1 Introduction

DX100

1.3 Mode

1.3 Mode

The following three modes are available for DX100.

- Teach Mode
- Play Mode
- Remote Mode

1.3.1 Teach Mode

In the teach mode, the following can be done.

- · Preparation and teaching of a job
- · Modification of a registered job
- Setting of various characteristic files and parameters

1.3.2 Play Mode

In the play mode, the following can be done.

- Playback of a taught job
- Setting, modification, or deletion of various condition files

1.3.3 Remote Mode

In the remote mode, the operations such as Servo ON Ready, Start, Cycle Change, Call Master Job can be commanded by external input signals.

The operations by external input signals become enabled in the remote mode, while [START] on the programming pendant becomes disabled.

The data transmission function (optional function) is also available in the remote mode.

The following table shows how each operation is input in each mode.

Mode	Teach Mode	Play Mode	Remote Mode
Operation			
Servo ON Ready	PP	PP	External input signal
Start	Invalid	PP	External input signal
Cycle Change	PP	PP	External input signal
Call Master Job	PP	PP	External input signal

Note: "PP" indicates the programming pendant.

1.3.4 Teach Mode Priority

In the teach mode, following operations are disabled:

- 1. Playback using [START].
- 2. Playback from external input signals.

	1	Introduction
DX100	1.4	Security Mode

1.4 Security Mode

1.4.1 Types of Security Modes

The following three types of security modes are available for DX100.

Any operation in the edit mode and the management mode requires a password. The password must contain between 4 and 8 letters, numbers, or symbols.

Operation Mode

The operator can monitor the line operation and start and stop the manipulator. Repairs, etc. can be performed if any abnormalities are detected.

• Edit Mode

Teaching, robot jog operations, and editing of jobs and various condition files can be performed in addition to the operations enabled in the operation mode.

Management Mode

The operator who performs setup and maintenance for the system can set the machine control parameter, set the time, change the password, etc. in addition to the operations enabled in the edit mode.

1 Introduction1.4 Security Mode

DX100

Table 1-1: Menu & Security Mode

Main Menu	Sub Menu	Security Mode		
		DISPLAY	EDIT	
JOB	JOB	Operation	Edit	
	SELECT JOB	Operation	Operation	
	CREATE NEW JOB 1)	Edit	Edit	
	MASTER JOB	Operation	Edit	
	JOB CAPACITY	Operation	-	
	RES. START(JOB) 1)	Edit	Edit	
	RES. STATUS ²⁾	Operation	-	
	CYCLE	Operation	Operation	
VARIABLE	BYTE	Operation	Edit	
	INTEGER	Operation	Edit	
	DOUBLE	Operation	Edit	
	REAL	Operation	Edit	
	STRING	Operation	Edit	
	POSITION(ROBOT)	Operation	Edit	
	POSITION(BASE)	Operation	Edit	
	POSITION(ST)	Operation	Edit	
	LOCAL VARIABLE	Operation	-	
IN/OUT	EXTERNAL INPUT	Operation	-	
	EXTERNAL OUTPUT	Operation	-	
	UNIVERSAL INPUT	Operation	Edit	
	UNIVERSAL OUTPUT	Operation	Edit	
	SPECIFIC INPUT	Operation	-	
	SPECIFIC OUTPUT	Operation	-	
	RIN	Operation	-	
	CPRIN	Operation	-	
	REGISTER	Operation	-	
	AUXILIARY RELAY	Operation	-	
	CONTROL INPUT	Operation	-	
	PSEUDO INPUT SIG	Operation	Management	
	NETWORK INPUT	Operation	-	
	NETWORK OUTPUT	Operation	-	
	ANALOG OUTPUT	Operation	-	
	SV POWER STATUS	Operation	-	
	LADDER PROGRAM	Management	Management	
	I/O ALARM	Management	Management	
	I/O MESSAGE	Management	Management	

DX100

1 Introduction1.4 Security Mode

Table 1-1: Menu & Security Mode (Continued)

Main Menu	Sub Menu	Security Mode		
		DISPLAY	EDIT	
ROBOT	CURRENT POSITION	Operation	-	
	COMMAND POSITION	Operation	-	
	SERVO MONITOR	Management	-	
	WORK HOME POS	Operation	Edit	
	SECOND HOME POS	Operation	Edit	
	DROP AMOUNT	Management	Management	
	POWER ON/OFF POS	Operation	-	
	TOOL	Edit	Edit	
	INTERFERENCE	Management	Management	
	SHOCK SENS LEVEL	Operation	Management	
	USER COORDINATE	Edit	Edit	
	HOME POSITION	Management	Management	
	MANIPULATOR TYPE	Management	-	
	ANALOG MONITOR	Management	Management	
	OVERRUN&S-SENSOR 1)	Edit	Edit	
	LIMIT RELEASE 1)	Edit	Edit	
	ARM CONTROL 1)	Management	Management	
	SHIFT VALUE	Operation	-	
SYSTEM INFO	VERSION	Operation	-	
	MONITORING TIME	Operation	Management	
	ALARM HISTORY	Operation	Management	
	I/O MSG HISTORY	Operation	Management	
	SECURITY	Operation	Operation	
FD/CF	LOAD	Edit	-	
	SAVE	Operation	-	
	VERIFY	Operation	-	
	DELETE	Operation	-	
	DEVICE	Operation	Operation	
	FOLDER	Edit	Edit	
	FORMAT 1)	Operation	Operation	
PARAMETER	S1CxG	Management	Management	
	S2C	Management	Management	
	S3C	Management	Management	
	S4C	Management	Management	
	A1P	Management	Management	
	A2P	Management	Management	
	A3P	Management	Management	
	A4P	Management	Management	
	RS	Management	Management	
	S1E	Management	Management	
	S2E	Management	Management	
	S3E	Management	Management	
	S4E	Management	Management	

1 Introduction 1.4 Security Mode

DX100

Table 1-1: Menu & Security Mode (Continued)

Main Menu	Sub Menu	Security Mode	Security Mode	
		DISPLAY	EDIT	
SETUP	TEACHING COND	Edit	Edit	
	OPERATE COND	Management	Management	
	DATE/TIME	Management	Management	
	GRP COMBINATION 2)	Management	Management	
	RESERVE JOB NAME	Edit	Edit	
	USER ID	Edit	Edit	
	SET SPEED	Management	Management	
	KEY ALLOCATION	Management	Management	
	RES. START(CNCT)	Management	Management	
	AUTO BACKUP SET	Management	Management	
	WRONG DATA LOG	Operation	Management	
ARC WELDING	ARC START COND.	Operation	Edit	
	ARC END COND.	Operation	Edit	
	ARC AUX COND.	Operation	Edit	
	POWER SOURCE COND.	Operation	Edit	
	ARC WELD DIAG.	Operation	Edit	
	WEAVING	Operation	Edit	
	ARC MONITOR	Operation	-	
	ARC MONITOR (SAMPLING)	Operation	-	
HANDLING	HANDLING DIAG.	Operation	Edit	
SPOT WELDING	WELD DIAGNOSIS	Operation	Edit	
	I/O ALLOCATION	Management	Management	
	GUN CONDITION	Management	Management	
	CLEARANCE SETTING	Operation	Edit	
	SPOT POWER SOURCE COND.	Management	Management	
SPOT WELDING	WELD DIAGNOSIS	Operation	Edit	
(MOTOR GUN)	GUN PRESSURE	Edit	Edit	
	PRESSURE	Edit	Edit	
	I/O ALLOCATION	Management	Management	
	GUN CONDITION	Management	Management	
	CLEARANCE SETTING	Operation	Edit	
	SPOT POWER SOURCE COND.	Management	Management	
	TIP INSTALLATION	Operation	Management	
GENERAL	WEAVING	Operation	Edit	
	GENERAL DIAGNOSIS	Operation	Edit	
ALL COMMON APPLICATION	I/O-VARIABLE CUSTOMIZE	Operation	Operation	

Displayed in the teach mode only.
 Displayed in the play mode only.

1 Introduction

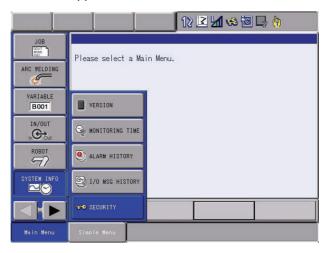
DX100

1.4 Security Mode

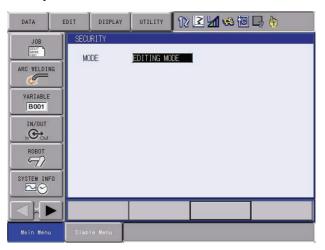
1.4.2 Changing Security Modes

The security mode can be changed only when the main manu is displayed.

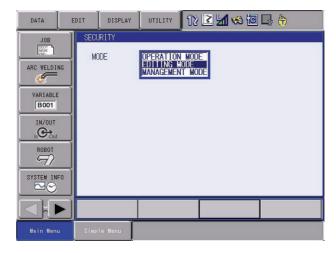
- 1. Select {SYSTEM INFO} under the main menu.
 - The sub menu appears.



- 2. Select (SECURITY).
 - The security of the main menu is shown.



 The security mode can be selected from operation mode, edit mode, or management mode.



DX100 1.4 Security Mode

- 3. Select the desired security mode.
 - When the selected security mode is higher than the currently set mode, the user ID input status window appears.
- 4. Input the user ID as required.
 - At the factory, the user ID number is preset as follows:
 Edit Mode: [00000000]
 Management Mode: [99999999]
- 5. Press [ENTER].
 - The selected security mode's input ID is checked. If the correct user ID is input, the security mode is changed.

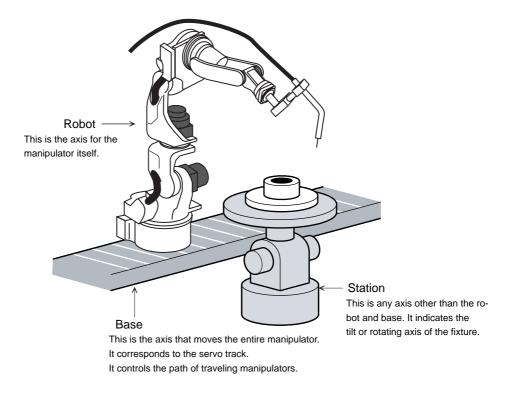
2.1 Control Groups and Coordinate Systems

2 Manipulator Coordinate Systems and Operations

2.1 Control Groups and Coordinate Systems

2.1.1 Control Group

For the DX100, a group of axes to be controlled at a time is called "Control Group", and the group is classified into three units: "ROBOT" as a manipulator itself, "BASE" that moves the manipulator in parallel, and "STATION" as jigs or tools other than "ROBOT" and "BASE". BASE and STATION are also called external axes.



2.1 Control Groups and Coordinate Systems

2.1.2 Types of Coordinate Systems

The following coordinate systems can be used to operate the manipulator:

Joint Coordinates Each axis of the manipulator moves independently.

Cartesian Coordinates The tool tip of the manipulator moves parallel to any of the X-, Y-, and Z-axes.

Cylindrical Coordinates

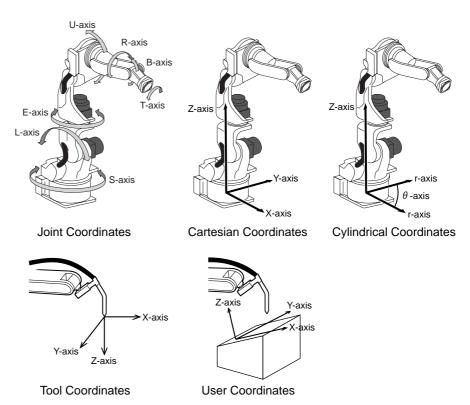
The θ axis moves around the S-axis. The R-axis moves parallel to the L-axis arm. For vertical motion, the tool tip of the manipulator moves parallel to the Z-axis.

Tool Coordinates

The effective direction of the tool mounted in the wrist flange of the manipulator is defined as the Z-axis. This axis controls the coordinates of the end point of the tool.

User Coordinates

The XYZ-cartesian coordinates are defined at any point and angle. The tool tip of the manipulator moves parallel to the axes of them.



	2	Manipulator Coordinate Systems and Operations
DX100	2.2	General Operations

2.2 General Operations

2.2.0.1 Check Safety

Before any operation of the DX100, read Section 1 "Safety" of "DX100 INSTRUCTIONS" again and keep safe around the robot system or peripherals.

2.2.0.2 Select Teach Mode

Set the mode switch on the programming pendant to "teach".

2.2.0.3 Select Control Group

If the DX100 has several Control Groups or Coordinate Control Systems (optional function), select control group first.

If two or more ROBOT, BASE, STATION are registered, switch control group by pressing [SHIFT] + [ROBOT] or [SHIFT] + [EX. AXIS].

After selecting a job, the control group registered in the selected job is enabled. The control group registered in the edit job can be switched by pressing [ROBOT] or [EX. AXIS].

Check the selected control group at the status display area on the programming pendant.

2.2.0.4 Select Coordinate System

Select a coordinate system by pressing [COORD] key.

Each time [COORD] key is pressed, the coordinate system switches in the following order:

Joint→Cartesian (Cylindrical)→Tool→User.

Check the selected coordinate on the status display area on the programming pendant.

DX100

- 2 Manipulator Coordinate Systems and Operations
- 2.2 General Operations

2.2.0.5 Select Manual Speed

Select manual speed of operation by pressing [FAST] or [SLOW]. The selected speed is effective not only for axis operation but [FWD] or [BWD] operation.



In operating the manipulator manually by the programming pendant, the maximum speed of center point is limited at 250 mm/s.

• Each time [FAST] is pressed, the speed switches in the order of "INCH"→"SLOW"→"MED"→"FAST".



• Each time [SLOW] is pressed, the speed switches in the order of "FAST"→"MED"→"SLOW"→"INCH".



Check selected manual speed on the status area of Programming Pendant.

2.2.0.6 Servo ON

Press [SERVO ON READY], then SERVO ON LED starts blinking. Squeeze the Enable switch, then SERVO ON LED starts lighting.

2.2.0.7 Axis Operation

Make sure of safety around the manipulator. Press axis key, then axis moves according to the selected control group, coordinates, and manual speed. See *chapter 2.3 "Coordinate Systems and Axis Operation" at page 2-5*.

2.2.0.8 HIGH SPEED

Press [HIGH SPEED] while pressing an axis key to make the manipulator move faster than the usual speed.



The [HIGH SPEED] key is disabled when "INCH" is selected for the manual speed.

2.3 Coordinate Systems and Axis Operation

2.3.1 Joint Coordinates

When operating in joint coordinates mode, the S, L, U, R, B, and T-axes of the manipulator move independently. The motion of each axis is described in the table below.

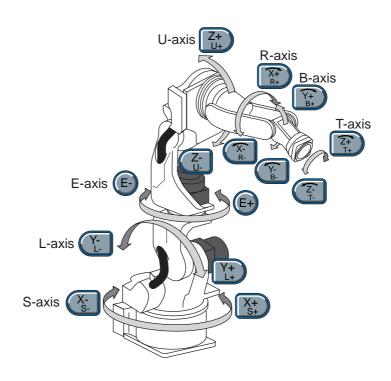
Table 2-1: Axis Motion in Joint Coordinates

Axis Name		Axis Operation Key	Motion	
Major Axes	S-axis	X- S- X+ S+	Main unit rotates right and left.	
	L-axis	Y- Y+ L+	Lower arm moves forward and backward.	
	U-axis	Z- U- U- U+	Upper are moves up and down.	
Wrist Axes	R-axis	X- R- X+ R+	Wrist rolls right and left.	
	B-axis	Y- B- Y+ B+	Wrist moves up and down.	
	T-axis	Z- T- T-	Wrist turns right and left.	
	E-axis	E- E+	Lower arm turns right and left.	



 When two or more axis keys are pressed at the same time, the manipulator will perform a compound movement.
 However, if two different directional keys for the same axis are pressed at the same time (such as [S-] + [S+]), none of the axes operate.

2



2.3.2 Cartesian Coordinates

In the cartesian coordinates, the manipulator moves parallel to the X-, Y-, or Z-axes. The motion of each axis is described in the table below.

Table 2-2: Axis Motion in Cartesian Coordinates

Axis Na	me	Axis Operation Key	Motion
Basic X-axis Axes		X- S- X+ S+	Moves parallel to X-axis.
	Y-axis	Y- Y+ L+	Moves parallel to Y-axis.
	Z-axis	Z- U- Z+ U+	Moves parallel to Z-axis.
Wrist Ax	es	Motion about TCP is executed. See <i>chapter 2.3.7</i> "Control Point Operation" at page 2-15.	



 When two or more axis keys are pressed at the same time, the manipulator will perform compound movement. However, if two different directional keys for the same axis are pressed at the same time (such as [X-] + [X+]), none of the axes operate.

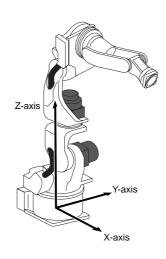
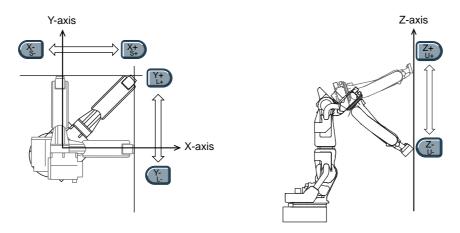


Fig. 2-1: Moves parallel to X- or Y-axis Fig. 2-2: Moves parallel to Z-axis



2.3.3 Cylindrical Coordinates

In the cylindrical coordinates, the manipulator moves as follows. The motion of each axis is described in the table below.

Table 2-3: Axis Motion in Cylindrical Coordinates

Axis Na	me	Axis Operation Key	Motion
Basic Axes	θ-axis	X- S- S+	Main unit rolls around S-axis.
	r-axis	Y- L- V+ L+	Moves perpendicular to Z-axis.
	Z-axis	Z- U- U+	Moves parallel to Z-axis.
Wrist Axes Motion about TCP is executed. See chapter 2 "Control Point Operation" at page 2-15.		•	

- 2 Manipulator Coordinate Systems and Operations
- 2.3 Coordinate Systems and Axis Operation



 When two or more axis keys are pressed at the same time, the manipulator will perform compound movement. However, if two different directional keys for the same axis are pressed at the same time (such as [Z-] + [Z+]), none of the axes operate.

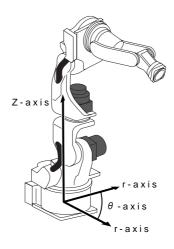


Fig. 2-3: Rolls around q-axis

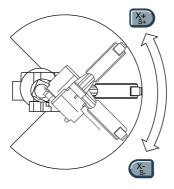
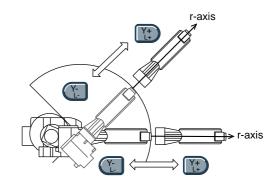


Fig. 2-4: Moves perpendicular to r-axis



2.3.4 Tool Coordinates

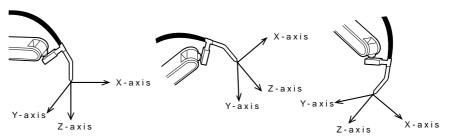
In the tool coordinates, the manipulator moves parallel to the X-, Y-, and Z-axes, which are defined at the tip of the tool. The motion of each axis is described in the table below.

Table 2-4: Axis Motion in Tool Coordinates

Axis Name		Axis Operation Key	Motion
Basic Axes	X-axis	X- S- S+	Moves parallel to X-axis.
	Y-axis	Y- L- L+	Moves parallel to Y-axis.
	Z-axis	Z- U- U+	Moves parallel to Z-axis.
Wrist Axes		Motion about TCP is executed. See chapter 2.3.7 "Control Point Operation" at page 2-15.	



 When two or more axis keys are pressed at the same time, the manipulator will perform compound movement. However, if two different directional keys for the same axis are pressed at the same time (such as [X-] + [X+]), none of the axes operate.

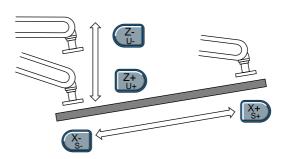


The tool coordinates are defined at the tip of the tool, assuming that the effective direction of the tool mounted on the manipulator wrist flange is the Z-axis. Therefore, the tool coordinates axis direction moves with the wrist.

In the tool coordinates motion, the manipulator can be moved using the effective tool direction as a reference regardless of the manipulator position or orientation. These motions are best suited when the manipulator is required to move parallel while maintaining the tool orientation with the workpieces.

DX100

- 2 Manipulator Coordinate Systems and Operations
- 2.3 Coordinate Systems and Axis Operation





For tool coordinates, the tool file should be registered in advance. For further details, refer to "8.3 Tool Data Setting" of coordinates "DX100 INSTRUCTIONS" (RE-CTO-A215).

2 Manipulator Coordinate Systems and Operations

DX100

2.3 Coordinate Systems and Axis Operation

2.3.4.1 Selecting Tool

Tool numbers are used to specify a tool when more than one tool is used on the system.

You may select from the registered tool files when you switch tools on the manipulator.

> This operation can be performed only when the number of tool is more than one.



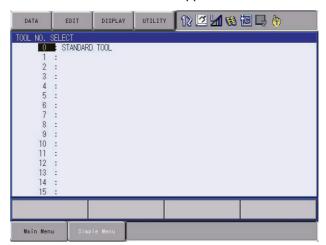
To use several tool files with one manipulator, set the following parameter.

S2C431: Tool number switch specifying parameter

- 1: Can be switched
- 0: Cannot be switched
- 1. Press the [COORD] key and select the tool coordinates



- Each time [COORD] key is pressed, the coordinate system switches in the following order:
 - Joint → Cartesian (Cylindrical) → Tool → User. Check the change on the status display area.
- 2. Press [SHIFT] + [COORD].
 - The TOOL NO. SELECT window appears.



- 3. Move the cursor to the tool to use.
 - The TOOL NO. SELECT window above shows an example; "TOOL NO. 0 TORCH MT-3501" is selected.
- 4. Press [SHIFT] + [COORD].
 - The window goes back to the previous window.

2.3.5 User Coordinates

2

In the user coordinates, the manipulator moves parallel to each axis of the coordinates which are set by the user. Up to 24 coordinate types can be registered. Each coordinate has a user number and is called a user coordinate file.

The figure and the table below describe the motion of each axis when the axis key is pressed.

Table 2-5: Axis Motion in User Coordinates

Axis Name		Axis Operation Key	Motion
Basic Axes	X-axis	X- S- X+ S+	Moves parallel to X-axis.
	Y-axis	Y- L- V+ L+	Moves parallel to Y-axis.
	Z-axis	Z- U- U+	Moves parallel to Z-axis.
Wrist Axes		Motion about TCP is executed. See chapter 2.3.7 "Control Point Operation" at page 2-15.	



 When two or more axis keys are pressed at the same time, the manipulator will perform compound movement. However, if two different directional keys for the same axis are pressed at the same time (such as [X-] + [X+]), none of the axes operate.

Fig. 2-5: Moves parallel to X or Y-axis

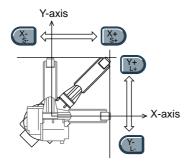
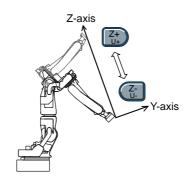
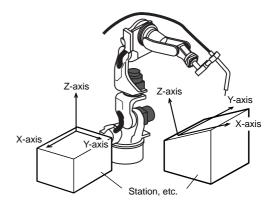


Fig. 2-6: Moves parallel to Z-axis





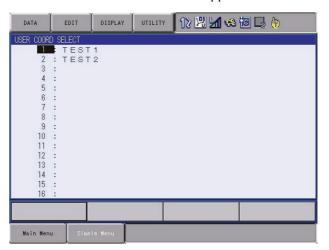
2.3.5.1 Selecting User Coordinates

Follow these procedures to select the desired coordinate system from among the registered user coordinates.

1. Press [COORD] to select the user coordinates



- Each time [COORD] key is pressed, the coordinate system switches in the following order:
 - Joint→Cartesian (Cylindrical)→Tool→User. Check the change on the status display area.
- 2. Press [SHIFT] + [COORD].
 - The USER COORD SELECT window appears.





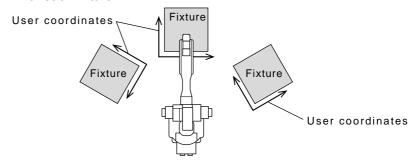
For more information on registration of the user coordinates, refer to "8.8 User Coordinate Setting" of "DX100 INSTRUCTIONS" (RE-CTO-A215).

3. Select the desired user number.

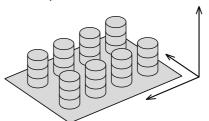
2.3.5.2 Examples of User Coordinate Utilization

The user coordinate settings allow easy teaching in various situations. For example:

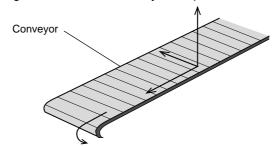
 When multiple positioners are used, manual operation can be simplified by setting the user coordinates for each fixture.



 When performing arranging or stacking operations, the incremental value for shift can be easily programmed by setting user coordinates on a pallet.



 When performing conveyor tracking operations, the moving direction of the conveyor is specified.



2.3.6 External Axis

The external axis can be operated by selecting "BASE" or "STATION" for the control group. The motion of each axis is described in the table below.

Axis Name		Axis Operation Key	Motion
BASE or STATION	1st axis	X- S- X+ S+	The 1st axis moves.
	2nd axis	Y- L- Y+ L+	The 2nd axis moves.
	3rd axis	Z- U- U+	The 3rd axis moves.

2.3.7 Control Point Operation

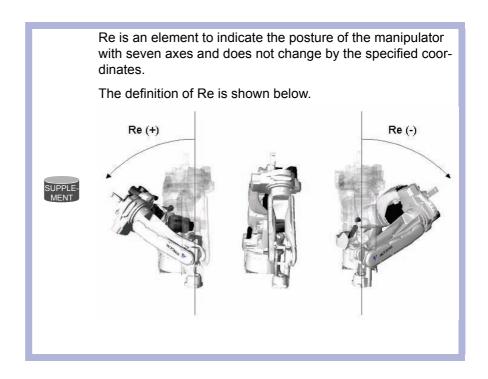
Motion about TCP (Tool Center Point) can only change the wrist orientation at a fixed TCP position in all coordinate systems except the joint coordinates. The motion of each axis is described in the table below.

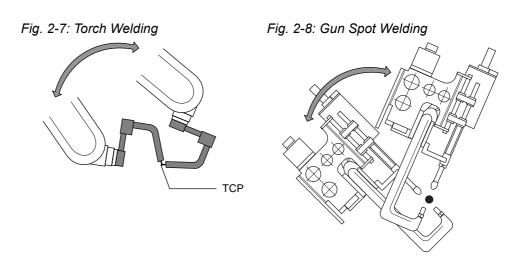
Table 2-6: Axis Motion in Motion about TCP

Axis Name	Axis Operation Key	Motion	
Major Axes	X- S- X+ S+	TCP moves. These movements differ depending on cartesian, cylindrical, tool and user coordinates.	
	Y- L- Y+ L+		
	Z- U- U+		
Wrist Axes	X- X+ R- R+	Wrist axes move with the TCP fixed. These movements differ depending on cartesian, cylindrical, tool and user coordinates.	
	Y- B- Y+ B+		
	\(\begin{align*} \hat{Z}+\\ \pi-\\ \ext{T-} \end{align*}		
E-axis	E- E+	* Available only for the manipulator with seven axes The posture of arm changes while the position and posture of the tool remain fixed. (The Re degree changes.)	



• When two or more axis keys are pressed at the same time, the manipulator will perform compound movement. However, if two different directional keys for the same axis are pressed at the same time (such as [X-] + [X+]), none of the axes operate.

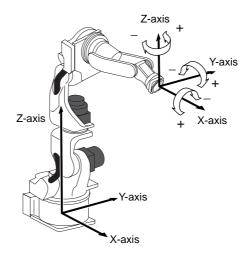




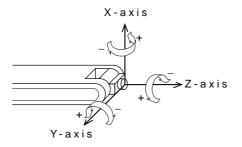
- 2 Manipulator Coordinate Systems and Operations
- 2.3 Coordinate Systems and Axis Operation

Turning of each wrist axis differs in each coordinate system.

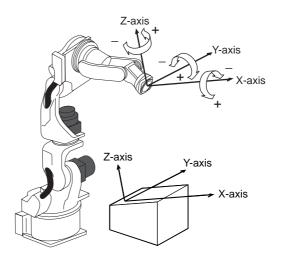
• In cartesian or cylindrical coordinates, wrist axis rotations are based on the X-, Y-, or Z-axis.



• In tool coordinates, wrist axis rotations are based on X-, Y-, or Z-axis of the tool coordinates.



- 2.3 Coordinate Systems and Axis Operation
 - In user coordinates, wrist axis rotations are based on X-, Y-, or Z-axis of the user coordinates.



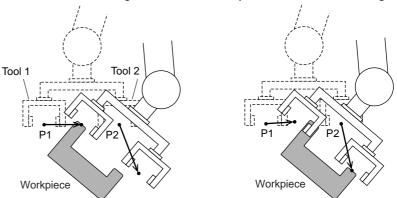
2.3.7.1 Control Point Change

The tool tip position (TCP) is the target point of axis operations and is set as the distance from the flange face. The control point change operation is an axis operation that involves selecting a tool from the list of registered tools (Refer to *chapter 2.3.4.1 "Selecting Tool" at page 2-11*), and then manipulating the axes while changing the TCP. This can be performed with all coordinates except the joint coordinates. The axis operation is the same as that of the motion about TCP.

<Example 1>TCP Change Operation with Multiple Tools

- (1) Set the TCPs for Tool 1 and Tool 2 as P1 and P2, respectively.
- (2) When Tool 1 is selected to perform an axis operation, P1 (Tool 1's TCP) is the target point of the operation. Tool 2 follows Tool 1 and is not controlled by the axis operation.
- (3) On the other hand, When Tool 2 is selected to perform an axis operation, P2 (Tool 2's TCP) is the target point of the axis operation. In this case, Tool 1 just follows Tool 2.

Fig. 2-9: Selection of Tool 1 and axis Fig. 2-10: Selection of Tool 2 and operations with controlling P1 axis operations with controlling P2



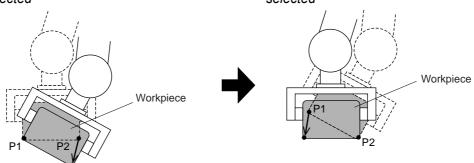
- 2 Manipulator Coordinate Systems and Operations
- 2.3 Coordinate Systems and Axis Operation

<Example 2>TCP Change Operation with a Single Tool

- (1) Set the two corners of the workpiece that the tool is holding as TCP P1 and P2 respectively.
- (2) By selecting two TCPs alternately, the workpiece can be moved as shown below:

Fig. 2-11: Motion about TCP with P1 selected

Fig. 2-12: Motion about TCP with P2 selected





For registration of the tool file, refer to "8.3 Tool Data Setting" of "DX100 INSTRUCTIONS" (RE-CTO-A215).

3.1 Preparation for Teaching

3 Teaching

3.1 Preparation for Teaching

To ensure safety, the following operations should always be performed before teaching:

- Check the emergency stop buttons to be sure they function properly.
- · Set the mode switch to "TEACH".

Then,

· Register a job.

3.1.1 Checking Emergency Stop Buttons

The Servo ON button on the programming pendant should be lit while the power is ON for the servo system. Perform the following operation to ensure that the emergency stop buttons on both the DX100 and the programming pendant are functioning correctly before operating the manipulator.

- 1. Press E. STOP button.
 - Press the emergency stop button on the DX100 or the programming pendant.
- 2. Confirm the servo power is turned OFF.
 - The SERVO ON button on the programming pendant lights while servo supply is turned ON.
 - When the emergency stop button is pressed and the servo power is turned OFF, the SERVO ON lamp will turn OFF.
- 3. Press [SERVO ON READY] of the programming pendant.
 - After confirming correct operation, press [SERVO ON READY]. The servo power will be ready to turn ON.
 - The servo power can be turned ON while the SERVO ON button lamp blinks.

3.1.2 Setting the Teach Lock

For safety purposes, always set the mode switch to "TEACH" before beginning to teach.

While the teach lock is set, the mode of operation is tied to the teach mode and the machines cannot be played back using either [START] or external input.

3 Teaching

DX100

3.1 Preparation for Teaching

3.1.3 Registering a Job

Specify the name, comments (as required), and control group to register a job.

3.1.3.1 Registering Job Names

Job names can use up to 32 alphanumeric and symbol characters. These different types of characters can coexist within the same job name.

The following rules apply to the designation of job names:

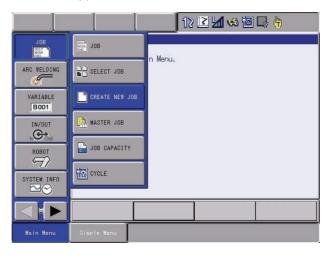
- A maximum of 32 characters can be used for a job name.
- If the job name is already used, an input error is caused.

<Example>

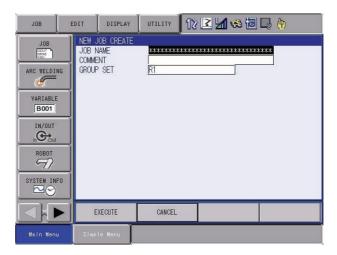


3.1.3.2 Registering Jobs

- 1. Select {JOB} under the main menu.
 - The sub-menu appears.



- 2. Select {CREATE NEW JOB}.
 - The NEW JOB CREATE window appears.



DX100	3 Teaching 3.1 Preparation for Teaching
	3. Input job name.

- Move the cursor to JOB NAME, and press [SELECT]. Input job names using the character input operation. For information on character input operation, refer to chapter 1.2.6 "Character Input Operation" at page 1-18.
- 4. Press [ENTER].

3.1.3.3 Registering Comments

Register a comment using up to 32 alphanumeric and symbol characters as required.

- 1. Enter a comment.
 - In the NEW JOB CREATE window, move the cursor to the comment and press [SELECT]. For information on character input operation, refer to chapter 1.2.6 "Character Input Operation" at page 1-18.
- 2. Press [ENTER].

3.1.3.4 Registering Control Groups

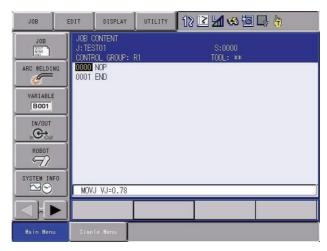
Select the control group that has been registered in advance. If external axes (BASE or STATION) or multiple robot systems are not used, the registration of control groups is not required.

	3	Teaching
DX100	3.1	Preparation for Teaching

3.1.3.5 Switching to the Teaching Window

After the name, comments (can be omitted), and the control groups have been registered, switch the window to the teaching window as follows.

- 1. In the NEW JOB CREATE window, press [ENTER] or select "EXECUTE."
 - Job name, comments, and control groups are all registered. Then, the JOB CONTENT window appears. NOP and END instructions are automatically registered.



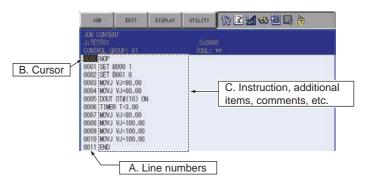
3 Teaching DX100

3.2 **Teaching Operation**

3.2 **Teaching Operation**

3.2.1 Teaching Window

Teaching is conducted in the JOB CONTENT window. The JOB CONTENT window contains the following items:



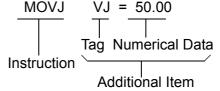
A. Line Numbers

The number of the job line is automatically displayed. Line numbers are automatically updated if lines are inserted or deleted.

B. Cursor

The cursor for manipulator control. For the FWD, BWD, and test operation, the manipulator motion starts from the line this cursor points.

C. Instructions, Additional Items, Comments, Etc.



Instructions : These are instructions needed to process or perform an

> operation. In the case of MOVE instructions, the instruction corresponding to the interpolation type is automatically displayed at the time position is taught.

Additional items : Speed and time are set depending on the type of

instruction. When needed, numerical or character data

is added to the condition-setting tags.

	3	Teaching
DX100	3.2	Teaching Operation

3.2.2 Interpolation Type and Play Speed

Interpolation type determines the path along which the manipulator moves between playback steps. Play speed is the rate at which the manipulator moves.

Normally, the position data, interpolation type, and play speed are registered together for a robot axis step. If the interpolation type or play speed settings are omitted during teaching, the data used from the previously taught step is automatically used.

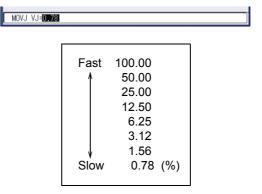
3.2.2.1 Joint Interpolation

The joint interpolation is used when the manipulator does not need to move in a specific path toward the next step position. When the joint interpolation is used for teaching a robot axis, the move instruction is MOVJ. For safety purposes, use the joint interpolation to teach the first step.

When [MOTION TYPE] is pressed, the move instruction on the input buffer line changes.

<Play Speed Setting Window>

- Speeds are indicated as percentages of the maximum rate.
- Setting "0:Speed Omit" sets the same speed as the previous determination.
- 1. Move the cursor to the play speed.
- 2. Set the play speed by pressing [SHIFT] + the cursor key.
 - The joint speed value increases or decreases.

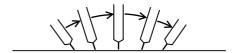


3 Teaching DX100

Teaching Operation 3.2

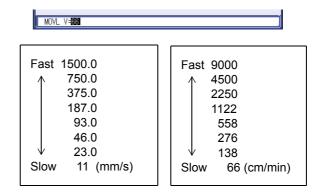
3.2.2.2 Linear Interpolation

The manipulator moves in a linear path from one taught step to the next. When the linear interpolation is used to teach a robot axis, the move instruction is MOVL. Linear interpolation is used for work such as welding. The manipulator moves automatically changing the wrist position as shown in the figure below.



<Play Speed Setting Window (same for circular and spline interpolation)>

- There are two types of displays, and they can be switched depending on the application.
- 1. Move the cursor to the play speed.
- 2. Set the play speed by pressing [SHIFT] + the cursor key.
 - The play speed value increases or decreases.



3.2 Teaching Operation

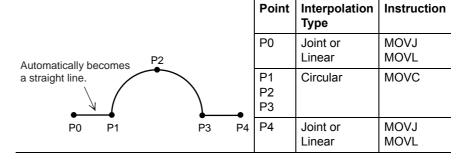
3.2.2.3 Circular Interpolation

The manipulator moves in an arc that passes through three points. When circular interpolation is used for teaching a robot axis, the move instruction is MOVC.

■ Single Circular Arc

When a single circular movement is required, teach the circular interpolation for three points, P1 to P3, as shown in the following figure. If joint or linear interpolation is taught at P0, the point before starting the circular operation, the manipulator moves from P0 to P1 in a straight line.

Table 3-1: Interpolation Type for Single Circular Arc



■ Continuous Circular Arcs

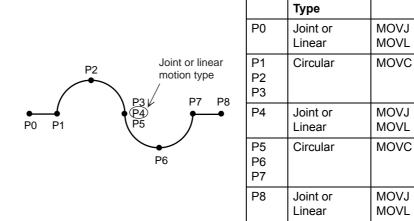
As shown below, when two or more successive circular movements with different curvatures are required, the movements must be separated from each other by a joint or linear interpolation step. This step must be inserted between the steps at an identical point. The step at the end point of the preceding circular movement must coincide with the beginning point of the following circular movement.

Point

Interpolation

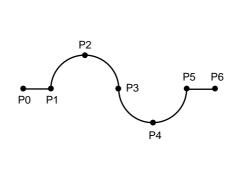
Instruction

Table 3-2: Interpolation Type for Continuous Circular Arcs



3.2 Teaching Operation

Alternatively, to continue movements without adding an extra joint or linear interpolation step in between, add "FPT" tag to the step whose curvature is needed to be changed.



	Point	Interpolation Type	Instruction
	P0	Joint or Linear	MOVJ MOVL
	P1 P2	Circular	MOVC
	P3	Circular	MOVC FPT
	P4 P5	Circular	MOVC
	P6	Joint or Linear	MOVJ MOVL

<Play Speed>

- The play speed set display is identical to that for the linear interpolation
- The speed taught at P2 is applied from P1 to P2. The speed taught at P3 is applied from P2 to P3.
- If a circular operation is taught at high speed, the actual arc path has a shorter radius than that taught.

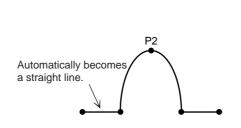
3.2.2.4 Spline Interpolation

When performing operations such as welding, cutting, and applying primer, using the spline interpolation makes teaching for workpieces with irregular shapes easier. The path of motion is a parabola passing through three points. When spline interpolation is used for teaching a robot axis, the move instruction is MOVS.

■ Single Spline Curve

When a single spline curve movement is required, teach the spline interpolation for three points, P1 to P3, as shown in the figure below. If joint or linear interpolation is taught at point P0, the point before starting the spline interpolation, the manipulator moves from P0 to P1 in a straight line.

Table 3-3: Interpolation Type for Single Spline Curve



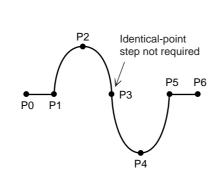
	Point	Interpolation Type	Instruction
	P0	Joint or Linear	MOVJ MOVL
	P1 P2 P3	Spline	MOVS
	P4	Joint or Linear	MOVJ MOVL

- 3 Teaching
- 3.2 Teaching Operation

Continuous Spline Curves

The manipulator moves through a path created by combining parabolic curves. This differs from the circular interpolation in that steps with identical points are not required at the junction between two spline curves.

Table 3-4: Interpolation Type for Continuous Spline Curves



Point	Interpolation Type	Instruction
P0	Joint or Linear	MOVJ MOVL
P1 to P5	Spline	MOVS
P6	Joint or Linear	MOVJ MOVL

When the parabolas overlap, a composite motion path is created.

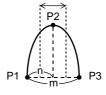


<Play Speed>

- The play speed setting window is identical to that for the linear interpolation.
- As with the circular interpolation, the speed taught at P2 is applied from P1 to P2, and the speed taught at P3 is applied from P2 to P3.

Teach points so that the distances between the three points are roughly equal. If there is any significant difference, an error will occur on playback and the manipulator may operate in an unexpected, dangerous manner. Ensure that the ratio of distances between steps m:n is within the range of 0.25 to 0.75.





- 3 Teaching
- 3.2 Teaching Operation

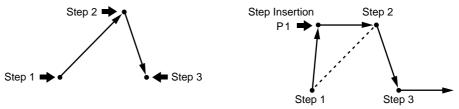
3.2.3 Teaching Steps

3.2.3.1 Registering Move Instructions

Whenever one step is taught, one move instruction is registered. There are two ways to teach a step. Steps can be taught in sequence as shown in the following left figure *fig. 3-1 "Registering Move Instructions"* or they can be done by inserting steps between already registered steps, as shown in the right figure *fig. 3-2 "Inserting Move Instructions"*

This paragraph explains the teaching of *fig. 3-1 "Registering Move Instructions"*, the operations involved in registering new steps.

Fig. 3-1: Registering Move Instructions Fig. 3-2: Inserting Move Instructions



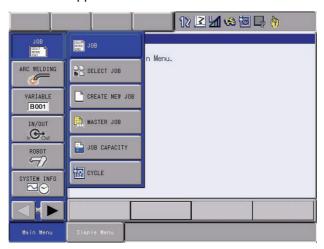
Teaching of fig. 3-2 "Inserting Move Instructions" is called "Inserting move instruction," to distinguish it from the method shown in fig. 3-1 "Registering Move Instructions". For more details on this operation, see chapter 3.4.2 "Inserting Move Instructions" at page 3-33. The basic operations for registration and insertion are the same. The only difference is pressing [INSERT] in the case of insertion. For registration (fig. 3-1 "Registering Move Instructions"), the instruction is always registered before the END instruction. Therefore, it is not necessary to press [INSERT]. For insertion (fig. 3-2 "Inserting Move Instructions"), [INSERT] must be pressed.

DX100

3.2 Teaching Operation

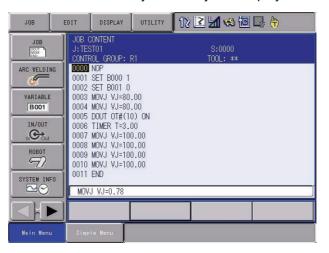
Setting the Position Data

- 1. Select {JOB} under the main menu.
 - The sub-menu appears.



2. Select {JOB}.

- The contents of the currently-selected job is displayed.



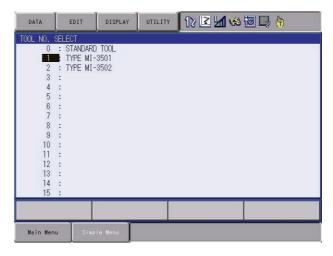
- 3. Move the cursor on the line immediately before the position where a move instruction to be registered.
- 4. Grip the Enable switch.
 - Grip the Enable switch to turn the servo power ON.
- 5. Move the manipulator to the desired position using the axis key.
 - Use the axis operation key to move the manipulator to the desired position.

3 DX100 3.2 **Teaching Operation**

Teaching

Selecting the Tool Number

- 1. Press [SHIFT] + [COORD].
 - When selecting the "JOINT," "XYZ/CYLINDRICAL," or "TOOL" coordinates, press [SHIFT] + [COORD] and the TOOL NO. SELECT window will be shown.



- 2. Select the desired tool number.
 - The contents of the currently-selected job is displayed.



- 3. Press [SHIFT] + [COORD].
 - The JOB CONTENT window appears.

Using Multiple Tools with One Manipulator



- When multiple tools are to be used with one manipulator, set parameter S2C431 to 1.
- See chapter 2.3.4 "Tool Coordinates" at page 2-9 for details on this operation.

Setting the Interpolation Type

- 1. Press [MOTION TYPE].
- 2. Select the desired interpolation type.
 - When [MOTION TYPE] is pressed, MOVJ → MOVL → MOVC → MOVS are displayed in order in the input buffer line.

3.2 Teaching Operation

Teaching

■ Setting the Play Speed

1. Move the cursor to the instruction.



- 2. Press [SELECT].
 - The cursor moves to the input buffer line.



- 3. Move the cursor to the play speed to be set.
 - The joint speed moves up and down.
- 4. Press [SHIFT] + the cursor key [\uparrow] or [\downarrow] simultaneously.



- 5. Press [ENTER].
 - The MOV instruction is registered.



Follow the above instructions when conducting teaching. (Tool number, interpolation type, or play speed does not need to be set if it is same as the previous step.)



To make the setting so that the play speed tag is not displayed as a default, select {EDIT} from the menu and then select "ENABLE SPEED TAG" to delete "*."



• The position level can be set at the same time that the move instruction is registered.

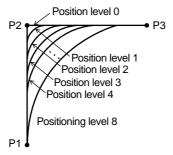
 To display the position level tag as a default, select {EDIT} from the menu and then select "ENABLE POS LEVEL TAG."

Position Level: The position level is the degree of approximation of the manipulator to a taught position.

The position level can be added to move instructions MOVJ (joint interpolation) and MOVL (linear interpolation).

If the position level is not set, the precision depends on the operation speed. Setting an appropriate level moves the manipulator in a path suitable to circumferential conditions and the workpiece.

The relationship between path and accuracy for position levels is as follows.



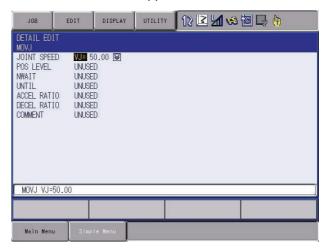
Position Levels	Accuracy
0	Teaching position
1	Fine
to	
8	Rough

DX100

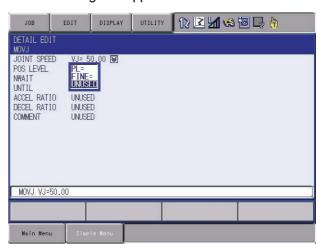
3.2 Teaching Operation

Setting the Position Level

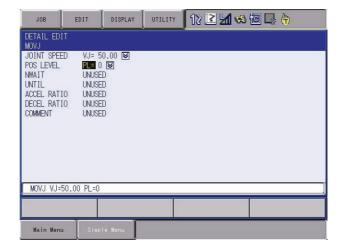
- 1. Select move instruction.
 - The DETAIL EDIT window appears.



- 2. Select the position level "UNUSED."
 - The selection dialog box appears.



- 3. Select "PL."
 - The position level is displayed. The position initial value is 1.

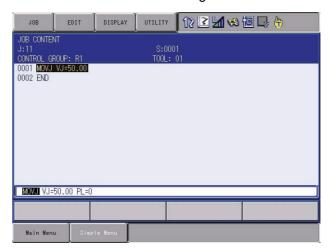


DX100

3.2 Teaching Operation

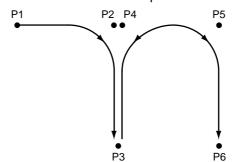
4. Press [ENTER].

 To change the position level, select the level in the input buffer line, type the value using the Numeric keys, and press [ENTER]. The position level's move instruction is registered.



5. Press [ENTER].

For example, to perform the movement steps shown below, set as follows:



Steps P2, P4, and P5 are simple passing points, and do not require accurate positioning. Adding PL=1 to 8 to the move instructions of these steps moves the manipulator around the inner corners, thereby reducing the cycle time.

If complete positioning is necessary as P3 or P6, add PL=0.

<EXAMPLE>

Passing points P2, P4, and P5:

MOVL V=138 PL=3

Positioning point P3 and P6:

MOVL V=138 PL=0

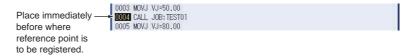
DX100

3.2 Teaching Operation

3.2.3.2 Registering Reference Point Instructions

Reference point instructions (REFP) set an auxiliary point such as a wall point for weaving. Reference point Nos. 1 to 8 are assigned for each application. Follow these procedures to register reference point instructions.

- 1. Select {JOB} under the main menu.
- 2. Select {JOB}.
- 3. Move the cursor.
 - Move the cursor to the line immediately before the position where the reference point to be registered.



- 4. Grip the Enable switch.
 - The servo power is turned ON.
- 5. Press the axis operation key.
 - Move the manipulator to the position to be registered as the reference point.
- 6. Press [REFP] or select "REFP" from the inform list.
 - The reference point instruction is displayed in the input buffer line.



- 7. Change the reference point number in one of the following ways.
 - Move the cursor to the reference point number, and press [SHIFT] + the cursor key to change the reference point number; or



Press [SELECT] when the cursor is on the reference point number.
 Then, the data input buffer line appears. Input the number and press [ENTER].



- 8. Press [INSERT].
 - The [INSERT] key lamp lights.
 When registering before the END instruction, pressing [INSERT] is not needed.
- 9. Press [ENTER].
 - The REFP instruction is registered.





The programming pendant does not have the [REFP] key for the application of spot welding, motor gun, and of material handling, assembling, and cutting.

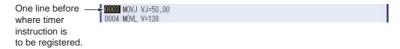
DX100

3.2 Teaching Operation

3.2.3.3 Registering Timer Instructions

The timer instruction stops the manipulator for a specified time. Follow these procedures to register timer instructions.

- 1. Select {JOB} under the main menu.
- 2. Select {JOB}.
- 3. Move the cursor.
 - Move the cursor to one line before the position where the timer instruction is to be registered.



- 4. Press [TIMER].
 - The TIMER instruction is displayed on the input buffer line.



- 5. Change the timer value.
 - Move the cursor to the timer value and change it by pressing [SHIFT] + the cursor key. The timer unit of adjustment is 0.01 seconds.



 If you use the Numeric keys to input the timer value, press [SELECT] when the cursor is on the timer value. The data input line appears. Input the value and press [ENTER].



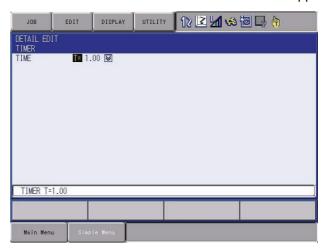
- 6. Press [INSERT].
 - The [INSERT] key lamp lights.
 - When registering before the END instruction, pressing [INSERT] is not needed.
- 7. Press [ENTER].
 - The TIMER instruction is registered.



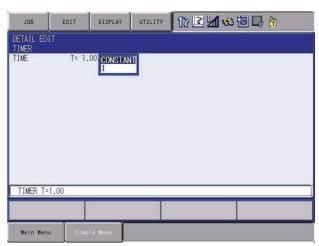
DX100 3.2 Teachi

3 Teaching3.2 Teaching Operation

- Changing Timer Value
 - 1. Press [TIMER].
 - 2. Press [SELECT].
 - The DETAIL EDIT window for the TIMER instruction appears.



- 3. Input the timer value on the instruction DETAIL EDIT window.
 - (1) When \bigotimes is selected, the items available to be changed are displayed in the dialog box.



- (2) Select the particular item to be changed.
- When a number is to be changed, move the cursor to the number and press [SELECT]. Input the desired value using the Numeric keys, and press [ENTER].



- 4. Press [ENTER].
 - The DETAIL EDIT window is closed and the JOB CONTENT window appears again. Modified content is displayed in the input buffer line.



	3
DX100	3.2

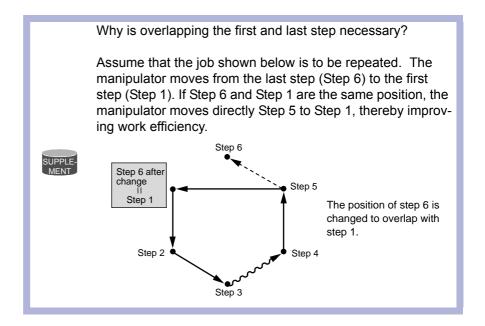
- 3 Teaching
- 3.2 Teaching Operation
- 5. Press [INSERT].
 - The [INSERT] key lamp lights.
 - When registering before the END instruction, pressing [INSERT] is not needed.
- 6. Press [ENTER].
 - The TIMER instruction is registered.



DX100

3.2 Teaching Operation

3.2.4 Overlapping the First and Last Steps



- 1. Move the cursor to the first step line.
- 2. Press [FWD].
 - The manipulator moves to the first step position.
- 3. Move the cursor to the last step line.
 - The cursor starts blinking.
 - When the cursor line position and the manipulator position are different in the JOB CONTENT window, the cursor blinks.
- 4. Press [MODIFY].
 - The key lamp lights.
- 5. Press [ENTER].
 - The position data for the first step is registered on the line of the last step.
 - At this time, only the position data can be changed in the last step.
 Interpolation type and play speed do not change.

3 Teaching

3.3 Checking Steps

3.3 Checking Steps

3.3.1 FWD/BWD Key Operations

Check whether the position of the taught steps is appropriate using [FWD] or [BWD] on the programming pendant. Each time [FWD] or [BWD] is pressed, the manipulator moves by a single step.

[FWD]: Moves the manipulator ahead in step number sequence.

Only the move instruction is executed when [FWD] is pressed, but when [INTERLOCK] + [FWD] are pressed, all instructions are executed.

[BWD]: Moves the manipulator backward a step at a time in reverse step number sequence. Only the move instruction is executed.



For safety, set manual speed at Mor or below.

- 1. Move the cursor to the step to be checked.
- 2. Press [FWD] or [BWD].
 - The manipulator reaches the following / previous step and stops.

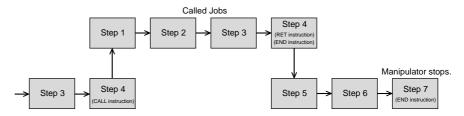
DX100

3.3 Checking Steps

3.3.1.1 Precautions When Using FWD / BWD Operations

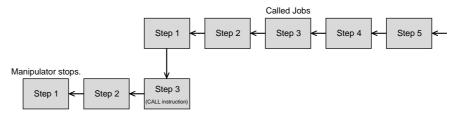
■ FWD Movements

- The manipulator moves in step number sequence. Only move instructions are executed when [FWD] is pressed. To execute all instructions, press [INTERLOCK] + [FWD].
- The manipulator stops after playing a single cycle. It does not move after the END instruction is reached, even if [FWD] is pressed. However, at the end of a called job, the manipulator moves the instruction next to the CALL instruction.



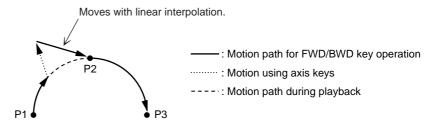
■ BWD Movements

- The manipulator moves in reverse step number sequence. Only move instructions are executed.
- The manipulator does not move after the first step is reached, even if [BWD] is pressed. However, at the beginning of a called job, the manipulator moves to the instruction immediately before the CALL instruction.



Circular Movements with FWD/BWD Key Operations

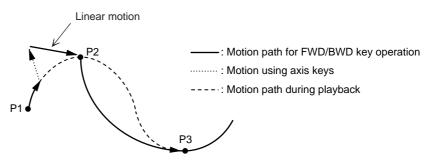
- The manipulator moves in a straight line to the first step of the circular interpolation.
- There must be three circular interpolation steps in a row to move the manipulator in an arc.
- If [FWD] or [BWD] operation is restarted after being stopped to move the cursor or to perform search, the manipulator moves in a straight line to the next step.
- If [FWD] or [BWD] operation is restarted after being stopped to move the axis as shown below, the manipulator moves in a straight line to P2, the next circular interpolation. Circular motion is restored from P2 to P3.



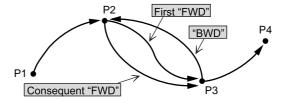
- 3 Teaching
- 3.3 Checking Steps

■ Spline Curve Movements with FWD/BWD Operations

- The manipulator moves in a straight line to the first step of spline interpolation.
- There must be three spline curve motion steps in a row to perform a spline curve operation.
- Depending on the position where the [FWD] / [BWD] operation is performed, the alarm "IRREGULAR DISTANCES BETWEEN TEACHING POINTS" may occur.
- Note that FWD/BWD inching operations change the path of the manipulator and caution is therefore required. Performing these operations also increases the likelihood that the "IRREGULAR DISTANCES BETWEEN TEACHING POINTS" will occur.
- If the [FWD] or [BWD] operation is restarted after being stopped to move the cursor or perform a search, the manipulator moves in a straight line to the next step.
- If the [FWD] or [BWD] operation is restarted after being stopped to move the axis as shown below, the manipulator moves in a straight line to P2, the next spline curve motion step. Spline curve motion is restored from P2 onward. However, the path followed between P2 and P3 is somewhat different from the path followed at playback.



• If the manipulator is moved to P3 with [FWD], stopped, and then returned to P2 with [BWD], the path followed between P2 and P3 is different for each of the following: the first FWD operation, the BWD operation, and the consequent FWD operation.



DX100 3.3 Ch

3 Teaching3.3 Checking Steps

3.3.1.2 Selecting Manual Speed

When [FWD] or [BWD] is pressed, the manipulator moves at the manual speed selected at that time. Selected manual speed can be checked by the manual speed indication on the programming pendant.



Manual speed is set with [FAST] and [SLOW]. FWD operation can be performed at a high speed by pressing [HIGH SPEED]. Follow these procedures to select a manual speed.

• Each time [FAST] is pressed, the speed switches in the order of "INCH"→"SLOW"→"MED"→"FAST".



• Each time [SLOW] is pressed, the speed switches in the order of "FAST"→"MED"→"SLOW"→"INCH".





- FWD/BWD operation is performed with SLW speed even if INCH is selected.
- [HIGH SPEED] is available only for the FWD operation but not for BWD operation.

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3.3 Checking Steps

3.3.1.3 Moving to Reference Point

To check the position of a taught reference point, follow these procedures to move the manipulator to the reference point.

- 1. Move the cursor to the reference point instruction line to be checked.
- 2. Press [REFP] + [FWD].
 - The manipulator moves to the reference point of the cursor line.



The programming pendant does not have the [REFP] key for the application of spot welding, general purposes (= material handling, assembling, cutting) or motor gun.

3.3.1.4 Test Operations

Playback operations can be simulated in the teach mode with test operations. This function is convenient for checking continuous paths and operation instructions.

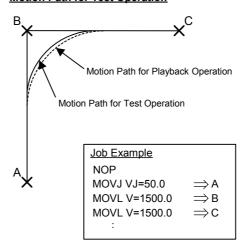
Test operation differs in the following ways from actual playback in the play mode.



- Operation speeds greater than the maximum teaching speed are reduced to the maximum teaching speed.
- Work instruction output, such as arc output, is not executed.

Note that the motion path for the playback operation is replayed during the test operation. Therefore, make sure that there is no obstacle around the manipulator and great caution should be exercised when the test operation is performed.

Motion Path for Test Operation





There may be a slight difference between the motion path for the test operation and the motion path for the playback operation due to a mechanical error or control delay, etc.

- 3 Teaching
- 3.3 Checking Steps

Test operation is performed by pressing [INTERLOCK] and [TEST START]. For safety purposes, these keys will only function while the keys are held down.

- 1. Select {JOB} under the main menu.
- 2. Press {JOB}.
 - The test operation JOB CONTENT window appears.
- 3. Press [INTERLOCK] + [TEST START].
 - The manipulator starts the test cycle operation.
 - However, after the operation starts, the motion continues even if [INTERLOCK] is released.
 - The manipulator moves only while these keys are held down.
 - The manipulator stops immediately when [TEST START] is released.



Always check safety conditions before pressing [INTER-LOCK] + [TEST START] to start the manipulator in motion.

3.3.1.5 Machine Lock Operation

When "MACHINE LOCK" is enabled, the [FWD] / [BWD] operation or the test operation can be performed to check the status of input and output without moving the manipulator.

- 1. Press [AREA].
- 2. Select {UTILITY}.
- 3. Select (SETUP SPECIAL RUN).
 - The SPECIAL TEACH window appears.
- 4. Select "MACHINE LOCK".
 - Press [SELECT] to switch "VALID" and "INVALID".
 - The setting of "MACHINE LOCK" is maintained even after the mode is switched: If the machine lock is set to "VALID" in the teach mode, it is still "VALID" after switching to the play mode.

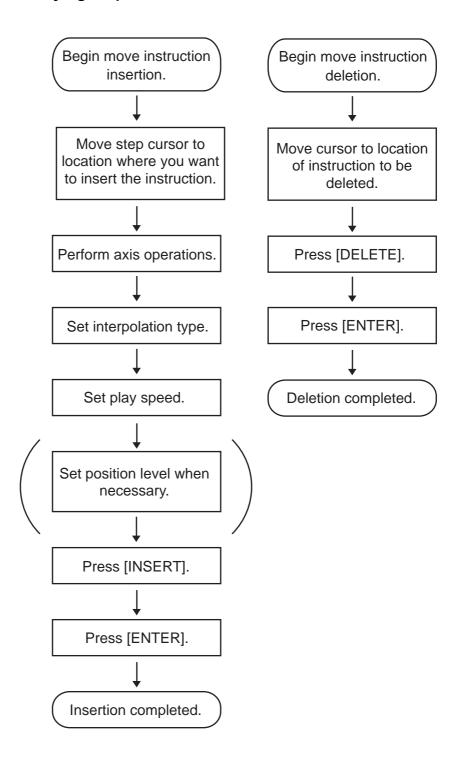


The same applies when the mode is switched from the play mode to the teach mode.

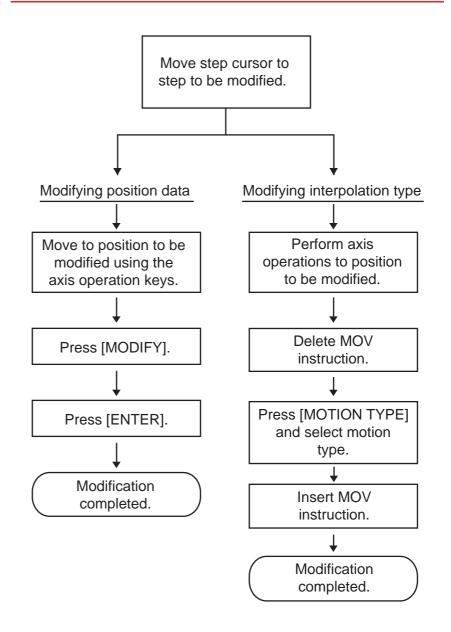
- Note that the machine lock becomes "INVALID" if the following operation is performed.
 - Execution of "CANCEL ALL SELECT" in the SPECIAL PLAY window.
 - Turning off the main power.

- 3 Teaching
- 3.4 Modifying Steps

3.4 Modifying Steps



3.4 Modifying Steps

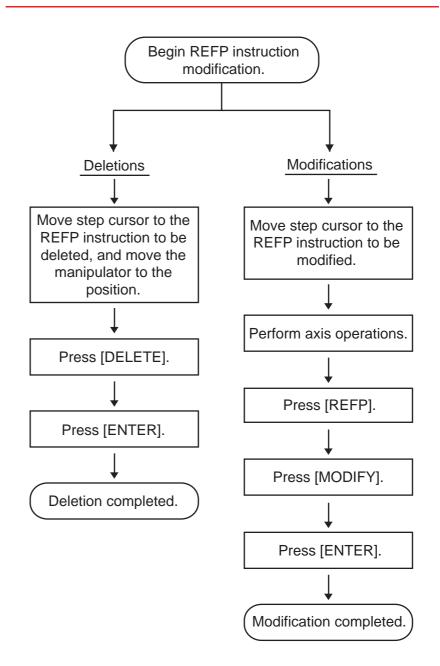




It is not possible to change a move instruction to a reference point instruction and vice versa.

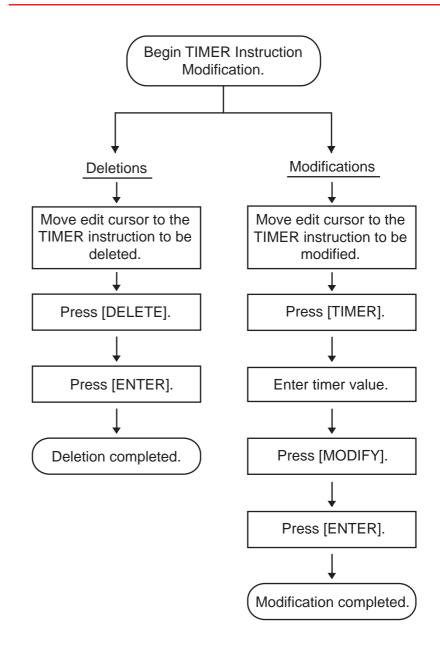
3 Teaching

3.4 Modifying Steps



3 Teaching

3.4 Modifying Steps



DX100 3.4 Modifying Steps

3.4.1 Displaying the JOB CONTENT Window for Editing

3.4.1.1 Currently Called Up Job

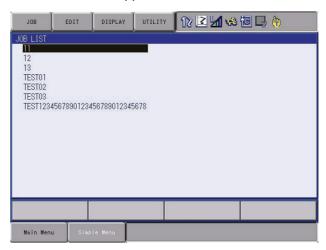
- 1. Select {JOB} under the main menu.
- 2. Select {JOB}.
 - The JOB CONTENT window appears.

3.4.1.2 Calling Up Other Jobs



In any other than the teach mode, set the mode switch to "TEACH."

- 1. Select {JOB} under the main menu.
- 2. Select {SELECT JOB}.
 - The JOB LIST window appears.



3. Select the job name to be called.

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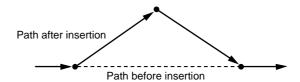
3.4 Modifying Steps

3.4.2 Inserting Move Instructions

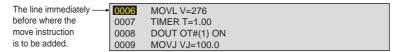


Move instructions cannot be inserted when the servo power is OFF

Step where move instruction is to be inserted



1. Move the cursor to the line immediately before the insert position.



- 2. Press the axis operation key.
 - Turn ON the servo power and press the axis operation key to move the manipulator to the position to be inserted.



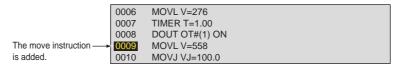
Confirm the move instruction on the input buffer line and set desired interpolation type and play speed.

- 3. Press [INSERT].
 - The key lamp will light.



When the inserting position is immediately before the END instruction, pressing [INSERT] is not needed.

- 4. Press [ENTER].
 - The move instruction is inserted after the cursor line.

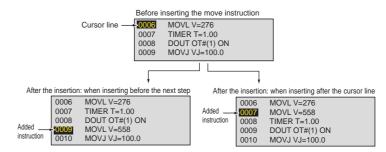


- 5. Press [ENTER].
 - <Examples of Inserting a Move Instruction>
 - When a move instruction is inserted in the following job, it is placed on different lines according to the setting in the

DX100

3.4 Modifying Steps

TEACHING CONDITION window.



Positions where the move instructions are inserted.



The default location for insertions is "before the next step," but it is also possible to insert "after the cursor line." This setting is made in the "Move Instruction Register Method" in the TEACHING CONDITION window.

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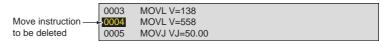
3.4 Modifying Steps

3.4.3 Deleting Move Instructions

Step where move instruction is to be deleted



1. Move the cursor to the move instruction to be deleted.



If the manipulator position differs from the cursor position on the window, the cursor blinks. Stop the blinking by either of the following procedures.



- 1. Press [FWD] and move the manipulator to the position where the move instruction is to be deleted.
- 2. Press [MODIFY]→ [ENTER] to change the position data of the blinking cursor position to the current manipulator position.
- 2. Press [DELETE].
 - The key lamp will blink.
- 3. Press [ENTER].
 - The step indicated by cursor line is deleted.

0003 MOVL V=138 0004 MOVJ VJ=50.00

Teaching 3.4 Modifying Steps

3.4.4 Modifying Move Instructions

3.4.4.1 Modifying Position Data

- 1. Move the cursor to the MOV instruction to be modified.
 - Display the JOB CONTENT window and move the cursor to the move instruction to be changed.
- 2. Press the axis operation key.
 - Turn ON the servo power and press the axis operation key to move the manipulator to the desired position.
- 3. Press [MODIFY].
 - The key lamp will blink.
- 4. Press [ENTER].
 - The position data in the present position is registered.



For MOV instructions for which position variables have been set, the position variables will not be changed.

3.4.4.2 Modifying Interpolation Type



Modifying only interpolation type is impossible. The interpolation type can be modified as a choice for modifying the position data.

- 1. Move the cursor to the move instruction to be modified.
 - Display the JOB CONTENT window, and move the cursor to the move instruction for which interpolation type is to be changed.
- 2. Press [FWD].
 - Turn ON the servo power and press [FWD] to move the manipulator to the position of the move instruction.
- 3. Press [DELETE].
 - The key lamp will blink.
- 4. Press [ENTER].
 - The cursor line step is deleted.
- 5. Press [MOTION TYPE].
 - Press [MOTION TYPE] to change the interpolation type.
 - Each time [MOTION TYPE] is pressed, the input buffer line instruction alternates.
- 6. Press [INSERT].
- 7. Press [ENTER].
 - The interpolation type and position data are changed at the same time.

3 Teaching

3.4 Modifying Steps

3.4.5 Undo Operation

After inserting, deleting, or modifying an instruction, the operation can be undone.

The UNDO operation becomes enabled by selecting $\{EDIT\} \rightarrow \{ENABLE UNDO\}$, and becomes disabled by selecting $\{EDIT\} \rightarrow \{*ENABLE UNDO\}$ while editing a job.



- The undo operation can be performed even after the manipulator is moved by the FWD or BWD operation or test operation after inserting, deleting, or modifying a move instruction. However, the undo operation cannot be performed if other instructions are edited or a job is executed in the play mode after editing the move instruction.
- The undo operation works only for the last five edited instructions only.
- 1. Press [ASSIST].
 - The assist menu appears.



- 2. Select {UNDO}.
 - The last operation is undone.
- 3. Select {REDO}.
 - The last UNDO operation is undone.

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3.4 Modifying Steps

3.4.6 Modifying Reference Point Instructions

3.4.6.1 Deleting Reference Point Instructions

If the manipulator position differs from the cursor position, an error message is displayed. If this occurs, follow either of the procedures below.



- Press [REFP] + [FWD] to move the manipulator to the position to be deleted.
- Press [MODIFY] then [ENTER] to change the reference point position data to the current position of the manipulator.
- 1. Move the cursor to the reference point instruction to be deleted.
- 2. Press [DELETE].
 - The key lamp will blink.
- 3. Press [ENTER].
 - The reference point instruction at the cursor line is deleted.

3.4.6.2 Modifying Reference Point Instructions

- 1. Move the cursor to the reference point instruction to be modified.
- 2. Move the manipulator with the axis operation keys.
 - Turn ON the servo power and use the axis operation keys to move the manipulator to the desired position.
- 3. Press [REFP].
- 4. Press [MODIFY].
 - The key lamp will light.
- 5. Press [ENTER].
 - The reference point instruction at the cursor line is changed.

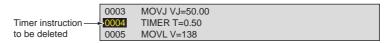
DX100

3.4 Modifying Steps

3.4.7 Modifying Timer Instructions

3.4.7.1 Deleting Timer Instructions

1. Move the cursor to the timer instruction to be deleted.



- 2. Press [DELETE].
 - The key lamp will light.
- 3. Press [ENTER].
 - The timer instruction at the cursor line is deleted.

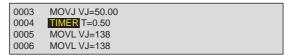


3.4.7.2 Modifying Timer Instructions

1. Move the cursor to the timer instruction to be modified.



2. Press [TIMER].



- 3. Move the cursor to the input buffer line timer value.
 - Move the cursor to the input buffer line timer value and press [SHIFT] + the cursor key to set the data.
 - To use the Numeric keys to input data, move the cursor to the input buffer line timer value and press [SELECT].



- 4. Change the timer value.
- 5. Press [MODIFY].
- 6. Press [ENTER].
 - This key lamp will light.

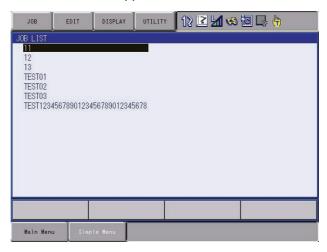
DX100

3.5 Modifying Jobs

3.5 Modifying Jobs

3.5.1 Calling Up a Job

- 1. Select {JOB} under the main menu.
- 2. Select {SELECT JOB}.
 - The JOB LIST window appears.



3. Select the desired job.

3.5.2 Windows Related to Job

There are five types of job windows. Jobs can be checked and edited in these windows.

- JOB HEADER Window Comments, data and time of registration, edit prohibit status, and so on are displayed and edited.
- JOB CONTENT Window

 The content of the registered job can be displayed and edited.
- COMMAND POSITION Window The taught data is displayed.
- JOB LIST Window
 The registered job is sorted alphabetically, then displayed, and the job is selected.
- JOB CAPACITY Window
 The number of registered jobs, amount of memory, number of steps used, etc. is shown.

DX100

3.5 Modifying Jobs

3.5.3 JOB HEADER Window

- 1. Select {JOB} under the main menu.
- 2. Select {JOB}.
- 3. Select {DISPLAY} under the menu.
- 4. Select {JOB HEADER}.
 - The JOB HEADER window appears. Scroll the window using the cursor.



A. JOB NAME

Displays the name of the current job.

B. COMMENT

Displays the comments attached to the current job. This can be edited in this window.

C. DATE

Displays the date and time of the last editing of the job.

D. CAPACITY

Displays the amount of memory that is being used to register this job.

E. LINES

Displays the total number of instructions registered in this job.

F. STEPS

Displays the total number of move instructions registered in this job.

G. EDIT LOCK

Displays whether the edit prohibit setting for this job is ON or OFF. This can be changed in this window.

H. TO SAVE TO FD

Displays "DONE" if the contents of the job have already been saved to an external memory after the date and time of the last editing operation, and displays "NOT DONE" if they have not been saved. The job is marked as "DONE" only if it is saved as an independent job or as a related job. If it is saved in a CMOS batch operation, it is not marked as "DONE."

I. GROUP SET

Displays the control group that this job controls. If the master axis is specified, the master axis is highlighted.



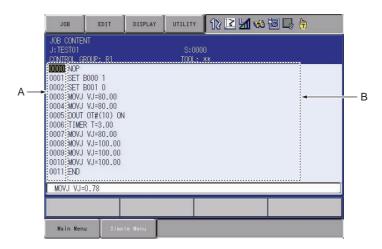
To return to the JOB CONTENT window from the JOB HEADER window, select {DISPLAY} from the menu and then select {JOB CONTENT}.

3.5 Modifying Jobs

3.5.4 JOB CONTENT Window

DX100

- 1. Select {JOB} under the main menu.
- 2. Select {JOB}.
 - The JOB CONTENT window appears.
 - (Left) : The cursor is moved to the address area.
 - − (Right): The cursor is moved to the instruction area.



A. Address Area

Displays line numbers.

B. Instruction Area

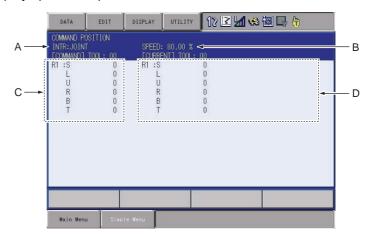
Displays instructions, additional items, and comments. Line editing is possible.

DX100

3.5 Modifying Jobs

3.5.4.1 COMMAND POSITION Window

- 1. Select {ROBOT} under the main menu.
- 2. Select (COMMAND POSITION).
 - Edit operations cannot be conducted on this window, but the taught play speed and position data can be viewed on this window.



A. Interpolation

Displays the interpolation type.

B. Speed

Displays the play speed.

C. Command Position

Displays the tool file number and position data that has been taught for this job. Steps which have no position data, such as move instructions which use position variables, are marked with an asterisk (*).

D. Current Data

Displays the current tool file number and position of the manipulator.

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3.5 Modifying Jobs

3.5.5 JOB CAPACITY Window

- 1. Select {JOB} under the main menu.
- 2. Select {JOB CAPACITY}.



A. NUMBER OF JOBS

Displays the total number of jobs currently registered in the memory of DX100.

B. USED MEMORY

Displays the total amount of memory used in the DX100.

C. STEPS

Displays the total number of used steps.

D. EDITING BUFFER

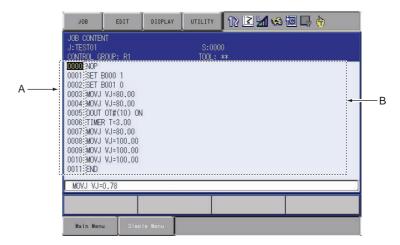
Displays editing buffer use.

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3.6 Editing Instructions

3.6 Editing Instructions

The editable content differs depending on whether the cursor is in the address area or instruction area.



A. When the cursor is in the address area

Instructions can be inserted, deleted, or modified.

B. When the cursor is in the instruction area

The data of additional items of already-registered instructions can be modified, inserted, or deleted.

Editing only additional items is called "line editing."

When inserting or modifying instructions, input the instruction with the function keys such as [TIMER], etc. or by using the instruction list dialog box

The selected instruction is displayed on the input buffer line with the same additional items as registered previously.

If the addition, deletion or modification of additional item is needed, edit on the instruction DETAIL EDIT window. If it is not needed, continue the registration process.

3.6 Editing Instructions

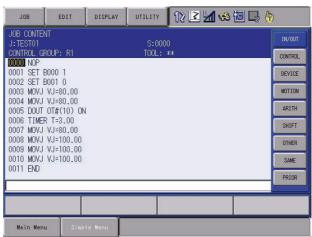
3.6.1 Instruction Group

The instructions are divided into eight groups by processing or each work.

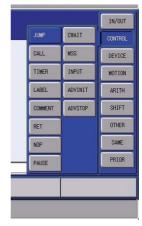
Display	Instruction Group	Content	Example
IN/OUT	I/O Instruction	Controls input and output	DOUT, WAIT
CONTROL	Control Instruction	Controls processing and each work	JUMP, TIMER
MOTION	Move Instructions	Moves the manipulator	MOVJ, REFP
DEVICE	Work Instructions	Operates arc welding, spot welding, handling, painting, etc.	ARCON, WVON, SVSPOT, SPYON
ARITH	Operating Instructions	Performs arithmetic calculation	ADD, SET
SHIFT	Shift Instructions	Shifts the teaching point	SFTON, SFTOF
SENS (Option)	Sensor Instructions (Option)	Instructions related to the sensor	COMARCON
OTHER	Other Instructions	Instructions for functions other than above	SHCKSET
SAME	-	Specifies the instruction where the cursor is.	
PRIOR	-	Specifies the previously-registered instruction.	

■ Instruction List

By pressing [INFORM LIST] , the instruction group list dialog box appears.



By selecting a group, the instruction list dialog box of the selected group appears.



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3.6 Editing Instructions

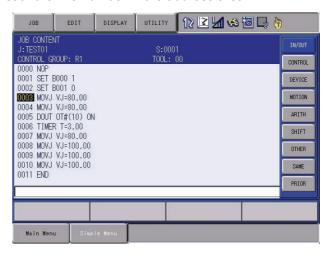
3.6.2 Inserting Instructions

- 1. Move the cursor to the address area in the JOB CONTENT window.
 - Move the cursor to the line immediately before where the instruction is to be inserted, in the teach mode.



2. Press [INFORM LIST].

 The INFORM command list appears, and an underline is displayed beneath the line number in the address area.



- 3. Select the instruction group.
 - The instruction list dialog box appears. The selected instruction is displayed on the input buffer line with the same additional items as registered previously.



- 4. Select the instruction.
- 5. Change the data of additional items or variables as required.
 - <When Nothing is to be Changed>
 - (1) Proceed to Step 6.

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3.6 Editing Instructions

- <When Additional Items are to be edited>

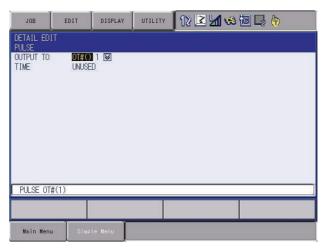
- Changing numeric data
- (1) Move the cursor to the desired item and press [SHIFT] + the cursor key to increase or decrease the value.



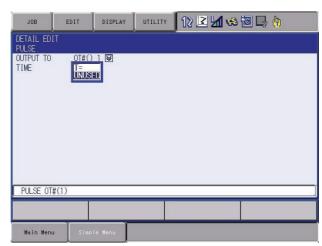
(2) To directly input the value using Numeric keys, press [SELECT] to display the input buffer line.



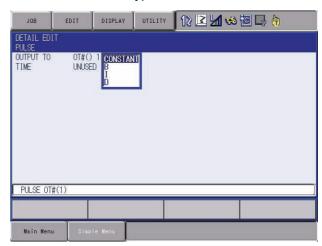
- (3) Type the value and press [ENTER]. The value on the input buffer line is changed.
 - 2. Adding, modifying, or deleting an additional item
- To add, modify, or delete an additional item, move the cursor to the instruction on the input buffer line and press [SELECT]. The DETAIL EDIT window appears.



- To add an item, move the cursor to "UNUSED" and press [SELECT].
 The selection dialog box appears.
- (2) Move the cursor to the desired item and press [SELECT]. To delete an item, move the cursor to the item to be deleted and select "UNUSED."



- 3.6 Editing Instructions
 - 3. Changing the data type
 - (1) To change the data type of an additional item, move the cursor to of the item and press [SELECT]. The data type list appears. Select the desired data type.



- (2) After additional items have been added, modified or deleted as required, press [ENTER]. The DETAIL EDIT window closes and the JOB CONTENT window appears.
- 6. Press [INSERT] and [ENTER].
 - The instruction displayed in the input buffer line is inserted.



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3.6 Editing Instructions

3.6.3 Deleting Instructions

- 1. Move the cursor to the address area in the JOB CONTENT window.
 - Move the cursor to the instruction line to be deleted, in the teach mode.



- 2. Move the cursor to the deleting line in the address area.
- 3. Press [DELETE] and [ENTER].
 - The instruction is deleted and the following lines move up.

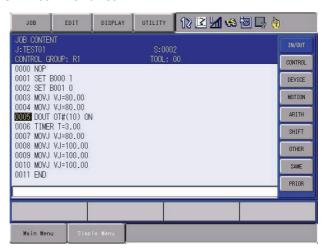


3.6.4 Modifying Instructions

- 1. Move the cursor to the address area in the JOB CONTENT window.
 - Move the cursor to the instruction line to be modified, in the teach mode.



- 2. Press [INFORM LIST].
 - The INFORM command list appears and the cursor moves to the INFORM command list.



- 3. Select the instruction group.
 - The instruction list dialog box appears. The selected instruction is displayed on the input buffer line with the same additional items as registered previously.

3.6 Editing Instructions



- 4. Select the instruction to be modified.
- 5. Change the data of additional items or variables as required.
 - <Editing Additional Items>
 - 1. Changing numeric data
 - (1) Move the cursor to the desired item and press [SHIFT] + the cursor key to increase or decrease the value.



 To directly input the value using Numeric keys, press [SELECT] to display the input buffer line.

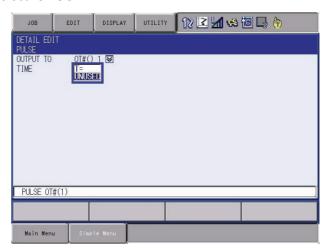


- (2) Type the value and press [ENTER]. The value on the input buffer line is changed.
 - 2. Adding, modifying, or deleting an item
- To add, modify or delete an additional item, move the cursor to the instruction on the input buffer line and press [SELECT]. The DETAIL EDIT window appears.

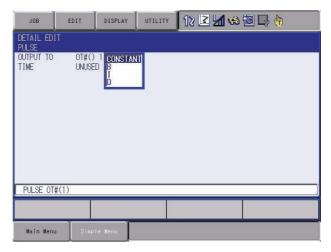


(2) To add an item, move the cursor to "UNUSED" and press [SELECT]. The selection dialog box appears.

- 3.6 Editing Instructions
 - (3) Move the cursor to the desired item and press [SELECT]. To delete an item, move the cursor to the item to be deleted and select "UNUSED."



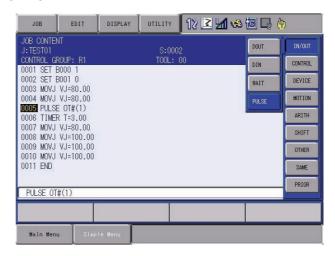
- 3. Changing the data type
- (1) To change the data type of an additional item, move the cursor to of the item and press [SELECT]. The data type list appears. Select the desired data type.



- (2) After additional items have been added, modified or deleted as required, press [ENTER]. The DETAIL EDIT window closes and the JOB CONTENT window appears.
- 6. Press [MODIFY] and [ENTER].

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- 3.6 Editing Instructions
 - The instruction is modified to the instruction displayed in the input buffer line.



DX100 3.6 Editing Instructions

3.6.5 Modifying Additional Numeric Data

- 1. Move the cursor to the instruction area in the JOB CONTENT window.
- 2. Select the line where the number data is to be modified.
 - The selected line can now be edited.



- 3. Move the cursor to the numeric data to be modified.
- 4. Input the desired number.
 - Press [SHIFT] + the cursor key to increase or decrease the value.
 To directly input the number, press [SELECT]. The input buffer line appears. Type the number and press [ENTER].



- 5. Press [ENTER].
 - The numeric data is modified.



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3.6 Editing Instructions

3.6.6 Modifying Additional Items

- 1. Move the cursor to the instruction area in the JOB CONTENT window.
- 2. Select the instruction line for which the additional item is to be modified.
 - The selected line can now be edited.



- 3. Select the instruction.
 - The DETAIL EDIT window appears.



- 4. Select the additional item to be modified.
 - The selection dialog box appears.



- 5. Select the desired additional item.
 - The modified additional item is displayed on the DETAIL EDIT window.



- 6. Press [ENTER].
 - The DETAIL EDIT window closes, and the JOB CONTENT window appears.
- 7. Press [ENTER].
 - Contents of the input buffer line are registered on the cursor line of the instruction area.



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3.6 Editing Instructions

3.6.7 Inserting Additional Items

- 1. Move the cursor to the instruction area in the JOB CONTENT window.
- 2. Select the instruction line for which the additional item is to be inserted.
 - The selected line can now be edited.



- 3. Select the instruction.
 - The selection dialog box appears.



- 4. Select the additional item to be inserted.
 - The additional item is inserted.



 When the additional item needs the numeric data, move the cursor to the number and press [SELECT]. The input buffer line appears.
 Type the number and press [ENTER].



- 5. Select inserting additional item.
 - The DETAIL EDIT window closes, and the JOB CONTENT window appears.
- 6. Press [ENTER].
 - Contents of the input buffer line are registered on the cursor line of the instruction area.



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3.6 Editing Instructions

3.6.8 Deleting Additional Items



This operation cannot be used for the additional item which is locked.

- 1. Move the cursor to the instruction area in the JOB CONTENT window.
- 2. Select the line where the additional item is to be deleted.
 - The selected line can be now be edited.



- 3. Select the instruction.
 - The DETAIL EDIT window appears.



- 4. Select the additional item to be deleted.
 - The selection dialog box appears.



- 5. Select "UNUSED."
 - "UNUSED" is displayed on the DETAIL EDIT window.



- 6. Press [ENTER].
 - The DETAIL EDIT window closes, and the JOB CONTENT window appears.
- 7. Press [ENTER].
 - Contents of the input buffer line are registered on the cursor line of the instruction area.



3 Teaching 3.7 Editing Jobs

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3.7 Editing Jobs

The following five operations are to edit jobs.

Copy : Copies a specified range to the buffer.

Cut :Copies a specified range from a job to the buffer, and deletes

it in a iob.

Paste :Inserts the contents of the buffer into a job.

Reverse Paste : Reverses the order of the contents of the buffer, and inserts

them into a job.

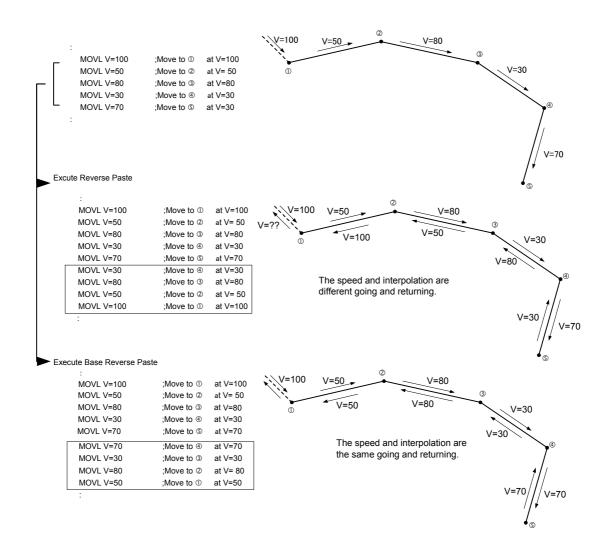
(Refer to the following figure.)

Base Reverse

Paste

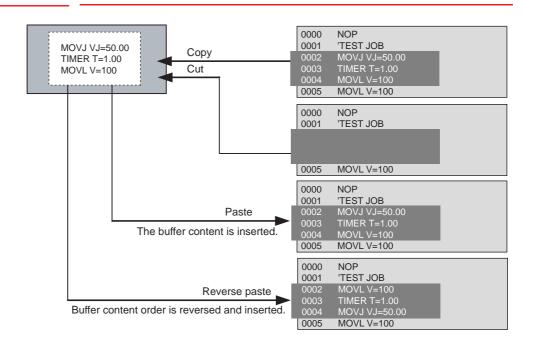
:Reverses the order of the contents of the buffer and adjusts the to-and-from speeds same, and inserts them into a job.

(Refer to the following figure.)



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3 Teaching3.7 Editing Jobs



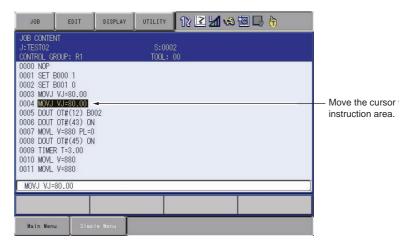
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3.7 Editing Jobs

3.7.1 Selecting the Range

After setting the range, Copy and Delete can be performed.

1. Move the cursor to the instruction area in the JOB CONTENT window.



- 2. Move the cursor to the start line and press [SHIFT] + [SELECT].
 - The range specification begins, and the address is displayed in reverse.



- 3. Move the cursor to the end line.
 - The range is varied by moving the cursor. Up to the line specified by the cursor is the range.

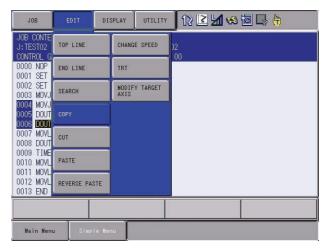
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Teaching 3.7 **Editing Jobs**

3.7.2 Copying

Before copying, the range to be copied has to be specified.

- 1. Select {EDIT} under the menu.
 - The pull-down menu appears.

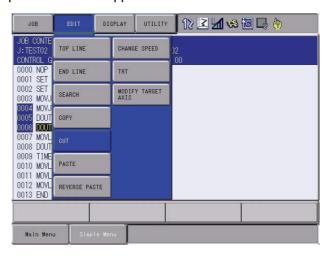


- 2. Select (COPY).
 - The specified range is copied to the buffer.

3.7.3 Cutting

Before cutting, the range to be cut has to be specified.

- 1. Select {EDIT} under the menu.
 - The pull-down menu appears.



- 2. Select (CUT).
 - The confirmation dialog box appears. When "YES" is selected, the specified range is deleted and copied to the buffer.
 - When "NO" is selected, the cutting operation is cancelled.



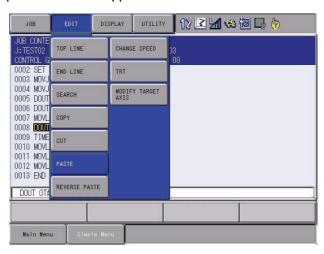
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- 3 Teaching
- 3.7 Editing Jobs

3.7.4 Pasting

Before pasting, the range to be pasted has to be stored in the buffer.

- 1. Move the cursor to the line immediately before the desired position in the JOB CONTENT window.
 - The pull-down menu appears.



- 2. Select {EDIT} under the menu.
- 3. Select {PASTE}.
 - The confirmation dialog box appears.
 - When "YES" is selected, the contents of the buffer are inserted to the job.
 - When "NO" is selected, the pasting operation is cancelled.

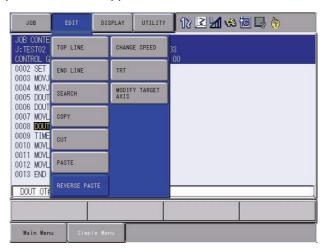


DX100 3.7 Editing Jobs

3.7.5 Reverse Pasting

Before pasting, the range to be pasted has to be stored in the buffer.

- 1. Move the cursor to the line immediately before the desired position in the JOB CONTENT window.
- 2. Select {EDIT} under the menu.
 - The pull-down menu appears.



- 3. Select {REVERSE PASTE}.
 - The confirmation dialog box appears.
 - When "YES" is selected, the contents of the buffer are reverse pasted to the job.
 - When "NO" is selected, the reverse-pasting operation is cancelled.



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- 3 Teaching
- 3.8 Test Operations

3.8 Test Operations

Playback operations can be simulated in the teach mode with test operations. This function is convenient for checking continuous paths and operation instructions.

Test operation differs in the following ways from actual playback in the play mode.

 Operation speeds greater than the maximum teaching speed are reduced to the maximum teaching speed.



- Only machine lock is available among special operations for playback in the play mode.
- Work instruction output, such as arc output, is not executed.

3.8.1 Test Operation Procedures

Test operation is performed by pressing [INTERLOCK] and [TEST START]. For safety purposes, these keys will only function while the keys are held down.

- 1. Select {JOB} under the main menu.
- 2. Press {JOB}.
 - The test operation JOB CONTENT window appears.
- 3. Press [INTERLOCK] + [TEST START].
 - The manipulator starts the test cycle operation.
 - The manipulator moves only while these keys are held down.
 However, after the operation starts, the motion continues even if [INTERLOCK] is released.
 - The manipulator stops immediately when [TEST START] is released.



Always check safety conditions before starting the manipulator in motion.

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3.9 Other Job-editing Functions

3.9 Other Job-editing Functions

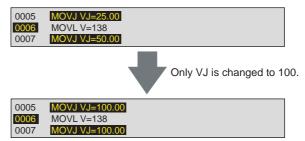
3.9.1 Editing Play Speed

There are two ways to modify play speed:

- Modification of Speed Type
- · Relative Modification

3.9.1.1 Modification of Speed Type

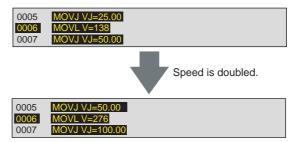
This method is used to modify the speed type (such as VJ, V, VR, etc.)



Type of Play Speed	Explanation			
VJ	Joint Speed	Normal robot axes		
V	TCP Speed			
VR	Posture Angle Speed			
VE	Base Axis Speed			

3.9.1.2 Relative Modification

All steps are selected regardless of the play speed type. This method is used to change all steps by a specified percentage (1% to 200%). This is called relative modification.



The speed of the entire job or specified section can be changed.

- 1. Select {JOB} under the main menu.
- 2. Select {JOB}.
 - The JOB CONTENT window appears.
- 3. Move the cursor to the instruction area.
- 4. Press [SHIFT] + [SELECT] in the speed modify start line.
 - If the section is not specified, the speed of the entire job will be changed.
 - Move the cursor to the end line. The line numbers of the selected lines are highlighted.

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- 3.9 Other Job-editing Functions
- 5. Select (EDIT) under the menu.
- Select {CHANGE SPEED}.
 - The SPEED MODIFICATION window appears.



7. Set desired items.

A. START LINE NO.

Displays the first line number of the section to be modified.

B. END LINE NO.

Displays the last line number of the section to be modified.

C. MODIFICATION TYPE

Selects the confirmation before changing: "CONFIRM" or "NO CONFIRM."

Each time [SELECT] is pressed when the cursor is on this item, the setting alternates between "CONFIRM" and "NO CONFIRM."

D. SPEED KIND

Selects the speed type.

When [SELECT] is pressed when the cursor is on this item, selection dialog box appears. Select the speed type to be changed.

E. SPEED

Specifies the speed value.

When [SELECT] is pressed when the cursor is on this item, the mode changes to the number input mode. Input the speed value and press [ENTER].

8. Select "EXECUTE."

- The speed begins to change.
- If "MODIFICATION TYPE" is set to "CONFIRM," the confirmation dialog box "Modifying speed" is displayed. Press [ENTER] to change the speed on the first line and search for the next speed. Press the UP/DOWN cursor button to keep the speed on the first line and search for the next speed. To cancel the speed modification, press [CANCEL].
- If "MODIFICATION TYPE" is set to "NOT CONFIRM," all the speeds of the specified section are changed.

3.9 Other Job-editing Functions

3.9.1.3 Modification by TRT (Traverse Time)

Modifications made by TRT have the following characteristics:

- By setting the time required to execute a move instruction (moving time) to a desired value, the speeds can be modified.
- It is possible to measure the moving time without actually moving the manipulator.

For example, when the movement from lines 5 through 20 currently requires 34 seconds, and you want to reduce it to 15 seconds or extend it to 50 seconds, this function is used.

- 1. Select {JOB} under the main menu.
- 2. Select {JOB}.
 - The JOB CONTENT window appears.
- 3. Move the cursor to the instruction area.
- 4. Press [SHIFT] + [SELECT] in the weaving time measure start line.
 - Move the cursor to the end line. The line numbers of the selected lines are highlighted.
- 5. Select (EDIT) under the menu.
- 6. Select {TRT}.
 - The TRT window appears.



7. Set the desired items.

A. START LINE NO.

Displays the first line number of the section to be measured and modified.

B. END LINE NO.

Displays the last line number of the section to be measured and modified.

C. MOVING TIME

The weaving time needed to move from the first number to last number is measured and displayed.

D. SETTING TIME

Set the desired weaving time.

When [SELECT] is pressed when the cursor is on this item, the input buffer line appears. Input the desired weaving time and press [ENTER].

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- 3 Teaching
- 3.9 Other Job-editing Functions

8. Select "EXECUTE."

- The speed is changed according to the setting.



- If instructions that include specific speed data such as SPEED or ARCON instructions (including speed data of the welding condition file) exist in the specified section, the speed data for those steps are not changed. Therefore, in such cases, the set time and the actual time required are not same.
- If the speed data is limited by the maximum value, the following message is displayed.

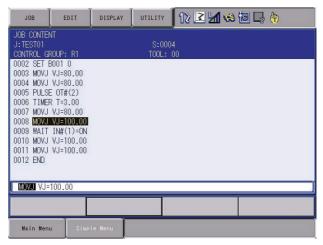


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3.9 Other Job-editing Functions

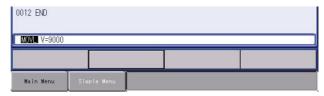
3.9.2 Editing Interpolation Type

- 1. Select {JOB} under the main menu.
- 2. Select {JOB}.
 - The JOB CONTENT window appears.
- 3. Move the cursor to the instruction area.
- 4. Select the line to be modified.
 - The instruction on the cursor is displayed in the input buffer line.

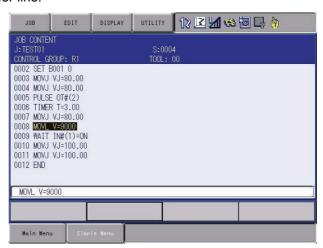


- 5. Press [SHIFT] + the cursor key simultaneously.
 - The interpolation type in the input buffer line changes.
 - The modification of the speed according to the modification of the interpolation type is calculated by the ratio to maximum speed at each speed.
 - Joint Speed: MAX=100.0%
 Linear Speed: MAX=9000cm/min

Joint Speed: 50% = Linear Speed: 4500cm/min Linear Speed: 10% = Linear Speed: 900cm/min



- 6. Press [ENTER].
 - The instruction on the cursor line is replaced with one on the input buffer line.



DX100 3.9 Other Job

3.9 Other Job-editing Functions

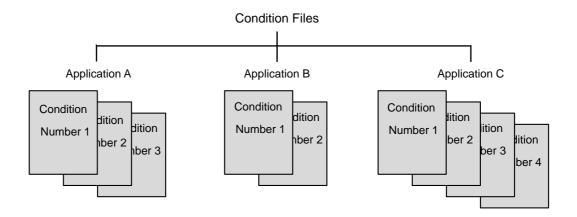
3.9.3 Editing Condition Files

Condition files are prepared in order to set the conditions for the manipulator to execute instructions.

Multiple condition files are provided for each application. More than one pattern can be set up in each condition file. The patterns are listed by "condition numbers." This number is specified by the work instruction in a job.



Refer to DX100 Operator's Manual of each application for information regarding the contents and editing methods of the condition file.



3.9 Other Job-editing Functions

3.9.4 User Variables

User variables are used for jobs to store counters, calculation results or input signals. Since the same user variable can be used in multiple jobs, save the numerical values as common references for the jobs and the user variables are maintained even when the power is turned OFF.

User variables have the following applications:

- Controlling of the number of workpieces
- Controlling of the number of jobs
- Sending/receiving of information between jobs

The data formats for user variables are described in the following table:

Table 3-5: User Variables

Data Format	Variable No. (pcs)	Functions	
Byte Type	B000 to B099 (100)	Range of storable values is from 0 to 255. Can store I/O status. Can perform logical operations (AND, OR, etc.)	
Integer Type	1000 to 1099 (100)	Range of storable values is from -32768 to 32767.	
Double Precision Integer Type	D000 to D099 (100)	Range of storable values is from -2147483648 to 2147483647.	
Real Type	R000 to R099 (100)	Range of storable values is from -3.4E+38 to 3.4E38. Accuracy: 1.18E-38 < x ≤ 3.4E38	
Character Type	S000 to S099 (100)	Maximum storable number of characters is 16.	
Position Type	P000 to P127 (128)	Can store position data in pulse form or in XYZ form. XYZ type variable can be used as target position data for move instructions, and as incremental values for parallel shift instructions.	
	BP000 to BP127 (128)		
	EX000 to EX127 (128)		

3.9 Other Job-editing Functions

· Play Speed V:

MOVL V=1000

The variable I000 is used for speed V with this move instruction.

The unit for V is 0.1mm per second.

For example, if 1000 were set as 1000, the following would be true:

 $1000=1000 \rightarrow$ unit for V is 0.1mm/s \rightarrow V=100.0mm/s Note that, depending on the unit being used, the value of the variable and the value of the actual speed on occasion might not match.



Play Speed VJ:

MOVL VJ=1000

The unit for VJ is 0.01%.

For example, if I000 were set as 1000, the following would be true:

 $1000=1000 \rightarrow \text{unit for VJ is } 0.01\% \rightarrow \text{VJ}=10.00\%.$

· Timer T:

TIMER T=1000

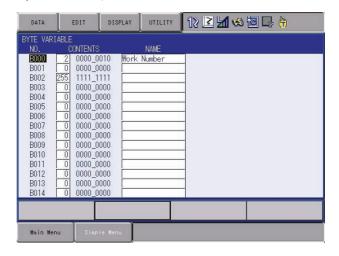
The unit for T is 0.01 seconds.

For example, if I000 were set as 1000, the following would be true:

 $1000=1000 \Rightarrow$ unit for T is 0.01 seconds \Rightarrow T=10.00 seconds.

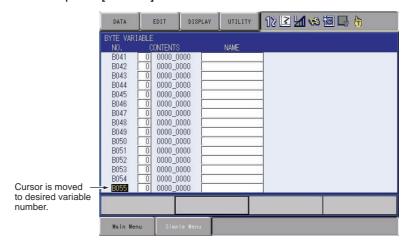
3.9.4.1 Setting Byte, Integer, Double Precision Integer, and Real Type Variables

- 1. Select {VARIABLE} under the main menu.
 - {BYTE}, {INTEGER}, {DOUBLE}, and {REAL} are displayed for the sub menu.
- 2. Select desired variable type.
 - The BYTE VARIABLE window appears. (Following is a case that {BYTE} is selected.)



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- 3.9 Other Job-editing Functions
- 3. Move the cursor to the desired variable No.
 - When the desired variable number is not displayed, move the cursor with either of the following operations.
 - Move the cursor on the variable No. and press [SELECT]. Then input the variable No. using the Numeric keys and press [ENTER].
 - Move the cursor to the menu area and select {EDIT} → {SEARCH}. Then input the variable No. with the Numeric keys and press [ENTER]



- 4. Move the cursor to the data of the variable.
 - The number can be directly typed.
- 5. Input the desired number.
- 6. Press [ENTER].
 - Input value is set to the variable on the cursor position.

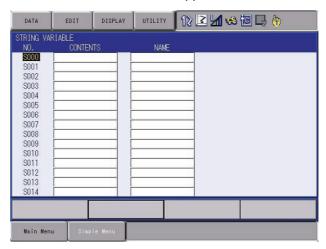


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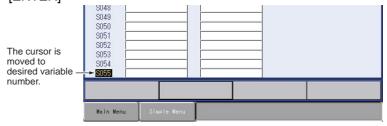
3.9 Other Job-editing Functions

3.9.4.2 Setting Character Type Variables

- 1. Select {VARIABLE} under the main menu.
- 2. Select {STRING}.
 - The STRING VARIABLE window appears.



- 3. Move the cursor to the desired variable No.
 - When the desired variable number is not displayed, move the cursor with either of the following operations.
 - Move the cursor on the variable No. and press [SELECT]. Then input the variable No. using the Numeric keys and press [ENTER].
 - Move the cursor to the menu area and select {EDIT} → {SEARCH}.
 Then input the variable No. with the Numeric keys and press [ENTER]



- 4. Move the cursor to the data of the variable.
 - The characters can be directly typed.
- 5. Input the desired characters.
 - For information on character input operation, refer to chapter 1.2.6 "Character Input Operation" at page 1-18.
- 6. Press [ENTER].
 - The input characters are set to the variable on the cursor position.



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3.9 Other Job-editing Functions

3.9.4.3 Registering Variable Name

- 1. Select {VARIABLE} under the main menu.
- 2. Select desired variable.
 - Select any variable type from among byte type, integer type, double precision integer type, real type, robot position type, base position type, and station position type.
- 3. Move the cursor to desired variable number.
 - If desired variable number is not displayed, move the cursor by either of following operations.
 - Select the variable number, input desired variable number and press [ENTER]. The cursor moves to the variable number to be input.
 - Move the cursor to the menu area and select {EDIT}→{SEARCH}.
 Input desired variable number and press [ENTER]. The cursor moves to the variable number to be input.
- 4. Select "NAME."
 - The input buffer line appears.



Refer to chapter 1.2.6 "Character Input Operation" at page 1-18 for the character input operation.

- 5. Input name.
- 6. Press [ENTER].
 - The variable name is registered.

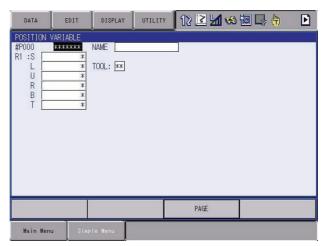


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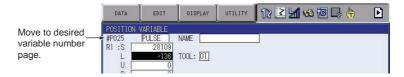
3.9 Other Job-editing Functions

3.9.4.4 Displaying Position Variables

- 1. Select {VARIABLE} under the main menu.
- 2. Select desired position variable type.
 - The POSITION VARIABLE window of desired type among robot type, base type, and station type appears.



- 3. Press the page key or [SHIFT] + page key .
 - When the desired variable number is not displayed, move the cursor with either of the following operations.
 - Press [DIRECT PAGE]. Then input the variable No. using the Numeric keys and press [ENTER].
 - Move the cursor to the menu area and select {EDIT} → {SEARCH}.
 Then input the variable No. with the Numeric keys and press [ENTER].



3.9 Other Job-editing Functions

3.9.4.5 Setting Position Variables

The following table shows the types of position variables and setting methods.



- The setting of position variables is done in the teach mode.
- Turn the servo power ON when setting the variables with the axis keys.

Table 3-6: Types of Position Variables and Setting Method

Туре	Pxxx (Robot)		BPxxx (Base)		EXxxx (Station)
	Pulse Type	XYZ Type	Pulse Type	XYZ Type	Pulse Type
		Select coordinates from base, robot, user, tool.			
Setting Method	Using the I	numeric keys 4500	7 8 9 1 2 3 1 2 3	Z-axis -axis	Y-axis
	<u>Using</u>	the axis keys (E) E+			

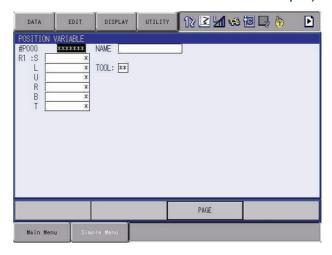
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3.9 Other Job-editing Functions

3.9.4.6 Setting Position Variables Using the Numeric Keys

■ Pulse Type

- 1. Select {VARIABLE} under the main menu.
- 2. Select desired position variable type.
 - The desired variable window appears (robot, base, or station). (The POSITION VARIABLE window is used for this example.)



- 3. Select the variable data type.
 - The selection dialog box appears.



 If the position variable was set before, confirmation dialog box appears for data clear. If "YES" is selected, the data is cleared.



- 4. Select {PULSE}.
- 5. Move the cursor to desired data to be input and press [SELECT].
- 6. Input the value.
- 7. Press [ENTER].
 - The value is set in the cursor position.



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3.9 Other Job-editing Functions

XYZ Type

- 1. Select {VARIABLE} under the main menu.
- 2. Select desired position variable type.
- 3. Select the variable data type.
 - The selection dialog box appears.



- 4. Select desired coordinates except PULSE.
- 5. Move the cursor to desired data to be input and press [SELECT].
- 6. Input the value.
- 7. Press [ENTER].
 - The value is set in the cursor position.



- (1) Setting of "<TYPE>"
- Each time [SELECT] is pressed when the cursor is on the setting data in the input buffer line, the settings alternate.



About "<TYPE>"

- It is not necessary to set a type if the position variable is to be used for parallel shift operations.
- When the position variable is used with a move instruction such as "MOVJ P001," it is necessary to set a type. For details on types, refer to chapter 3.9.4.10 "Manipulator Types" at page 3-82.
 Current Position Window (XYZ) shows the current setting of a type.

3.9 Other Job-editing Functions

3.9.4.7 Setting Position Variables Using the Axis Keys

■ Pulse Type

- 1. Select {VARIABLE} under the main menu.
- 2. Select desired position variable type.
 - The desired variable window appears (robot, base, or station).
- 3. Press [SHIFT] + [ROBOT]. When you need an external axis position, press [SHIFT]+[EX.AXIS].
 - (1) When there are two or more robot, base, or a station, specify the axis with following operation.

Robot

Each time [SHIFT] + [ROBOT] is pressed, the axis displayed on the status line changes:

 $R1 \rightarrow R2 \rightarrow ... \rightarrow R8$.

Base or Station

Each time [SHIFT]+[EX.AXIS] is pressed, the axis displayed on the status line changes:

$$B1 \rightarrow B2 \rightarrow ... \rightarrow B8 \rightarrow S1 \rightarrow S2 \rightarrow \rightarrow S24.$$

- (2) Check the selected axis on the status line.
- 4. Move the manipulator with the axis keys.
 - Move the manipulator or the external axis to the desired position to be set to position variable.
- 5. Press [MODIFY].
- Press [ENTER].

XYZ Type

- 1. Select {VARIABLE} under the main menu.
- 2. Select desired position variable type.
 - (1) When there are two or more robot, base, or a station, specify the axis with following operation.

Robot

Each time [SHIFT] + [ROBOT] is pressed, the axis displayed on the status line changes:

 $R1 \rightarrow R2 \rightarrow ... \rightarrow R8$.

· Base or Station

Each time [SHIFT]+[EX.AXIS] is pressed, the axis displayed on the status line changes:

$$B1 \rightarrow B2 \rightarrow ... \rightarrow B8 \rightarrow S1 \rightarrow S2 \rightarrow \rightarrow S24.$$

- (2) Check the selected axis on the status line.
- 3. Move the manipulator with the axis keys.
 - Move the manipulator or the external axis to the desired position to be set to position variable.
- 4. Press [MODIFY].
- 5. Press [ENTER].

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3.9 Other Job-editing Functions

3.9.4.8 Deleting Data Set of Position Variables

- 1. Select {VARIABLE} under the main menu.
- 2. Select desired position variable type.
- 3. Select {DATA} under the menu.
 - The pull-down menu appears.



- 4. Select (CLEAR DATA).
 - The position variable data on the displayed page are deleted.



3.9.4.9 Checking Positions by Position Variables

- 1. Select {VARIABLE} under the main menu.
- 2. Select desired position variable type.
 - (1) When there are two or more robot, base, or a station, specify the axis with following operation.

Robot

Each time [SHIFT] + [ROBOT] is pressed, the axis displayed on the status line changes:

$$R1 \rightarrow R2 \rightarrow ... \rightarrow R8$$
.

Base or Station

Each time [SHIFT]+[EX.AXIS] is pressed, the axis displayed on the status line changes:

$$B1 \rightarrow B2 \rightarrow ... \rightarrow B8 \rightarrow S1 \rightarrow S2 \rightarrow \rightarrow S24.$$

- (2) Check the selected axis on the status line.
- 3. Press [FWD].
 - Selected axis moves to the position specified by the variable.



The selected axis (manipulator, base, or station) moves directly to the set variable position.

Before pressing [FWD], check that the surrounding area is safe.

3.9 Other Job-editing Functions

3.9.4.10 Manipulator Types

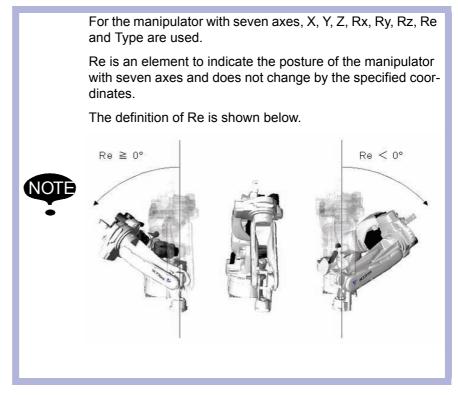
When the position data of the job data are described using the XYZ format, several postures may be taken according to the manipulator's structure when moving it to the described position.

Although these postures have the same coordinates for TCP, they vary in pulse for each axis.

Thus, the manipulator's posture cannot be uniquely defined only by the coordinate value, and it is necessary to specify the data other than the coordinate value to define the manipulator's posture.

This is called "Type."

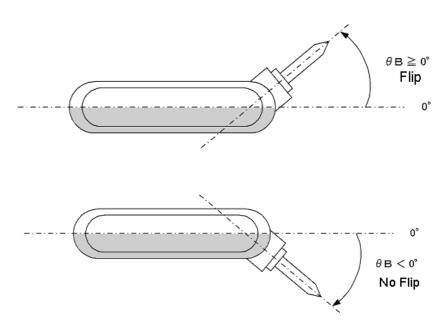
Type varies according to the manipulator model.



- 3 Teaching
- 3.9 Other Job-editing Functions

3.9.5 Flip/No Flip

When the angle of B-axis is within (+) range ($\theta B \ge 0^{\circ}$), it is called "Flip", and when within (-) range ($\theta B < 0^{\circ}$), "No Flip."



3.9.6 R-axis Angle

This specifies whether the R-axis angle is less than $\pm 180^{\circ}$ or greater than $\pm 180^{\circ}$.

R < 180°	R ≥ 180°
-180° 180°	360° -360°
-180 < θ R ≤ 180	$180 < \theta R ≤ 360$, $-360 < \theta R ≤ -180$



 θ R is the angle when the R-axis home position is 0 $^{\circ}.$

- 3 Teaching
- 3.9 Other Job-editing Functions

3.9.7 T-axis Angle

This specifies positions of the R-, B-, and T-axis. For manipulators with wrist axes (three axes), this specifies whether the T-axis angle is less than $\pm 180^{\circ}$ or greater than $\pm 180^{\circ}$.

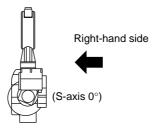
T <180°	T ≥ 180°
-180° 180°	360° -360°
-180 < θ T ≤180	$180 < \theta \text{ T} \le 360, -360 < \theta \text{ T} \le -180$



 θ T is the angle when the T-axis home position is 0° .

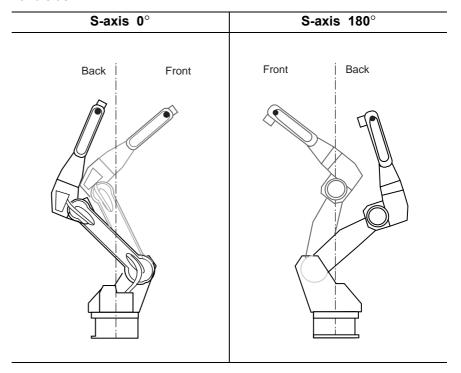
3.9.8 Front/Back

This specifies where in the S-axis rotation center the B-axis rotation center locates when viewing the L-axis and U-axis from the right-hand side. When viewed from the right-hand side, the right of the S-axis rotation center is called the front, and the left is called the back.



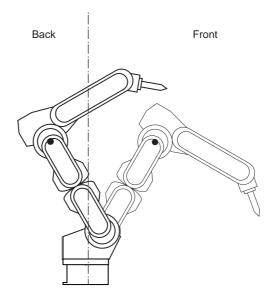
3.9 Other Job-editing Functions

The diagram below shows the S-axis at 0° and at 180° . This is the configuration when the L-axis and the U-axis are viewed from the right-hand side.



For the manipulator with seven axes, this specifies where in the S-axis rotation center the U-axis rotation center locates when viewing the L-axis and U-axis from the right-hand side.

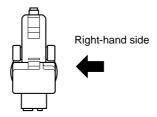
When viewed from the right-hand side, the right of the S-axis rotation center is called the front, and the left is called the back.

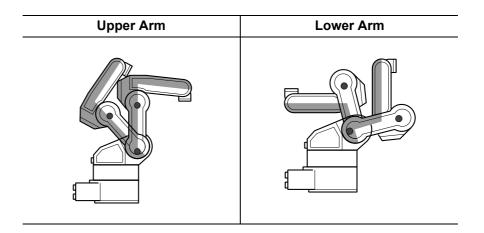


- 3 Teaching
- 3.9 Other Job-editing Functions

3.9.9 Upper Arm/Lower Arm

This specifies a type comprised of L-axis and U-axis when the L-axis and U-axis are viewed from the right-hand side.





3.9.10 S-axis Angle

This designation is required for the manipulators which have working envelopes greater than $\pm 180^{\circ}$.

This specifies whether the S-axis angle is less than $\pm 180^{\circ}$ or greater than $\pm 180^{\circ}$.

S<180°	S ≥ 180°
-180° 180°	360° -360°
-180° < θ S ≤ 180°	180° < θ S ≤ 360° -360° < θ S ≤ -180°



 θ S is the angle when the S-axis home position is 0°.

3.9 Other Job-editing Functions

3.9.11 Editing Local Variables

As well as user variables, local variables can be used for the storage of counters, calculations, and input signals. The data format is the same as that of user variables. As shown in the following table, the letter L is affixed to the variable number to indicate a local variable.

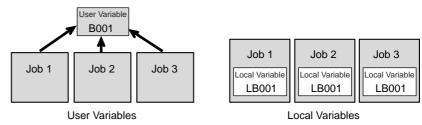
Table 3-7: Local Variables

Da	ta Format	Variable No.	Functions	
Byte Typ	e	LB000 to LB□□□	Range of storable values is from 0 to 255. Can store I/O status. Can perform logical operations (AND, OR, etc.)	
Integer T	уре	LI000 to	Range of storable values is from -32768 to 32767.	
Double F Integer T		LD000 to	Range of storable values is from -2147483648 to 2147483647.	
Real Typ	е	LR000 to	Range of storable values is from -3.4E+38 to 3.4E+38 Accuracy: 1.18E-38 < x ≤ 3.4E+38	
Characte	er Type	LS000 to LS□□□	Maximum storable number of characters is 16.	
Position Type	Robot Axes	LP000 to LP□□□	Can store position data in pulse form or in XYZ form.	
	Base Axes LBP000 to U		XYZ type variables can be used as target position data for move instructions, and as	
	Station Axes	LEX000 to	incremental values for parallel shift instructions.	

Local variables differ from user variables in the following four ways:

Used in One Job Only

With user variables it is possible to define and use one variable in multiple jobs, but local variables are used only in the job in which they are defined, and cannot be read from other jobs. Accordingly, local variables do not affect other jobs, so it is possible to define a variable number (such as LB001) separately in different jobs, and use it in different ways in each of these jobs.



Able to Use Any Number of Variables

The number is set in the JOB HEADER window. When the number is set, the area for the value is saved in memory.

3.9 Other Job-editing Functions

· Not Able to Display the Variable Contents

To display the local variable contents, user variables are needed. For example, to view the contents of local variable LP000, save it temporarily as user variable P001. Then execute the instruction SET P001 LP000, and view the POSITION VARIABLE window for P001.

• Enabled Only During the Execution of the Defined Job
The contents of the local variables are enabled only during the execution of the defined job.

The local variable field is assured when the defined job is called (when the job is executed by a CALL or JUMP instruction, or the job is selected by the menu). Once the job is completed by the execution of a RET, END, or JUMP instruction, the local variable data that was set is disabled. However, if a job which uses local variables itself calls a separate job, then is returned by use of a RET instruction, the data that was present prior to the CALL instruction remains in effect and can be used.

Precautions for Variables and Units



As was the case with user variables, note that, depending on the value of the unit being used, the value of the variable and the value of the actual speed or time an occasion might not match. Refer to *chapter 3.9.4* "User Variables" at page 3-71.

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3.9 Other Job-editing Functions

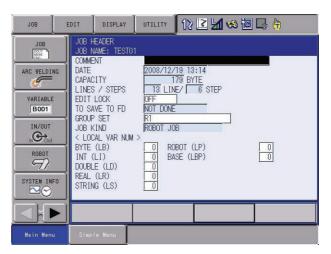
3.9.11.1 Setting the Number of Local Variables

The number of local variables used in a job is set in the JOB HEADER window. When the number of local variables is set, memory is allocated for those variables.

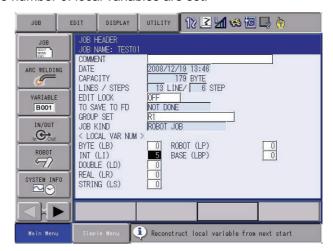


Only when expanding the "INSTRUCTION LEVEL," it is possible to use local variables. Refer to "8.12 Instruction Level Setting" of "DX100 INSTRUCTIONS" (RE-CTO-A215) for details on setting the language level.

- 1. Select {JOB} under the main menu.
- 2. Select {JOB}.
- 3. Select {DISPLAY} under the menu.
- 4. Select {JOB HEADER}.
 - The JOB HEADER window appears. Scroll the window using the cursor.



- 5. Select the number of local variables to be set.
 - The input buffer line appears.
- 6. Input the number of variables.
- 7. Press [ENTER].
 - The number of local variables are set.



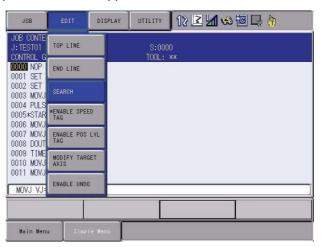
DX100

3.9 Other Job-editing Functions

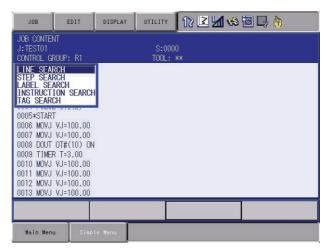
3.9.12 Search

When editing or checking, jobs and steps can be searched for. Search can be done when the cursor is in either the address or instruction area on the JOB CONTENT window.

- 1. Select {JOB} under the main menu.
- 2. Select {JOB}.
 - The JOB CONTENT window appears.
- 3. Select {EDIT} under the menu.
 - The pull-down menu appears.



- 4. Select (SEARCH).
 - The selection dialog box appears.



5. Select the search type.

Search is an operation by which the cursor is moved to a specific step or instruction in the edit job. The desired item can be instantly searched for without using the cursor.

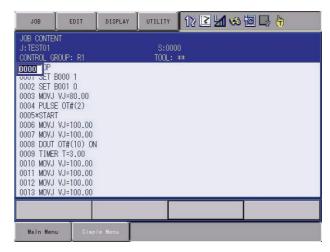
DX100

3.9 Other Job-editing Functions

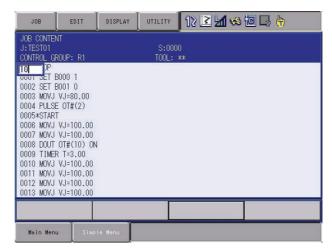
3.9.12.1 Line Search

This function moves the cursor to the desired line number.

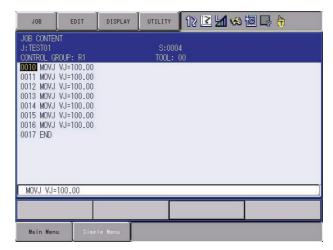
- 1. Select (EDIT), (SEARCH) and "LINE SEARCH."
 - The number can be entered.



2. Input desired line number.



- 3. Press [ENTER].
 - The cursor is moved to the line number and the window appears.



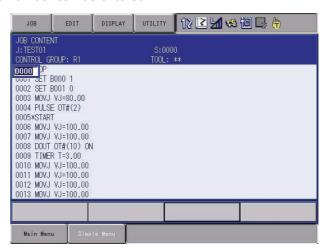
DX100

3.9 Other Job-editing Functions

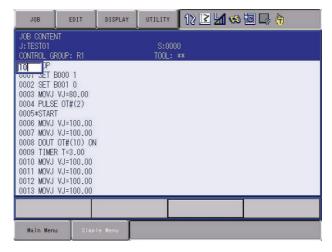
3.9.12.2 Step Search

This function moves the cursor to the desired step number (move instruction).

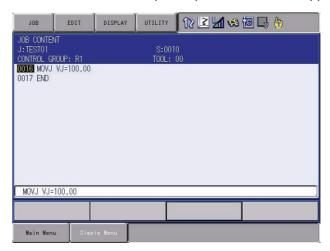
- 1. Select {EDIT], {SEARCH} and "STEP SEARCH."
 - The number can be entered.



2. Input desired step number.



- 3. Press [ENTER].
 - The cursor is moved to the input step and the window appears.



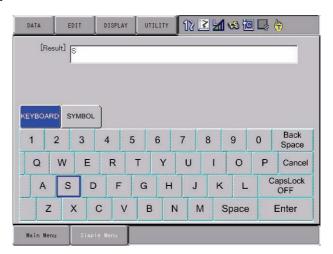
DX100

3.9 Other Job-editing Functions

3.9.12.3 Label Search

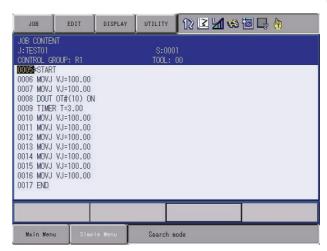
This function searches for the desired label and the instruction using that label.

- 1. Select {EDIT}, {SEARCH} and "LABEL SEARCH."
 - The characters can be entered.
- 2. Input desired label name.
 - For information on character input operation, refer to chapter 1.2.6 "Character Input Operation" at page 1-18.
 - At this time, search can be conducted by entering any one character of the label. For example, to search for the "START" label, enter only "S," and the search can be done.



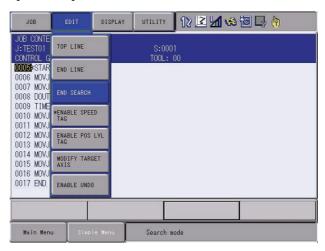
3. Press [ENTER].

- The cursor is moved to the desired label and the window appears.



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- 3.9 Other Job-editing Functions
- 4. Use the cursor to continue search.
 - While searching, forward search and backward search are possible by pressing the cursor key.
 - To end search, select {EDIT} → {END SEARCH} on the menu and press [SELECT].

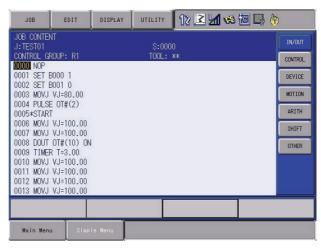


3.9 Other Job-editing Functions

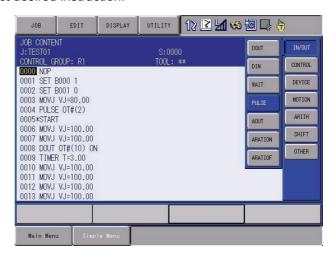
3.9.12.4 Instruction Search

This function moves the cursor to a desired instruction.

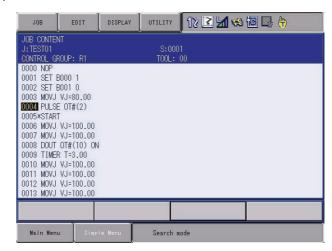
- 1. Select {EDIT}, {SEARCH} and "INSTRUCTION SEARCH."
 - The INFORM command list appears.



- 2. Select desired instruction group.
- 3. Select desired instruction.

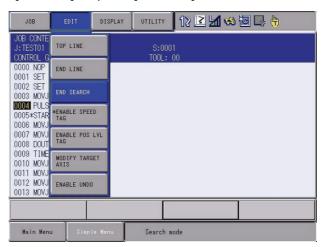


 The cursor is moved to the selected instruction and the window appears.



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- 3 Teaching3.9 Other Job-editing Functions
- 4. Use the cursor to continue search.
 - While searching, forward search and backward search are possible by pressing the cursor key.
 - To end search, select {EDIT} → {END SEARCH} on the menu and press [SELECT], or press [CANCEL].



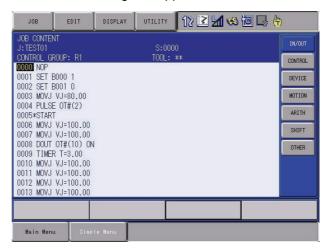
DX100

3.9 Other Job-editing Functions

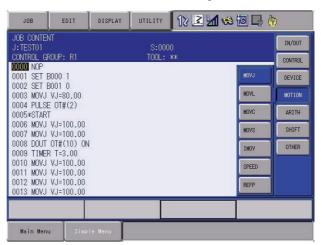
3.9.12.5 Tag Search

This function moves the cursor to the desired tag.

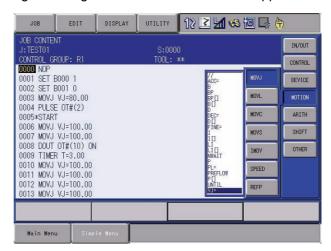
- 1. Select {EDIT}, {SEARCH} and "TAG SEARCH."
 - The instruction list dialog box appears.



- 2. Select desired instruction group.
- 3. Select desired instruction for which the tag is to be searched.

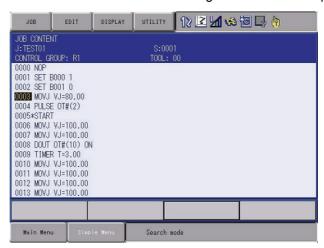


- The tag list dialog box for selected instruction appears.

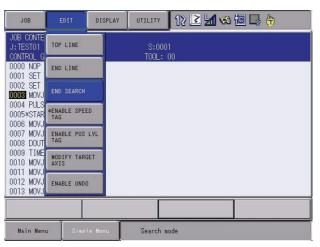


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- 3.9 Other Job-editing Functions
- 4. Select the desired tag.
 - The cursor is moved to the selected tag and the window appears.



- 5. Use the cursor to continue search.
 - While searching, forward search and backward search are possible by pressing the cursor key.
 - To end search, select {EDIT} → {END SEARCH} on the menu and press [SELECT], or press [CANCEL].



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4.1 Preparation for Playback

4 Playback

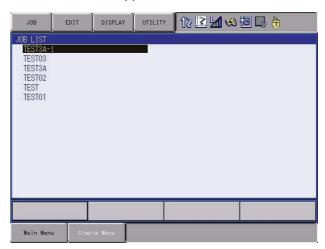
4.1 Preparation for Playback

4.1.1 Selecting a Job

Playback is the act of executing a taught job. Before playback operation, first call the job to be executed.

4.1.1.1 Calling a Job

- 1. Select {JOB} under the main menu.
- 2. Select {SELECT JOB}.
 - The JOB LIST window appears.



3. Select the desired job.

DX100

4.1 Preparation for Playback

4.1.1.2 Registering the Master Job

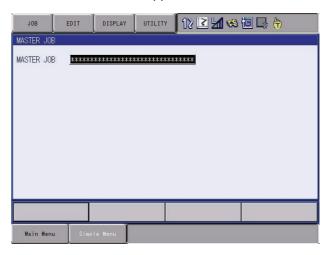
If a particular job is played back frequently, it is convenient to register that job as a master job (master registration). A job registered as the master job can be called more easily than the method described on the preceding page.



Only one job can be registered as the master job. Registering a master job automatically cancels the previously registered master job.

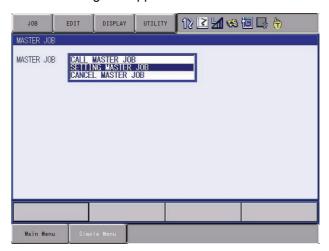
Be sure to register a master job in the teach mode.

- 1. Select {JOB} under the main menu.
- 2. Select {MASTER JOB}.
 - The MASTER JOB window appears.

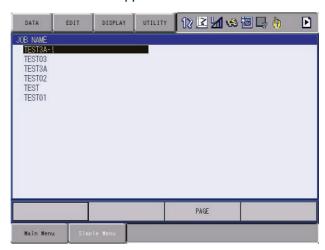


3. Press [SELECT].

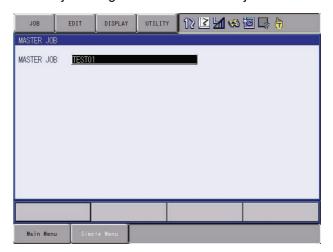
- The selection dialog box appears.



- 4 Playback
- 4.1 Preparation for Playback
- 4. Select {CALL MASTER JOB}.
 - The JOB LIST window appears.



- 5. Select a job to be registered as a master job.
 - The selected job is registered as the master job.



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4.1 Preparation for Playback

4.1.1.3 Calling the Master Job

This operation is to call a master job. The job can be called in the JOB CONTENT window, PLAYBACK window, JOB SELECT window, or the MASTER JOB window.

■ Calling from the JOB CONTENT, PLAYBACK, JOB SELECT Window

1. Select {JOB} under the menu.



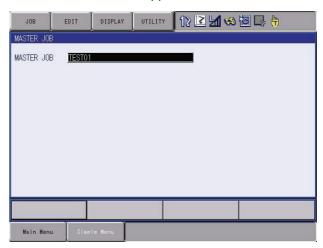
- 2. Select {MASTER JOB}.
 - The master job is called, and the JOB CONTENT window appears.

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4.1 Preparation for Playback

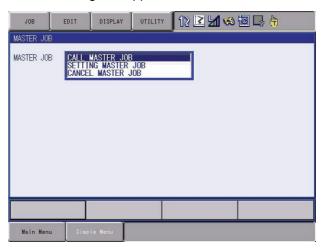
■ Calling from the MASTER JOB Window

- 1. Select {JOB} under the main menu.
- 2. Select {MASTER JOB}.
 - The MASTER JOB window appears.



3. Press [SELECT].

- The selection dialog box appears.



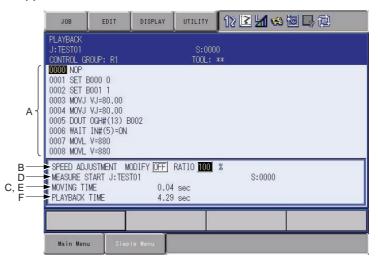
- 4. Select {CALL MASTER JOB}.
 - The master job is called, and the JOB CONTENT window (during the teach mode), or the PLAYBACK window (during the play mode) appears.

DX100

4.1 Preparation for Playback

4.1.2 The PLAYBACK Window

When the mode switch on the programming pendant is switched to "PLAY" while displaying the JOB CONTENT window, the PLAYBACK window appears.



A. Job Content

The cursor moves according to the playback operation. The contents are automatically scrolled as needed.

B. Override Speed Settings

Displayed when override speed setting is performed.

C.Cycle Time

Displays the operating time of the manipulator. Each time the manipulator is started, the previous cycle time is reset, and a new measurement begins. Either showing or hiding the cycle time display is selectable.

D. Start No.

First step in the measurement. Measurement starts when the start button lamp lights and the playback starts.

E. Motion Time

Displays the weaving time of the manipulator.

F. Playback Time

Displays the time from the beginning to the end of the measurement. Measurement ends when the manipulator stops and the start button lamp goes off.

4.1.2.1 Display of Cycle Time

Follow the procedure below to set whether or not to display the cycle time on the PLAYBACK window.

- 1. Select {DISPLAY} under the menu.
- 2. Select (CYCLE TIME).
 - The cycle time is displayed.
 - Repeat the same operation to hide the cycle time display.

- 4 Playback
- 4.1 Preparation for Playback

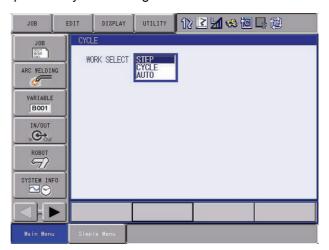
4.1.2.2 Operation Cycle

There are three types of manipulator operation cycles:

- AUTO : Repeats a job continuously.
- 1 CYCLE: Executes a job once. If there is a called job during execution, it is performed, after which the execution processing returns to the original job.
- 1 STEP : Executes one step (instruction) at a time.

The operation cycle can be changed as follows:

- 1. Select {JOB} under the main menu, and then select {CYCLE}.
- 2. Select the operation cycle to be changed.
 - The operation cycle is changed.



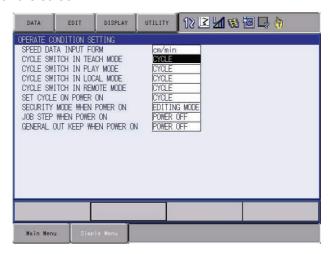
- 4 Playback
- 4.1 Preparation for Playback

Automatic Setting for Operation Cycle

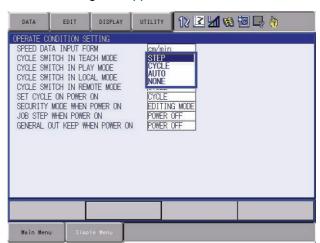
Automatic setting of the operation cycle can be changed by the following operation.

This can be done in the management mode only.

- 1. Select {SETUP} under the main menu.
- 2. Select {OPERATE COND}.
 - The OPERATING CONDITION window appears. Use the cursor to scroll the screen.



- 3. Select the desired operation.
 - The selection dialog box appears.



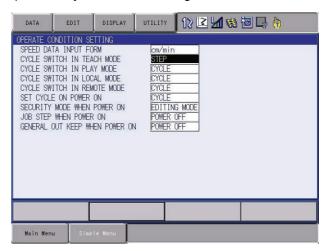
"NONE" setting



The operation cycle is not changed when "NONE" is set. For example, if the setting is "CYCLE SWITCH IN PLAY MODE = NONE," the operation cycle is maintained even after switching to the play mode.

4. Select a cycle.

- 4 Playback
- 4.1 Preparation for Playback
 - The operation cycle when switching modes is set.



4 Playback

4.2 Playback

4.2 Playback

4.2.1 Playback Operation



After checking to be sure there is no one near the manipulator, start the playback operation by following the procedures below.

Playback is the operation by which the taught job is played back. Follow the procedures below to start the playback operation.

- Programming pendant (start button)
- Peripheral device (external start input)

Which is used to start playback is specified by the mode switch on the programming pendant.

Mode Switch on Programming Pendant	Job is started up by
[PLAY]	[START] button on programming pendant
[REMOTE]	Peripheral device

For playback using the programming pendant, follow the procedures below.

4.2.1.1 Selecting the Start Device

- 1. Set the mode switch on the programming pendant to "PLAY."
 - The remote mode is disabled and the play mode is enabled so the machines are to be started up by the programming pendant.

4.2.1.2 Servo On

- 1. Press [Servo ON Ready].
 - DX100 servo power is ON and the Servo ON lamp on the programming pendant lights.

4.2.1.3 Start Operation

- 1. Press [START].
 - The start button lamp lights and the manipulator begins operation.

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4.2 Playback

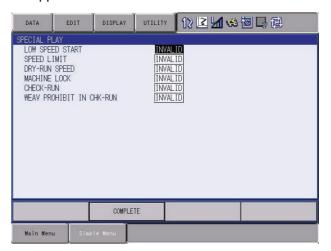
4.2.2 Special Playback Operations

The following special operations can be performed during playback:

- · Low speed operation
- · Limited speed operation
- · Dry run speed operation
- · Machine lock operation
- · Check mode operation

Two or more special operations can be performed at the same time. If multiple operations are selected, the speed during playback is limited to the speed of the slowest operation. Settings for special operations are done in the SPECIAL PLAY window.

When the PLAYBACK window is displayed, move the cursor to the menu area and select {UTILITY} → {SETUP SPECIAL RUN}. The SPECIAL PLAY window appears.



4.2.2.1 Low Speed Operation

The manipulator moves at low speed during the first step after starting. After the operation of this step, the manipulator stops regardless of the selection of the operation cycle and then low speed operation is canceled. Low speed operation is also cancelled if the manipulator is manually stopped during the low speed operation.

After one step operation or any stop of manipulator during low speed operation, pressing [START] allows the manipulator to move at the taught speed.

- 1. Select "LOW SPEED START" on the SPECIAL PLAY window.
 - The setting alternates between "VALID" and "INVALID."
- 2. Select "COMPLETE."
 - The window returns to the PLAYBACK window.

DX100 4.2 Playback

4.2.2.2 Limited Speed Operations

The manipulator operates within the limited speed for the teach mode. Usually, the limited speed is set to 250mm/s. However, operation is performed at actual playback speeds for steps in which the set speed is under this limit.

- 1. Select "SPEED LIMIT" under the SPECIAL PLAY window.
 - The setting alternates between "VALID" and "INVALID."
- 2. Select "COMPLETE."
 - The window returns to the PLAYBACK window.

4.2.2.3 Dry-run Speed Operations

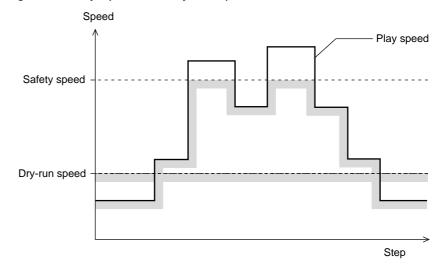
The dry-run speed is a constant speed that is independent of the teaching speeds. The manipulator executes all the steps at a constant speed, which is convenient for quick check of a job consisting of slow operations. The dry-run speed is 10% of maximum speed.



Be careful of steps programmed at lower speeds than the dry-run speed, because they are executed at greater speeds than programmed.

- 1. Select the "DRY-RUN SPEED" under the SPECIAL PLAY window.
 - The setting alternates between "VALID" and "INVALID."
- 2. Select "COMPLETE."
 - The window returns to the PLAYBACK window.

Fig. 4-1: Safety Speed and Dry-run Speed



Playback DX100

Playback 4.2

4.2.2.4 Machine Lock Operation

A job is played back without moving the manipulator to check the status of input and output.

- 1. Select "MACHINE LOCK" under the SPECIAL PLAY window.
 - The setting alternates between "VALID" and "INVALID."
- 2. Select "COMPLETE."
 - The window returns to the PLAYBACK window.

• The setting of "MACHINE LOCK" is maintained even after the mode is switched: If the machine lock is set to "VALID" in the teach mode, it is still "VALID" after switching to the play mode.



The same applies when the mode is switched from the play mode to the teach mode.

- Note that the machine lock becomes "INVALID" if the following operation is performed.
 - Execution of "CANCEL ALL SELECT" in the SPECIAL PLAY window.
- · Turning off the main power.

4.2.2.5 Check Mode Operation

The machine runs without issuing work instructions, such as the ARCON instruction. It is used primarily to check the path of the program.

- 1. Select "CHECK-RUN" under the SPECIAL PLAY window.
 - The setting alternates between "VALID" and "INVALID."
- 2. Select "COMPLETE."
 - The window returns to the PLAYBACK window.

4.2.2.6 Weaving Prohibit Setting during Check Mode Operation

The weaving operation is not executed in the weaving section of the job.

- 1. Select "WEAV PROHIBIT IN CHK-RUN" under the SPECIAL PLAY window.
 - The setting alternates between "VALID" and "INVALID."
- 2. Select "COMPLETE."
 - The window returns to the PLAYBACK window.

4 Playback

4.2 Playback

4.2.2.7 Cancel All Special Operations

All special operations are disabled by the following operation.

- 1. Select {EDIT} from the menu.
- 2. Select "CANCEL ALL SELECT."
 - The message "All special functions canceled" appears.



Special operations are also automatically cancelled if the main power is shut OFF.

4 Playback

4.3 Stop and Restart

4.3 Stop and Restart

The manipulator stops in the following conditions:

- Hold
- · Emergency stop
- · Stop by alarm
- Others

4.3.1 Hold

Hold operation causes the manipulator to stop all motion.



[HOLD] lamp lights while it is held down. At the same time, [START] lamp goes OFF.

4.3.1.1 Using the Programming Pendant

■ Hold

- 1. Press [HOLD] on the programming pendant.
- 2. The manipulator stops. The [HOLD] lamp lights while the [HOLD] button is held down.

■ Release

- 1. Press [START] on the programming pendant.
- 2. The manipulator restarts its operation from the position where it was stopped.

4.3.1.2 Using an External Input Signal (System Input)

■ Hold

- 1. Turn ON the hold signal from an external input (system input).
 - The manipulator stops temporarily.



- The output signal "HOLD" turns ON.
- The programming pendant [HOLD] lamp lights.

Release

- 1. Turn off the hold signal from an external input (system input).
 - Hold is released.
 - To continue the operation, press [START] or turn ON the external input signal (system input). The manipulator restarts its operation, beginning from the position where it was stopped.

4 Playback

4.3 Stop and Restart

4.3.2 Emergency Stop

At an emergency stop, the servo power supply that drives the manipulator is turned OFF and the manipulator stops immediately. An emergency stop can be performed by using either of the following:

- Button on the Front Door of the DX100
- · Programming pendant
- External input signal (system input)

■ Emergency Stop

1. Press the emergency stop button



- The servo power turns OFF and the manipulator stops immediately.
- On the front door of the DX100:



- On the programming pendant:



Using the Emergency Stop Button on the Programming Pendant



Using the External Input Signal (System Input)



■ Release

1. Turn the emergency stop button



in the direction of the arrows.

- On the front door of the DX100:



- On the programming pendant:



 To turn ON the servo power supply again, press [SERVO ON READY] and then grip the Enable switch of the programming pendant.





DX100

4.3 Stop and Restart

4.3.2.1 Restart After Emergency Stop



CAUTION

- Prior to restarting after an emergency stop, confirm the position for the next operation and make sure there is no interference with the workpiece or fixture.
- The application of an emergency stop during high speed operations on continuous steps can result in the manipulator stopping two or three steps prior to the step that is being displayed. There is a risk of interference with the workpiece or fixture when the manipulator is restarted under such conditions.

Playback DX100

4.3 Stop and Restart

4.3.3 Stop by Alarm

If an alarm occurs during operation, the manipulator stops immediately and the ALARM window appears on the programming pendant indicating that the machine was stopped by an alarm.

- If more than one alarm occurs simultaneously, all alarms can be viewed on the window. Scroll down the viewing area of the window when necessary.



The following operations are available in the alarm status: window change, mode change, alarm reset, and emergency stop. To display the ALARM window again when the window is changed during alarm occurrence, select {SYSTEM INFO} and then {ALARM HISTORY}.

Releasing Alarms

<Minor Alarms>

- 1. Press [SELECT].
 - Select "RESET" under the ALARM window to release the alarm status.
 - When using an external input signal (system input), turn ON the "ALARM RESET" setting.

<Major Alarms>

- 1. Turn OFF the main power supply and remove the cause of the alarm.
 - If a severe alarm such as hardware failure alarm occurs, the servo power is automatically shut off and the manipulator stops. If releasing does not work, turn OFF the main power and correct the cause of the alarm.

4 Playback DX100

Stop and Restart 4.3

4.3.4 Others

4.3.4.1 Temporary Stop by Mode Change

When the play mode is switched to the teach mode during playback, the manipulator stops immediately.



To restart the operation, return to the play mode and perform a start operation.

4.3.4.2 Temporary Stop by the PAUSE Instruction

When the PAUSE instruction is executed, the manipulator stops operating.



To restart the operation, perform a start operation. The manipulator restarts from the next instruction.

- 4 Playback
- 4.4 Modifying Play Speed

4.4 Modifying Play Speed

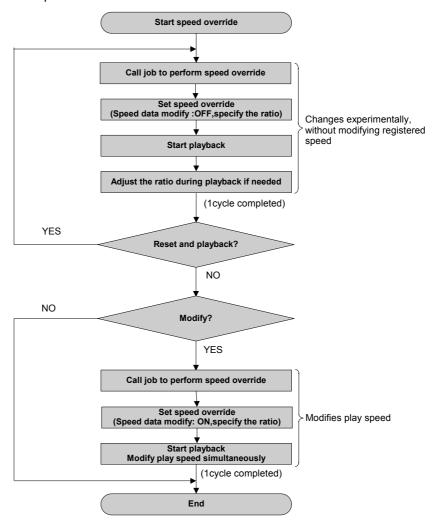
4.4.1 Speed Override

Speed modifications using the speed override have the following features:

- Speed can be modified during playback.
 The job can be played back at various speeds until the play speed is properly adjusted.
- Speed can be increased or decreased by a ratio of the current play speed.

The ratio settings range from 10% to 150% in increments of 1%. Therefore, it is convenient when, for example, all play speed settings are to be increased by 150% at the same time.

The operation flow is shown below.

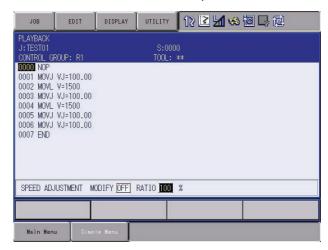


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4.4 Modifying Play Speed

4.4.1.1 Setting Speed Overrides

- 1. Select {UTILITY} under the menu in the PLAYBACK window.
- 2. Select {SPEED OVERRIDE}.
 - The PLAYBACK window shows the speed override status.



- 3. Select "ON" or "OFF".
 - Each time [SELECT] is pressed, "ON" and "OFF" alternate.
 - Select "ON" to modify the registered play speed during playback.
 - When "OFF" is selected, the registered play speed is not modified.
 To change the play speed temporarily (for example, to experiment with various speeds), select "OFF."



- 4. Line up the cursor with the override ratio and move the cursor up and down to change the ratio.
 - If you want to input the ratio number directly, move the cursor to the override ratio and press [SELECT].
 - The number input line appears. Input the override ratio using the Numeric keys.



4 Playback

4.4 Modifying Play Speed

4.4.1.2 Modifying Play Speed

- Set speed override.
- 2. Playback the manipulator.
 - The play speed is increased or decreased in the set ratio.
 - When setting "MODIFY" to "ON," the step's play speed is modified when each step is reached.
 - When one cycle is completed by the END instruction, the speed override setting is cancelled.
 - Assuming that the manipulator moves from step 1 to step 2, the play speed of step 2 is not modified if the speed override is cancelled before reaching step 2.



 The play speed after the modification by the speed override is limited by the maximum and the minimum speed of manipulator.

- When the safety speed operation is commanded with the setting of "MODIFY: ON," the manipulator operates at the safety speed. However, the play speed in memory is modified as set by the speed override.
- Play speed set by the SPEED instruction is not modified.

4.4.1.3 Cancelling Speed Override Settings

- 1. Select {UTILITY} under the menu in the PLAYBACK window.
- 2. Select (SPEED OVERRIDE).
 - The setting of the speed override ratio is cancelled.
 - If cancelled, the speed ratio setting is not displayed on the PLAYBACK window.

The speed override settings are automatically cancelled in the following cases:

• When dry-run speed operation is set.



- When the mode is changed to any mode other than the play mode.
- When an alarm or error occurs.
- When one cycle operation is completed with the END instruction.
- When the power supply is turned OFF.

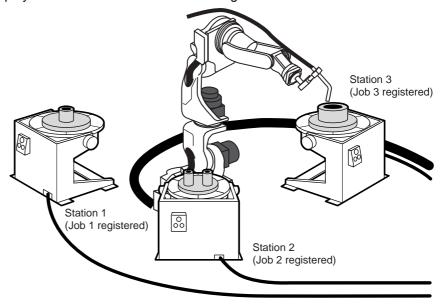
DX100

4.5 Playback with Reserved Start

4.5 Playback with Reserved Start

4.5.1 Preparation for Reserved Start

In the reserved start function, jobs registered at different stations are played back in the reserved order using the start buttons on the stations.



For example, in the case where three stations handle three different workpieces, as shown in the illustration above, the jobs would be registered as follows:

- Job 1 is registered to process workpiece 1 at Station 1
- Job 2 is registered to process workpiece 2 at Station 2
- Job 3 is registered to process workpiece 3 at Station 3

To play back the jobs, prepare workpiece 1 and press the start button on Station 1. The manipulator executes Job 1. Prepare workpieces 2 and 3 while Job 1 is being executed, and press the start buttons on Stations 2 and 3. Even if Job 1 is being executed at that time, jobs on different stations are reserved in the order that the start buttons have been pressed, and will be executed in that order.

During playback, the status of the reservation can be checked on the start reservation window.

DX100

4.5 Playback with Reserved Start

4.5.1.1 Enabling Reserved Start

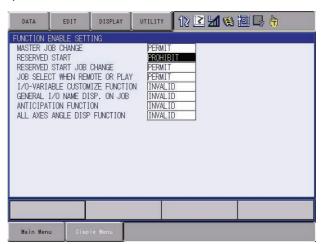
The start button on the station is operative when the reserved start function is enabled, and the following start operations are disabled.

- [START] on the programming pendant
- Start operation from external input signal (system input)

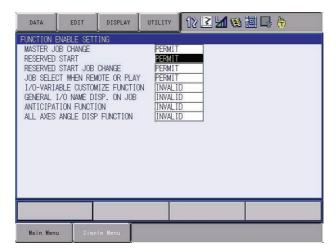


The OPERATING CONDITION window is shown only when the security mode is management mode.

- 1. Select {SETUP} under the main menu.
- 2. Select {OPERATE COND}.
 - The OPERATING CONDITION window appears.
 - The screen is scrolled up/down by the cursor key when it locates at the top/bottom of the items.



- 3. Select "RESERVED START."
 - Each time [SELECT] is pressed, "PERMIT" and "PROHIBIT" alternate. Select "PERMIT."



4 Playback

4.5 Playback with Reserved Start



When the reserved start is enabled, the external start and the programming pendant start are prohibited even if setting is "PERMIT."

Regardless of the operation cycle selected, it is automatically set to 1 CYCLE.

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4.5 Playback with Reserved Start

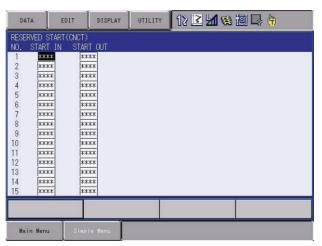
4.5.1.2 Registering Reserved Start I/O Signal

Register the start I/O signal as a preparation to perform the start operation from the station.

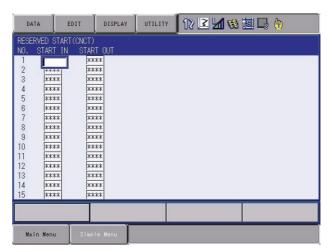


This operation can be done only when the operation mode is the teach mode and the security mode is the management mode, and only when the setting of "RESERVED START JOB CHANGE" is "PERMIT" in the OPERATING CONDITION window.

- 1. Select {SETUP} under the main menu.
- 2. Select {RES. START(CNCT)}.
 - The RESERVED START (CNCT) window appears.



- 3. Select "START IN" or "START OUT" for each station.
 - The number can now be entered.

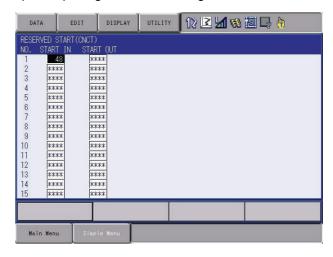


4. Input signal number and press [ENTER].

DX100 4.5

4 Playback

- 4.5 Playback with Reserved Start
 - The input/output signal number is registered.



DX100

4.5 Playback with Reserved Start

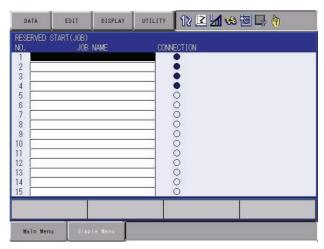
4.5.1.3 Registering Jobs to Stations

Register the starting job of each station.

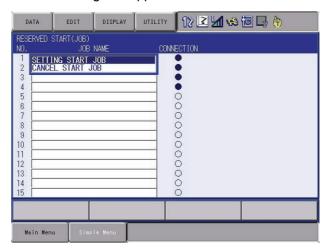


This operation can be done only when the operation mode is the teach mode and the setting of "RESERVED START JOB CHANGE" is "PERMIT" in the OPERATING CONDITION window.

- 1. Select {JOB} under the main menu.
- 2. Select {RES. START(JOB)}.
 - The RESERVED START (JOB) window appears.
 - indicates that the input/output number is registered.
 - O indicates that the input/output number is not registered.

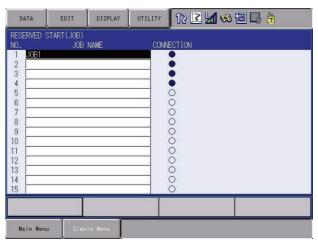


- 3. Select the job name for each station.
 - The selection dialog box appears.



- 4. Select "SETTING START JOB."
 - The JOB LIST window appears.
- 5. Select a job.

- 4
- Playback Playback with Reserved Start 4.5
 - The starting job is registered.



DX100

4.5 Playback with Reserved Start

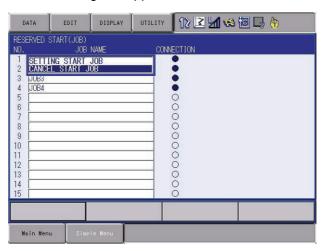
4.5.1.4 Deleting Registered Jobs from Stations

Delete the registered job of each station.

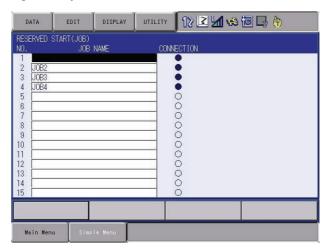


This operation can be done only when the operation mode is the teach mode and the setting of "RESERVED START JOB CHANGE" is "PERMIT" in the operation condition display.

- 1. Select {JOB} under the main menu.
- 2. Select {RES. START(JOB)}.
 - The RESERVED START (JOB) window appears.
- 3. Select the job name of the station to be deleted.
 - The selection dialog box appears.



- 4. Select "CANCEL START JOB."
 - The registered job is deleted.



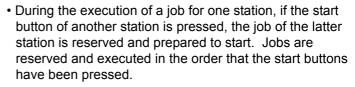
DX100

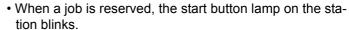
4.5 Playback with Reserved Start

4.5.2 Playback from Reserved Start

4.5.2.1 Start Operation

- 1. Set the mode switch to "PLAY."
- 2. Press start button on the station.
 - The job registered for the station starts up and the manipulator performs one cycle operation.
 - While the job is being executed, the start button lamp on the station lamps.
 - If the workpiece must be prepared at the station, prepare it before pressing the start button.





- No station job is reserved when it is being executed even if its start button is pressed.
- To suspend a job being executed, perform the Hold operation



Reservations are cancelled when the start button is pressed again during the job reservation operation.

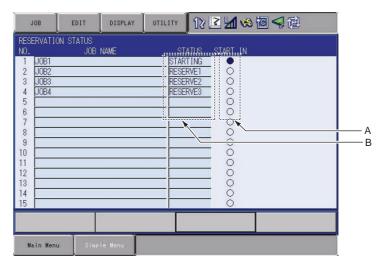
DX100

4.5 Playback with Reserved Start

4.5.2.2 Checking Job Reservation Status

The job reservation status during playback can be checked.

- 1. Select {JOB} under the main menu.
- 2. Select {RES. STATUS}.
 - The RESERVATION STATUS window appears.



A. STATUS

Reservation status is displayed.

STARTING: Indicates the station currently working.

STOP: Indicates any station where work has been temporarily stopped by a hold operation.

RESERVE1,RESERVE2,...: Indicates the order in which jobs have been reserved for start.

B.START IN

Input signal status is displayed.

"●": Input signal ON

"O": Input signal OFF

DX100

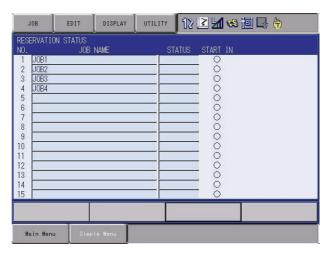
4.5 Playback with Reserved Start

4.5.2.3 Resetting Job Reservation



If "STARTING" is displayed, the job cannot be reset.

- 1. Select {JOB} on the RESERVATION STATUS window.
- 2. Select {RESET RESERVATION} or {RESET ALL}.
 - When {RESET RESERVATION} is selected, job reservation stated to "RESERVE" is reset.
 - When {RESET ALL} is selected, job reservation stated to "STOP" and "RESERVE" is reset.



- The confirmation dialog box appears.



3. Select "YES."

All job reservations are reset automatically in the following conditions:



- When the reserved start sets to "PROHIBIT." (When "RESERVED START" is set to "PROHIBIT" on the OPER-ATING CONDITION window.)
- When another job is called or an edit operation is performed.

4 Playback

4.5 Playback with Reserved Start

4.5.3 Hold Operation

Hold operation causes the manipulator to stop all motion. It can be performed by the following buttons or signal.

- [HOLD] on the programming pendant
- External Input Signal (system input)
- · Hold button for the station axis



[HOLD] lamp lights while it is held down. At the same time, [START] lamp goes OFF.

4.5.3.1 [HOLD] on the Programming Pendant

■ Hold

- 1. Press [HOLD] on the programming pendant.
 - The manipulator stops temporarily.
 - The [HOLD] lamp lights while the [HOLD] button is held down.

■ Release

- 1. Press the start button on the suspended station.
 - The manipulator restarts its operation from the position where it was stopped.

4.5.3.2 Hold by External Input Signal (System Input)

■ Hold

- 1. Input ON signal to the external input (system input) specified for the hold operation.
 - The manipulator stops temporarily.



The hold lamp for the external output signal lights.

 The [HOLD] lamp on the programming pendant lights and the [START] lamp turns OFF.

■ Release

- 1. Input OFF signal to the external input (system input) specified for the hold operation.
 - Hold is released.
- 2. To continue the operation, press the start button on the suspended station.
 - The manipulator restarts its operation from the position where it was stopped.

- 4 Playback
- 4.5 Playback with Reserved Start

4.5.3.3 Hold at the Station

■ Hold

- 1. Press the hold button on the station.
 - The manipulator stops temporarily.



■ Release

- 1. Press the hold button on the suspended station.
 - Hold is released.
 - Press the start button on the station, then the manipulator restarts its operation from the position where it was stopped.



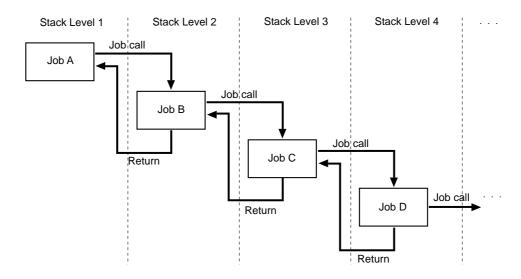
Pressing the start button on a station that is not in the Hold status does not start manipulator operation. The job registered for the station is reserved or the reservation, if it has been made, is canceled.

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4.6 Displaying Job Stack

4.6 Displaying Job Stack

During the execution of the series of jobs that combined with CALL or JUMP instructions, the job stack can be displayed to check where the current job is and how many jobs are left.



SUPPLE-MENT

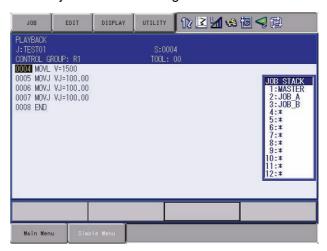
Job calls can be used for up to 12 stack levels.

- 1. Select {DISPLAY} under the menu on the PLAYBACK window.
 - The pull-down menu appears.



- 2. Select {JOB STACK}.
 - The job stack status dialog box appears.

- 4 Playback
- 4.6 Displaying Job Stack
 - To close the job stack status dialog box, select {DISPLAY} and then {JOB STACK} under the menu again.



 For above example, the playback of Job C is being executed and the Job C is called from Job B. Also, the Job B is called from Job A. 5

5 Editing Jobs

This section explains how to manage the jobs without moving the manipulator. Copying, deleting, and modifying of the jobs can be done only in the teach mode. Other operations can be done in any mode.



Edit operations are restricted when the edit lock is applied.

Editing Move Instructions

See *chapter 3 "Teaching" at page 3-1* for basic information on editing move instructions.

- It is not possible to add, delete, or modify move instructions which have position data. See *chapter 3.4 "Modifying Steps"* at page 3-28 for details.
- The following MOV instruction edit operations are explained in this section:



For move instructions:

- Insertion, deletion, or modification of additional items
- Modification of interpolation type or play speed for move instructions
- Setting, modification, or deletion of UNTIL statements (interruption conditions based on input signals)
- Setting and deletion of NWAIT instructions

For move instructions using position variables:

• Insertion and deletion of move instruction.



Refer to chapter 1.2.6 "Character Input Operation" at page 1-18 for the character input operation.

5.1 Copying Jobs

5.1 Copying Jobs

This operation is used to copy registered jobs and use them to create new jobs. It can be done using either the JOB CONTENT window or the JOB LIST window.

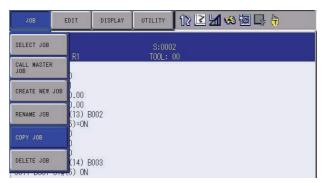
5.1.0.1 Copying Jobs on the JOB CONTENT Window

On the JOB CONTENT window, the current edit job becomes the copy source job.

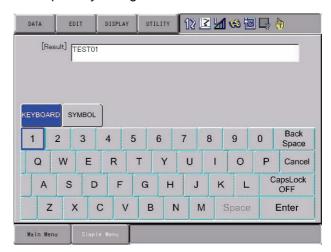
- 1. Select {JOB} under the main menu.
- 2. Select {JOB}.
 - The JOB CONTENT window appears.



3. Select {JOB} → {COPY JOB} under the pull-down menu.



- 4. Input the job name.
 - Input the new job name.
 - The name of the copy source job is displayed on the input area. It is possible to partially change this name to enter a new name.



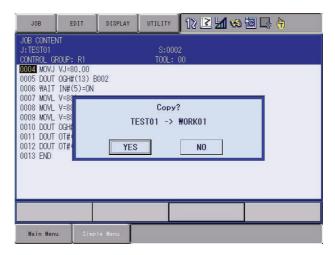
5.1 Copying Jobs



See chapter 1.2.6 "Character Input Operation" at page 1-18 for information on letter input operations.

5. Press [ENTER].

- The confirmation dialog box appears.
- If "YES" is selected, the job is copied and the new job appears.
- If "NO" is selected, the job copy is not executed, and the process is cancelled.



	5	Editing Jobs
DX100	5.1	Copying Jobs

5.1.0.2 Copying Jobs on the JOB LIST Window

On the JOB LIST window, select the copy source job from the registered jobs and specify the copy destination directory.

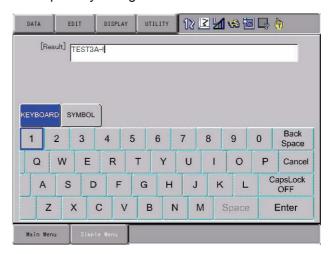
- 1. Select $\{JOB\} \rightarrow \{SELECT\ JOB\}$ under the main menu.
 - The JOB LIST window appears.



- 2. Move the cursor to the copy source job.
- 3. Select $\{JOB\} \rightarrow \{COPY JOB\}$ under the pull-down menu.



- 5 Editing Jobs
- 5.1 Copying Jobs
- 4. Input the job name.
 - Input the new job name.
 - The name of the copy source job is displayed on the input area. It is possible to partially change this name to enter a new name.

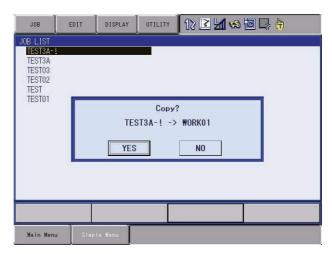




See chapter 1.2.6 "Character Input Operation" at page 1-18 for information on letter input operations.

5. Press [ENTER].

- The confirmation dialog box appears.
- If "YES" is selected, the job is copied and the new job appears.
- If "NO" is selected, the job copy is not executed, and the process is cancelled.



5.2 **Deleting Jobs**

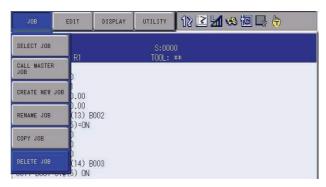
5.2 **Deleting Jobs**

This operation is used to delete jobs that are registered on the DX100. It can be performed in either the JOB CONTENT window or the JOB LIST window.

5.2.0.1 Deleting Jobs on the JOB CONTENT Window

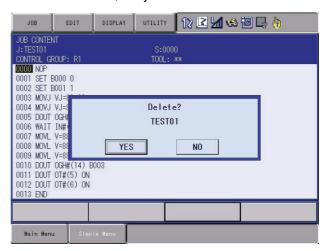
On the JOB CONTENT window, the current edit job is deleted.

- 1. Select {JOB} under the main menu.
- 2. Select {JOB}.
 - The JOB CONTENT window appears.
- 3. Select {JOB} → {DELETE JOB} under the pull-down menu.



4. Press "YES".

- The confirmation dialog box appears.
- When "YES" is selected, the edit job is deleted. When deletion is completed, the JOB LIST window appears.
- When "NO" is selected, the job deletion is cancelled.



DX100

5.2 Deleting Jobs

5.2.0.2 Deleting Jobs on the JOB LIST Window

On the JOB LIST window, select the job to be deleted from the list of the registered jobs.

- 1. Select {JOB} → {SELECT JOB} under the main menu.
 - The JOB LIST window appears.

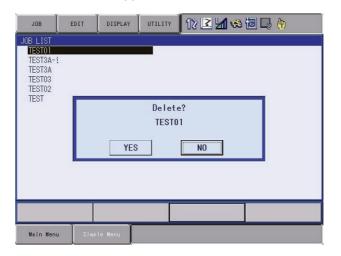


- 2. Move the cursor to the job to be deleted.
- 3. Select $\{JOB\} \rightarrow \{DELETE\ JOB\}$ under the pull-down menu.



4. Press "YES".

- The confirmation dialog box appears.
- When "YES" is selected, the selected job is deleted. When deletion is completed, the JOB LIST window appears.
- If "NO" or [CANCEL] is selected, the job deletion is cancelled and the JOB LIST window appears.





To select all the registered jobs at a time, select {EDIT} from the menu and then select "SELECT ALL."

DX100

5.3 Modifying Job Names

5.3 Modifying Job Names

This operation is used to modify the name of a job that is registered. The operation can be performed in either the JOB CONTENT window or the JOB LIST window.

5.3.0.1 Modifying Job Names on the JOB CONTENT Window

- 1. Select {JOB} under the main menu.
- 2. Select {JOB}.
 - The JOB CONTENT window appears.



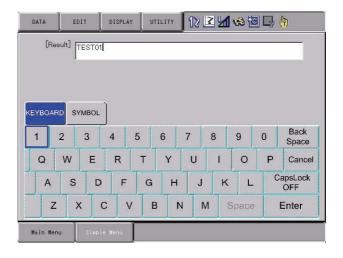
3. Select {JOB} → {RENAME JOB} under the pull-down menu.



- 4. Input the job name.
 - Input the new job name.
 - The name of the source job is displayed on the input area. It is possible to partially change this name to enter a new name.

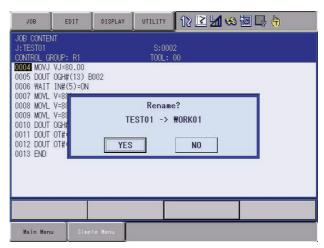


See chapter 1.2.6 "Character Input Operation" at page 1-18 for information on letter input operations.



5.3 Modifying Job Names

- 5. Press [ENTER].
 - The confirmation dialog box appears.
 - When "YES" is selected, the job name is changed and a new job name is displayed.
 - When "NO" is selected, the job name is not changed, and the process is cancelled.



DX100

5.3 Modifying Job Names

5.3.0.2 Modifying Job Names on the JOB LIST Window

On the JOB LIST window, select the job whose name is to be modified from the list of the registered jobs.

- 1. Select {JOB} → {SELECT JOB} under the main menu.
 - The JOB LIST window appears.



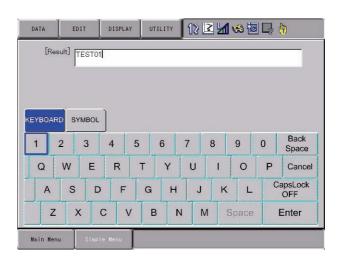
- 2. Move the cursor to the name to be changed.
- 3. Select {JOB} → {RENAME JOB} under the pull-down menu.



- 4. Input the job name.
 - Input the new job name.
 - The name of the source job is displayed on the input area. It is possible to partially change this name to enter a new name.



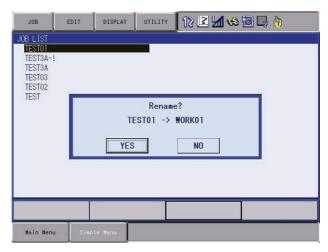
See chapter 1.2.6 "Character Input Operation" at page 1-18 for information on letter input operations.



- 5. Press [ENTER].
 - The confirmation dialog box appears.
 - When "YES" is selected, the job name is changed and a new job name is displayed.

DX100

- 5.3 Modifying Job Names
 - When "NO" is selected, the job name is not changed, and the process is cancelled.



5.4 DX100 **Editing Comments**

5.4 **Editing Comments**

Comments of up to 32 characters can be added to each job to identify each job more specifically. Comments are displayed and edited on the JOB HEADER window.

- 1. Select {JOB} under the main menu.
- 2. Select {JOB}.
- 3. Select {DISPLAY} under the pull-down menu.
- 4. Select {JOB HEADER}.
 - The JOB HEADER window appears.



- Select "COMMENT."
 - The window for character input appears.
- 6. Input comments.
 - Input comments.
 - For the jobs that are already registered, comments are displayed on the input area. It is possible to partially change comments to enter new comments.



See chapter 1.2.6 "Character Input Operation" at page 1-18 for information on letter input operations.



5.4 **Editing Comments**

7. Press [ENTER].

The comment on the input area is registered and is displayed on the "COMMENT" area in the JOB HEADER window.



DX100

5.5 Setting Edit Lock on Individual Job Units

5.5 Setting Edit Lock on Individual Job Units

In order to prevent inadvertent changes in the registered jobs or data, it is possible to set the edit lock to each job. When the edit lock is ON, the job cannot be edited or deleted.

The edit lock can be set and cancelled on the JOB HEADER window.



Setting of the edit lock can be changed only when the security mode is management mode.

- 1. Select {JOB} under the main menu.
- 2. Select {JOB}.
- 3. Select {DISPLAY} under the pull-down menu.
- 4. Select {JOB HEADER}.
 - The JOB HEADER window appears.



- 5. Select "EDIT LOCK" and set the edit prohibit.
 - Each time [SELECT] is pressed, the setting alternates between "ON" (edit disabled) and "OFF" (edit enabled).

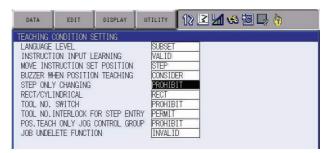
DX100

5.6 Enabling the Modification of Position Data Only

5.6 Enabling the Modification of Position Data Only

Even in the edit-locked job, the position data can be modified.

- 1. Select {SETUP} under the main menu.
- 2. Select {TEACHING COND}.
 - The TEACHING CONDITION SETTING window appears.





TEACHING CONDITION SETTING window is shown only when the security mode is edit mode or management mode.

- 3. Select "STEP ONLY CHANGING" and press [SELECT].
 - Each time [SELECT] is pressed, the setting alternates between "PROHIBIT" and "PERMIT."

6.1 One-touch Operation "Direct Open"

6 Convenient Functions

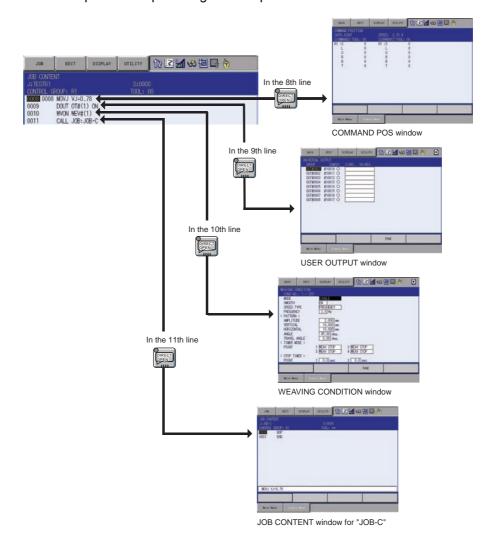
6.1 One-touch Operation "Direct Open"

The direct open function immediately shows the JOB CONTENT window or condition file contents of a job called by the CALL instruction. Move the cursor to the desired job name or condition file name and simply press the

direct open key to display the contents of the file. This function can be used for the following window:

- JOB CONTENT window for a job name directly specified by a CALL instruction
- CONDITION FILE window for a file name directly specified by a work instruction
- COMMAND POS window for a move instruction
- I/O window with an I/O instruction (when I/O numbers are specified)

<Example > Example Using Direct Open



DX100

- 6 Convenient Functions
- 6.1 One-touch Operation "Direct Open"
- 1. In the JOB CONTENT window, move the cursor to the job name or the condition file for which the window is to be displayed.
- 2. Press the direct open key



- This key lamp lights and the JOB CONTENT window or the condition file window appears.
- When the direct open key is pressed once again, the key lamp turns OFF, and the window returns to the former JOB CONTENT window.

• The direct open function cannot be used again while a directly opened window is shown.



- If another window is selected while the direct open function is effective, the function is automatically cancelled and the lamp on the direct open key goes out.
- Once another JOB CONTENT window is opened by the direct open function, the former job cannot be continuously operated. (Stopped until the opened JOB CONTENT window is closed.)

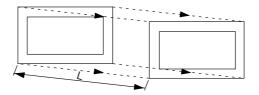
DX100 6.2 Convenient Functions

6.2 Parallel Shift Function

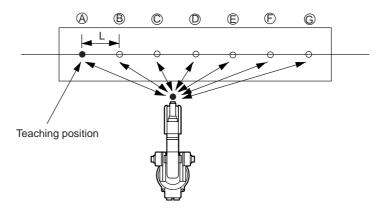
6.2 Parallel Shift Function

6.2.1 Function Overview

Parallel shift refers to the shifting of an object from a fixed position in such a way that all points within the object move an equal distance. In the model for parallel shift shown in the following, the shift value can be defined as the distance L (three-dimensional coordinate displacement). The parallel shift function is relevant to the actual operation of the manipulator because it can be used to reduce the amount of work involved in teaching by shifting a taught path (or position.)



In the example in the figure below, the taught position A is shifted in increments of the distance L (this is actually a three-dimensional XYZ displacement that can be recognized by the robot) in order to enable the operation that was taught at position A to also be performed at positions B through G.



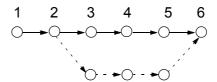
DX100 6.2 Convenient Functions

6.2 Parallel Shift Function

6.2.1.1 Parallel Shift of Step

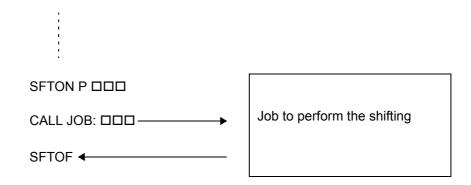
The block from the SFTON to the SFTOF instructions is subject to the shift operation.

Line (Step) Instruction NOP 0000 0001(001) MOVJ VJ=50.00 0002(002) MOVL V=138 0003 SFTON PDDDUF# (1) 0004(003) MOVL V=138 Shifted block 0005(004) MOVL V=138 0006(005) MOVL V=138 0007 **SFTOF** 0008(006) MOVL V=138



6.2.1.2 Parallel Shift of Job

When shifting an entire series of operations, the range to be shifted by the shift instruction can be set using the method indicated above, but the method shown in the following, in which just the part to be shifted is made into a separate job, can also be used.

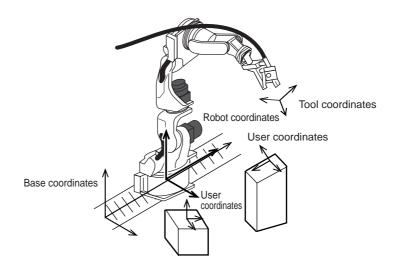


6.2 Parallel Shift Function

6.2.2 Setting the Shift Value

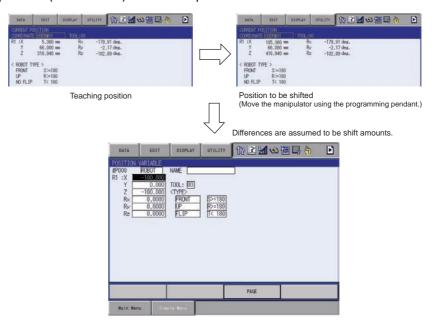
6.2.2.1 Coordinate Systems

The shift value for parallel shift is X, Y, and Z increment in each coordinates. There are four coordinates: base coordinates, robot coordinates, tool coordinates, and user coordinates. In systems with no servo track, the base coordinates and robot coordinates are the same.



6.2.2.2 Setting the Shift Value

When setting the shift value for the position variables, use the current position (coordinates) of the manipulator in the window.



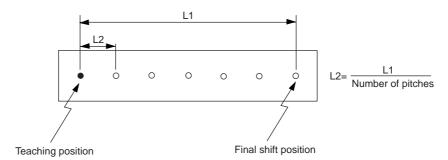
The shift value is the X, Y, and Z difference between the shift position and teaching position and the difference in angular displacement RX, RY, And RZ (normally set at "0"). If shifting is executed at equal pitch intervals, for example for palletizing, find the difference between the teaching position

DX100 6.2

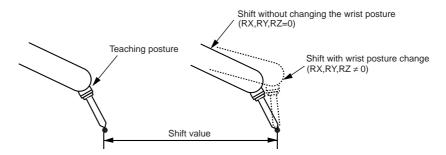
6 Convenient Functions

6.2 Parallel Shift Function

and the final shift position, then divide by the number of pitch intervals (number of divisions) to calculate the shift value per pitch.



The posture of the wrist is defined by the angular displacement of the coordinates of the wrist axes. Consequently, if the shift value is specified with X, Y, and Z only (RX, RY, RZ=0), the wrist is shifted while maintaining the same posture as at the teaching point. Since shifting is normally performed without changing the posture, there is no need to specify an angular displacement for the wrist. The motion when a parallel shift is performed is shown in the following:



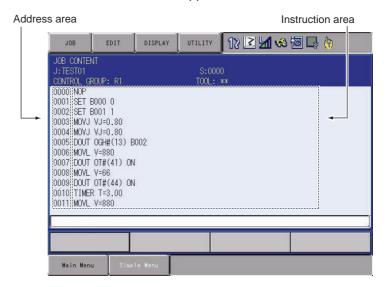
The shift value is calculated on the position data window for the coordinates in which the shift is performed. Since this is normally performed in the user coordinates, the position data window for the user coordinates is used.

DX100 6.2 Parallel Shift Function

6.2.3 Registering Shift Instructions

To register the instruction, move the cursor to the address area in the JOB CONTENT window during teach mode as follows:

- 1. Select {JOB} under the main menu.
- 2. Select {JOB}.
 - The JOB CONTENT window appears.



3. Move the cursor to the address area.

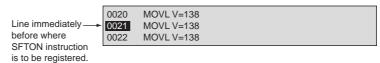
DX100

6.2 Parallel Shift Function

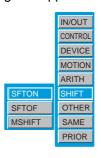
6.2.3.1 SFTON Instruction

This is the instruction that starts a parallel shift.

1. Move the cursor to the line immediately before where the SFTON instruction is to be registered.



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



- 3. Select (SHIFT).
- 4. Select the SFTON instruction.
 - The SFTON instruction is displayed in the input buffer line.
- 5. Modify the additional items or number values as required.
 - <When Nothing is to be Changed> Proceed to Step 6.
 - <When Editing Additional Items>
 - Adding or modifying additional items
 To change the position variable number, move the cursor to the position variable number and press [SHIFT] + the cursor key to increase or decrease the value.



To directly input the value using the Numeric keys, press [SELECT] to display the input buffer line.

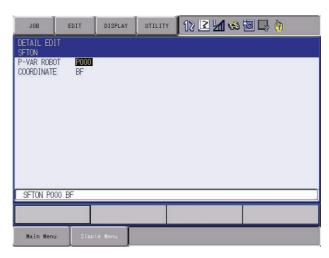


After the number is input, press [ENTER] to modify the number value in the input buffer line.

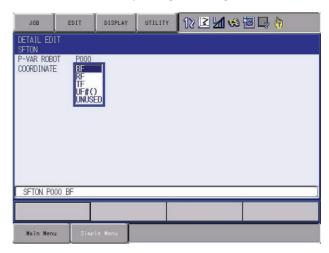
 Adding the coordinate system in which the shift is performed Move the cursor to the instruction in the input buffer line and press [SELECT]. The DETAIL EDIT window appears.



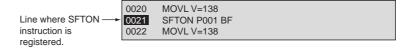
6.2 Parallel Shift Function



 Line up the cursor with "UNUSED" and press [SELECT]. The selection dialog box appears. Line up the cursor with the coordinate system to be added, and press [SELECT].



- After the coordinate system addition is completed, press [ENTER].
 The DETAIL EDIT window closes and the JOB CONTENT window appears.
- 6. Press [INSERT] and then [ENTER].
 - The instruction displayed in the input buffer line is registered.



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- 6 Convenient Functions
- 6.2 Parallel Shift Function

6.2.3.2 SFTOF Instruction

This is the instruction that ends a parallel shift.

1. Move the cursor to the line immediately before where the SFTOF instruction is to be registered.



- 2. Press [INFORM LIST].
 - The instruction list dialog box appears.
- 3. Select {SHIFT}.
- 4. Select the SFTOF instruction.
 - The SFTOF instruction is displayed in the input buffer line.



- 5. Press [INSERT] and then [ENTER].
 - The SFTOF instruction is registered.



DX100

6.2 Parallel Shift Function

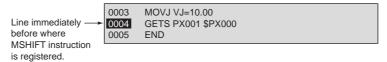
6.2.3.3 MSHIFT Instruction

When a parallel shift of the wrist posture is attempted, the manipulator may not be shifted to the target posture in the following cases.

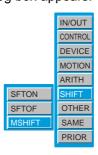
- Posture displacement (Rx, Ry, Rz) is specified to the shift value set by the user.
- When a displacement between two points is calculated using an INFORM operating instruction (ADD instruction, SUB instruction, etc.), and a posture displacement (Rx, Ry, Rz) is specified in the shift value.

In such cases, the MSHIFT instruction can be used to automatically calculate the optimum shift value for an operation to reach the target shift position and posture. With an MSHIFT instruction, the shift value between the reference position and the target position (shift position) when the parallel shift is performed is determined in the specified coordinate system, and set as the specified position variable.

1. Move the cursor to the line immediately before where the MSHIFT instruction is to be registered.



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

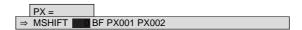


- 3. Select {SHIFT}.
- 4. Select the MSHIFT instruction.
 - The MSHIFT instruction is displayed in the input buffer line.
- 5. Change the number data or additional items as required.
 - <When Nothing is to be Changed>
 Proceed to Step 6.
 - <When Editing Additional Items>
 - Adding or modifying additional items
 To change the position variable number, move the cursor to the position variable number and press [SHIFT] + the cursor key to increase or decrease the value.



To directly input the value using the Numeric keys, press [SELECT] to display the input buffer line.

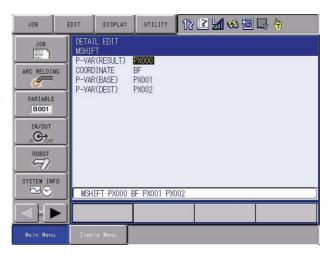
6.2 Parallel Shift Function



After the number is input, press [ENTER] to modify the number value in the input buffer line.

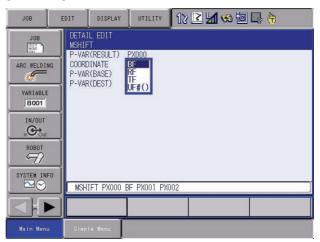
 Changing the coordinate system in which the shift is performed Move the cursor to the instruction in the input buffer line and press [SELECT]. The DETAIL EDIT window appears.





Line up the cursor with "BF" and press [SELECT]. The selection dialog box appears.

Line up the cursor with the coordinate system to be changed, and press [SELECT].



After the coordinate system modification is complete, press [ENTER]. The DETAIL EDIT window closes and the JOB CONTENT window appears.

- 6. Press [INSERT] and then [ENTER].
 - The instruction displayed in the input buffer line is registered.



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6.2 Parallel Shift Function

6.2.4 Continuation of the Parallel Shift Function



CAUTION

- If the shift function is cancelled through a job editing operation after the execution of a parallel shift instruction, the job must be started again from the beginning.
- Because no shift is performed when the operation is restarted, there
 is a possibility of interference between the workpiece and fixture.

If any of the following operations are performed after executing a parallel shift instruction, the shift function is cancelled.

- Job editing operation (changing, deleting, adding)
- Job copy, job name change
- Registering a new job, deleting a job, or modifying a selected job
- · Restart after the alarm occurs
- · When control power is turned OFF



With any operation other than those listed above, the parallel shift function remains in effect .

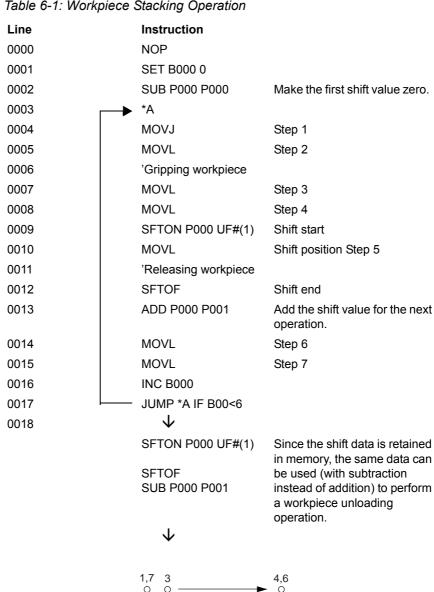
6	Convenient Functions	
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6.2.5 Examples of Use

6.2.5.1 Example of Use of Shift Addition/Subtraction

Table 6-1: Workpiece Stacking Operation



	6	Convenient Functions
DX100	6.2	Parallel Shift Function

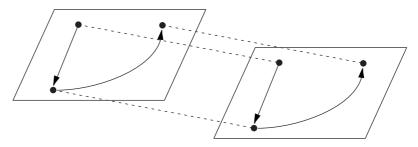
6.2.5.2 Example of Use of MSHIFT Instruction

Line	Instruction	Explanation
0000	NOP	
0001	MOVJ VJ=20.00	Move the manipulator to the reference position.
0002	GETS PX000 \$PX000	Set the reference position as position variable P000.
0003	MOVJ VJ=20.00	Move the manipulator to the target position.
0004	GETS PX001 \$PX000	Set the target position as position variable P001.
0005	MSHIFT PX010 BF PX000 PX001	Set shift value and set it as position variable P010.
0006	END	

6.3 Parallel Shift Job Conversion Function

6.3.1 Function Overview

If the manipulator and base positions are moved after a job has been taught, the entire job has to be modified. The parallel shift conversion function shortens the modification time required in cases like this by shifting all steps of the job by the same value to create a new job.



When the parallel shift conversion is performed, all job steps are shifted by the same value.

Steps Outside the P-point Maximum Envelope

• "/OV" is displayed for the steps which result in a position outside the P-point maximum envelope of the manipulator. When the position is corrected, "/OV" display disappears.

Position Variable



 Position variables are not subject to the parallel shift job conversion.

Not Converted Job

- The following jobs cannot be converted. If conversion is attempted, no operation is performed.
 - · Jobs without any group axes
 - Concurrent jobs (optional)



CAUTION

If a job name after conversion is not specified when executing the
parallel shift job conversion, the position data of the job is shifted
and converted, then the data is overwritten with a new position data
after the shift. Be sure to save the job in the external memory
device or create the same job by copying before executing
conversion.

6.3.2 Coordinate Systems for Conversion

When performing the parallel shift job conversion, it is necessary to specify the coordinate systems in which the conversion is to be performed. The coordinate system can be selected from the following:

- · Base coordinates
- · Robot coordinates
- · Tool coordinates
- User coordinates (64 types)
- Master tool coordinates (R*+R* job)
- · Pulse coordinates

In the case of an ordinary job for which group axes are registered, shift conversion is performed in accordance with the selected coordinate system. The relationship between group combinations and coordinates are shown in the following table.

1 to 4 in the table are followed by their explanations.

Table 6-2: Relationship Between Group Combinations and Coordinates at Conversion

Group	Explanation			
Combination in Job	Usable Coordinate	System		
R	Shift is performed on the basis of selected coordinates.			
	Base coordinates, robot coordinates, tool coordinates, user coordinates, pulse coordinates			
R(B)	Shift is performed on the basis of selected coordinates.			
	1. Base Coordinates	The base axis is shifted by the specified amount and the TCP of the manipulator is shifted by the specified amount in the base coordinates.		
	2. Robot Coordinates	The base axis is shifted by the specified amount. The TCP of the manipulator is shifted by the specified amount in the robot coordinates. These shifts are carried out independently.		
	3. Tool Coordinates	The base axis is shifted by the specified amount. The TCP of the manipulator is shifted by the specified amount in the tool coordinates. These shifts are carried out independently.		
	4. User Coordinates	The base axis is shifted by the specified amount and the TCP of the manipulator is shifted by the specified amount in the user coordinates.		
	5. Pulse Coordinates	The taught position of each axis is shifted by the specified amount on the basis of pulse values.		
S	Shift is performed on the coordinates.	basis of pulse values regardless of the		

Table 6-2: Relationship Between Group Combinations and Coordinates at Conversion

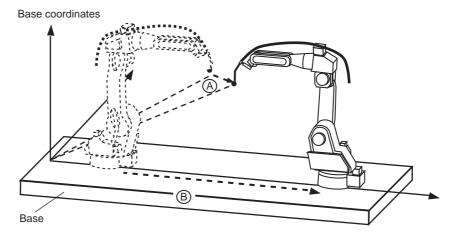
R+S	The manipulator is shifted in the selected coordinates. The station axis is shifted on the basis of pulse values regardless of the coordinates.		
	Base coordinates, robot coordinates, tool coordinates, user coordinates, pulse coordinates		
R(B)+S	The manipulator is shifted in the selected coordinates, as in 1 to 5 above. The station axis is shifted on the basis of pulse values regardless of the coordinates.		
R+R	Two manipulators are shifted in the selected coordinates.		
	Base coordinates, robot coordinates, tool coordinates, user coordinates, master tool coordinates ¹⁾ , pulse coordinates		
R(B)+R(B)	Two manipulators are shifted in the selected coordinate system, as in 1 to 5 above. Two base axes are also shifted.		

¹ In the master tool coordinates, conversion only occurs at the "slave" from the standpoint of the SMOV instruction.

■ About 1 to 4 in the Table

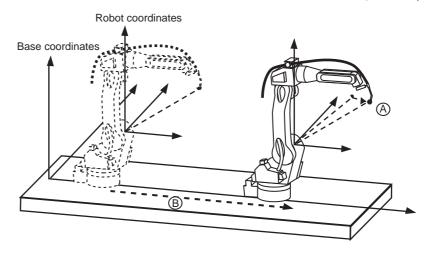
1. Base Coordinates

The base axis is shifted by B and the TCP of the manipulator is shifted by A in the base coordinates.



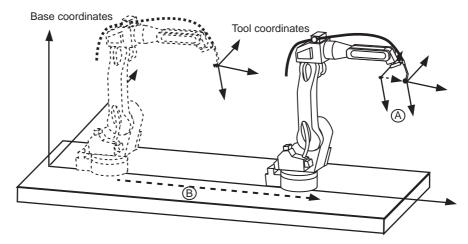
2. Robot Coordinates

The base axis is shifted by B. The TCP of the manipulator is shifted by A in the robot coordinates. These shifts are carried out independently.



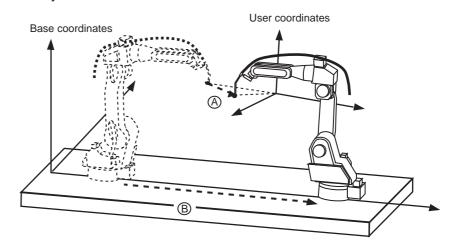
3. Tool Coordinates

The base axis is shifted by B and the TCP of the manipulator is shifted by A in the tool coordinates. These shifts are carried out independently.



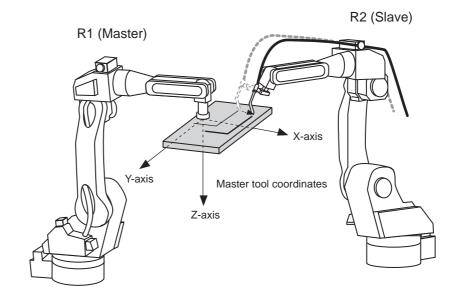
4. User Coordinates

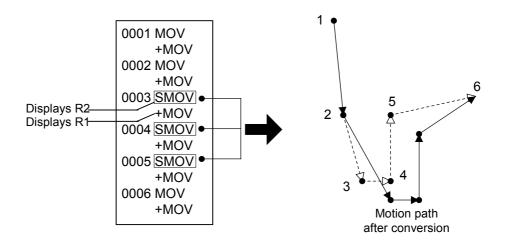
The base axis is shifted by B and the TCP of the manipulator is shifted by A in the user coordinates. These shifts are carried out independently.



■ Converting R*+R* Jobs with Master Tool Coordinates

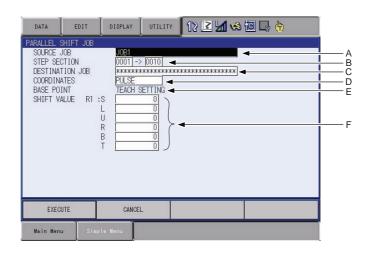
R*+R* coordinated jobs can be subjected to the parallel shift job conversion in the master tool coordinates. Only the steps taken at the "slave" from the standpoint of the SMOV instruction are subject to conversion (i.e. the steps of R2 in the figure below).





6.3.3 Executing the Parallel Shift Job Conversion

6.3.3.1 Window Display



A. SOURCE JOB

Selects the job before conversion. The job which is shown in the JOB CONTENT window is set initially. To change the job, perform the following procedure.

Move the cursor to the job name and press [SELECT]. The JOB LIST window appears. Select the desired job.

B. STEP SECTION (Start Step \rightarrow **End Step)**

Specifies the step section of the source job. All the steps are set initially. If there is no step in the source job, "***" is displayed. To change the section, perform the following procedure.

Move the cursor to the step section indication and press [SELECT]. The input buffer line appears. Input the step number and press [ENTER].

C. DESTINATION JOB

Specifies the converted job. If this is not specified ("*******" is displayed), the source job is overwritten with a job after conversion. If the converted job is specified, the source job is copied and converted. To change the job, perform the following procedure.

Move the cursor to the converted job name indication and press [SELECT]. The character input line appears. The source job name is displayed in the input line. To enter a job name without using the source job name, press [CANCEL] and then input a job name.

D. COORDINATES

Selects the conversion coordinates. Move the cursor to the coordinates name and press [SELECT]. The selection dialog box appears. Select the desired coordinates.

When the user coordinates are selected, the input buffer line appears. Input the desired user coordinate number and press [ENTER].

E. BASE POINT

Calculates the difference by the two teaching points as a shift value.

DX100 6.3 Convenient Functions
6.3 Parallel Shift Job Conversion Function

F. SHIFT VALUE

The axis shown is varied according to the setting of "4. coordinates" above.

Move the cursor to the input box and press [SELECT] to directly input the shift value.

If the shift value is calculated by the two teaching points, the difference is shown as a shift value.

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6.3 Parallel Shift Job Conversion Function

6.3.3.2 Parallel Shift Job Conversion Operation

There are two methods for specifying the shift value.

- Directly input the shift value by numerical value.
- Calculate the shift value by teaching the original base point and converted base point.

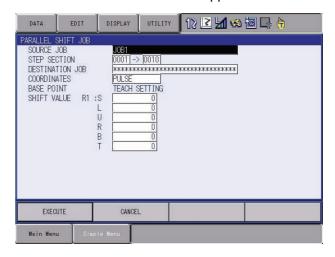


The method using position variables by parameter setting is described in *chapter 6.3.4* "Specifying the Shift Value by Position Variables" at page 6-29 other than above two methods.

The following are the operation procedures by each setting of shift value for parallel shift job conversion.

■ Numerical Value Input

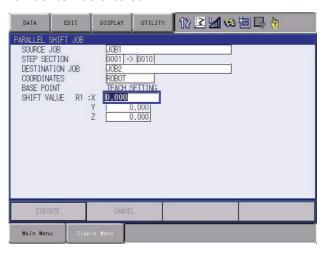
- 1. Select {JOB} under the main menu.
- 2. Select {JOB}.
 - The JOB CONTENT window appears.
- 3. Select {UTILITY} under the pull-down menu.
- 4. Select {PARALLEL SHIFT JOB}.
 - The PARALLEL SHIFT JOB window appears.



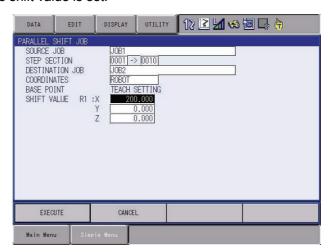
- 5. Specify the conversion items.
 - Specify each item.

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- 6.3 Parallel Shift Job Conversion Function
- 6. Select the shift value to be set.
 - The number can be entered.



- 7. Type the shift value using the Numeric keys.
- 8. Press [ENTER].
 - The shift value is set.



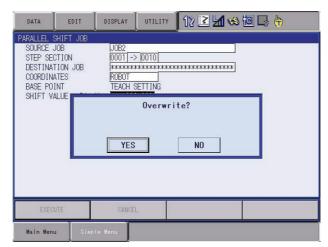
- 9. Display the PARALLEL SHIFT JOB window. Select "EXECUTE."
 - The confirmation dialog box appears when the converted job is not specified. Select "YES" then the conversion is executed.
 - The JOB CONTENT window appears when the conversion is completed.

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- 6 Convenient Functions
- 6.3 Parallel Shift Job Conversion Function

 When "CANCEL" is selected, the display goes back to the JOB CONTENT window without executing conversion.





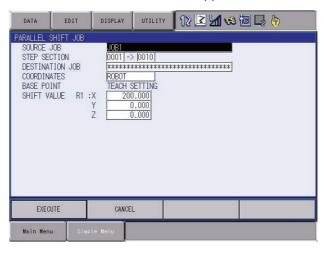
If an alarm occurs during conversion, conversion is suspended.

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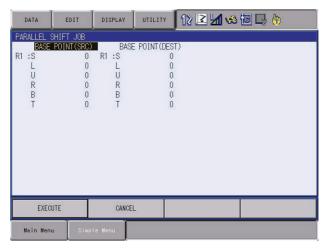
6.3 Parallel Shift Job Conversion Function

Calculation by Teaching

- 1. Select {JOB} under the main menu.
- 2. Select {JOB}.
 - The JOB CONTENT window appears.
- 3. Select {UTILITY} under the pull-down menu.
- 4. Select {PARALLEL SHIFT JOB}.
 - The PARALLEL SHIFT JOB window appears.

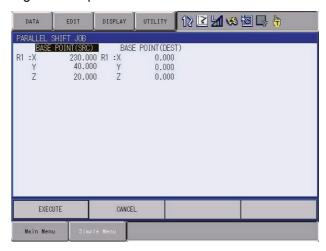


- 5. Specify the conversion items.
 - Specify each item.
- 6. Display the PARALLEL SHIFT JOB window. Select "TEACH SETTING" in the item of "BASE POINT."
 - The BASE POINT window appears.

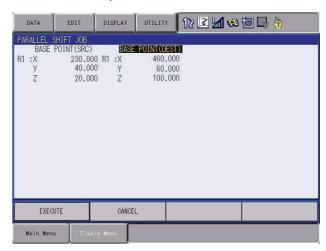


- 7. Select "BASE POINT(SRC)."
- 8. Move the manipulator to the original base point by the axis keys.

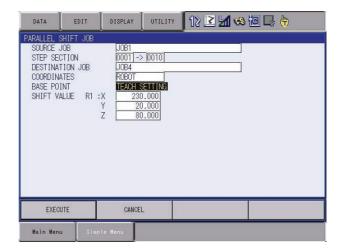
- 6.3 Parallel Shift Job Conversion Function
- 9. Press [MODIFY] and [ENTER].
 - The original base point is set.



- 10. Select "BASE POINT(DEST)."
- 11. Move the manipulator to the converted base point by the axis keys.
- 12. Press [MODIFY] and [ENTER].
 - The conversion base point is set.

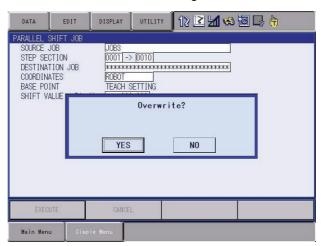


- 13. Touch "EXECUTE."
 - The difference is calculated by the two teaching points and set as a shift value.



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- 6 Convenient Functions
- 6.3 Parallel Shift Job Conversion Function
- 14. Display the PARALLEL SHIFT JOB window. Select "EXECUTE."
 - The confirmation dialog box appears when the converted job is not specified. Select "YES" then the conversion is executed.
 - The JOB CONTENT window appears when the conversion is completed.
 - When "CANCEL" is selected, the display goes back to the JOB CONTENT window without executing conversion.





If an alarm occurs during conversion, conversion is suspended.

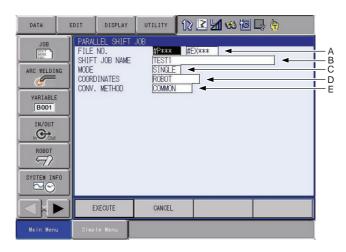
6.3.4 Specifying the Shift Value by Position Variables

The shift value can be specified using position variables by parameter settings.

Parameter S2C652: SHIFT VALUE FOR PARALLEL SHIFT JOB CONVERSION

- 0: Shift value by numeral/teaching (Initial setting)
- 1: Position variable shift value

6.3.4.1 Window Display



A. FILE NO.

Specifies position variables.

B. SHIFT JOB NAME

The job which was shown in the JOB CONTENT window is set initially. To change the job, perform the following procedure.

Move the cursor to the conversion job name and press [SELECT]. The JOB LIST window appears. Move the cursor to the desired job and press [SELECT]. The PARALLEL SHIFT JOB window reappears, and the job name which was selected is shown.

C. MODE

Specifies the conversion mode.

SINGLE (INDEPENDENT JOB CONVERSION)

Only the selected job is converted even if the selected job includes the jobs called by JUMP or CALL instructions. Related jobs are not converted

RELATIVE (RELATIVE JOB CONVERSION)

Both the selected job and all the related jobs (the jobs called by JUMP or CALL instructions) are converted.

For details of each conversion mode, refer to *chapter 6.3.4.2* "Jobs Targeted for Conversion".

D. COORDINATES

Selects the conversion coordinates.

Move the cursor to the coordinates name and press [SELECT]. The selection dialog box appears. Select the desired coordinates.

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6 Convenient Functions

6.3 Parallel Shift Job Conversion Function

When the user coordinates are selected, the input buffer line appears. Input the desired user coordinate number and press [ENTER].

E. CONV. METHOD

Specifies the conversion methods of related jobs such as a coordinated job with two manipulators or the system with multiple stations.

COMMON (COMMON SHIFT)

All the manipulators (or all the bases, or all the stations) are converted by the same shift value.

EACH (INDIVIDUAL SHIFT)

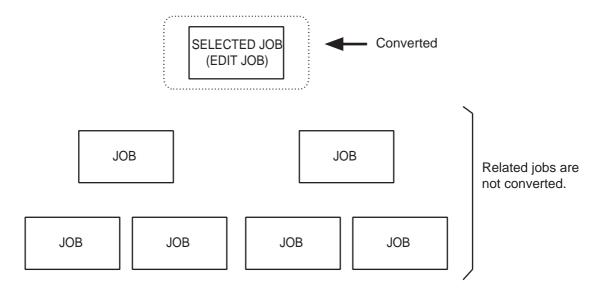
Each manipulator (or each base, or each station) is converted separately by different shift values.

For details of each conversion method, refer to *chapter 6.3.4.3* "Conversion of Coordinated Jobs" at page 6-32.

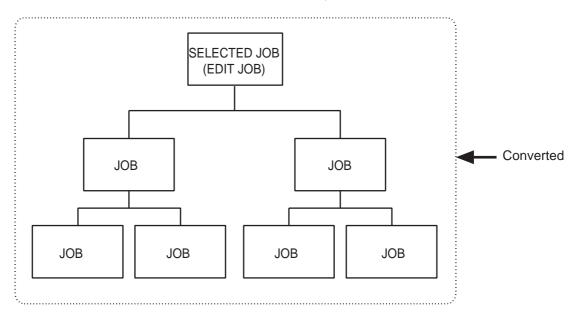
6.3.4.2 Jobs Targeted for Conversion

There are two ways to specify the job to be converted as described in the following:

Independent Job Conversion
 Only the selected job is converted even if the selected job includes
 the jobs called by JUMP or CALL instructions. Related jobs are not
 converted.



Related Job Conversion
 Both the selected job and all the related jobs (the jobs called by JUMP or CALL instructions) are converted.



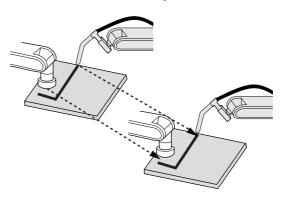
6.3.4.3 Conversion of Coordinated Jobs

There are two ways to convert a related job such as a coordinated job with two manipulators or the system with multiple stations as described in the following:

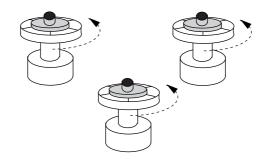
■ Common Shift

All the manipulators (or all the bases, or all the stations) are converted by the same shift value.

Coordinated job with R1+R2



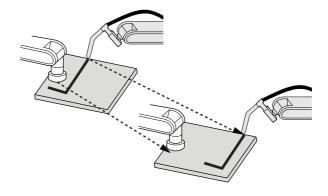
The system with multiple stations



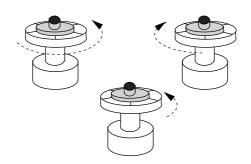
■ Individual Shift

Each manipulator (or each base, or each station) is converted separately by different shift values.

Coordinated job with R1+R2



The system with multiple stations



■ Variables used in an individual shift

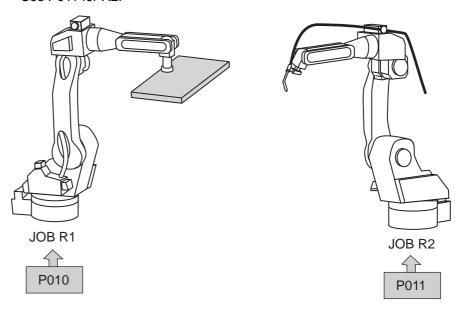


Be sure to use the variables of which numbers are consecutive after the selected number. The variables of which numbers are not consecutive are unable to be selected.

Example 1) When selecting P010 for a coordinated job with R1 + R2: $\frac{1}{2}$

Use P010 for R1.

Use P011 for R2.



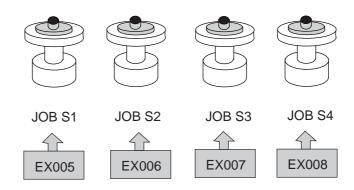
Example 2) When selecting EX005 for multiple jobs with four stations:

Use EX005 for S1.

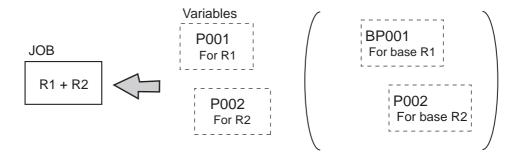
Use EX006 for S2.

Use EX007 for S3.

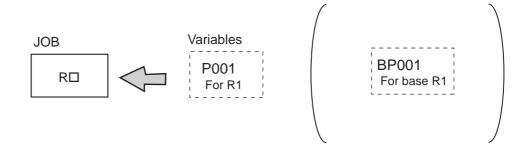
Use EX008 for S4.



- Relation between variables and jobs for conversion in an individual shift
- In the case of independent job conversion:
 - Coordinated job with R1 + R2 Different shift values can be set for each manipulator and base.



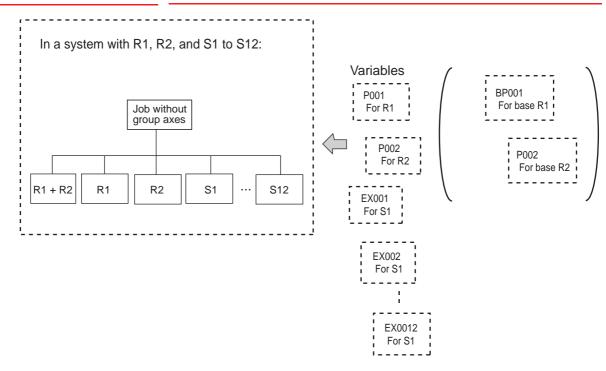
• Job with R□ (+ S□)
Use one variable for a job with one manipulator.



- In the case of related job conversion:
 - Different shift values can be set for each manipulator, base, and station.

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6.3 Parallel Shift Job Conversion Function

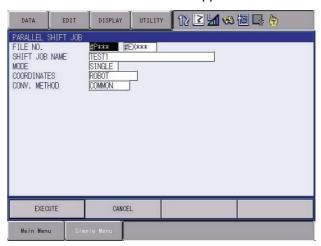


6.3.4.4 Operation Procedure

The following is the operation procedure for the parallel shift job conversion using position variables.

- 1. Set the parameter.
 - Set the parameter S2C652 (SHIFT VALUE FOR PARALLEL SHIFT JOB CONVERSION) to 1 (Position variable shift value.)
- 2. Set the position variable.
 - Specify a position variable in advance when setting a shift value by position variables.
 - For the setting of position variables, refer to chapter 3.9.4 "User Variables" at page 3-71.
- 3. Select {JOB} under the main menu.
- 4. Select {JOB}.
 - The JOB CONTENT window appears.
- 5. Select {UTILITY} under the pull-down menu.
- 6. Select {PARALLEL SHIFT JOB}.

- 6.3 Parallel Shift Job Conversion Function
 - The PARALLEL SHIFT JOB window appears.



- 7. Specify the conversion items.
 - Specify each item.
- 8. Select "EXECUTE."
 - Select "EXECUTE" then the parallel shift job conversion is executed.
 The JOB CONTENT window appears when the conversion is completed.
 - When "CANCEL" is selected, the display goes back to the JOB CONTENT window without executing conversion.



If an alarm occurs during conversion, conversion is suspended.



Specify the position variable in advance when using the setting value as a shift value.

6.4 PAM Function

6.4 PAM Function

6.4.1 Function Overview

The function for position adjustment during playback (PAM: Position Adjustment by Manual) allows position adjustment by simple operations while observing the motion of the manipulator and without stopping the manipulator. Positions can be adjusted in both teach mode and play mode.

The following data can be adjusted by key input from the programming pendant.

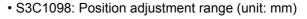
- Teaching Point (Position)
- Teaching Point (Posture angle)
- · Operation Speed
- Position Level

6.4.1.1 Input Ranges for Adjustment Data

The input ranges for adjustment data are indicated in the following table.

Data	Input Range			
Number of Steps for Adjustment	Up to 10 steps can be adjusted at the same time.			
Position Adjustment Range (X, Y, Z)	Unit: mm, valid to two decimal places, maximum ±10 mm			
Posture Angle Adjustment Range (Rx, Ry, Rz)	Unit: deg, valid to two decimal places, maximum ±10 deg			
Speed Adjustment Range (V)	Unit: %, valid to two decimal places, maximum ±50%			
PL Adjustment Range	0 to 8			
Adjustment Coordinates	Robot coordinates, base coordinates, tool coordinates, user coordinates (Default coordinates: robot coordinates)			

The input ranges for adjustment data can be changed by the following parameters:

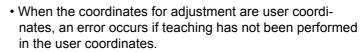




- S3C1099: Speed adjustment range (unit: 0.01%)
- S3C1100: Adjustment coordinate specification
- S3C1102: Posture angle adjustment range (unit: 0.01 deg)

For details, refer to chapter 8 "Parameter" at page 8-1.

- 6.4 PAM Function
 - Base axis and station axis data cannot be adjusted.
 - Adjustment when a TCP instruction is executed is performed by adjusting the data of the selected tool.





- If an attempt is made to adjust "PL" when there is no "PL" in the step subject to the adjustment, an error occurs.
- Position variable and reference point steps cannot be adjusted. An error occurs if adjustment is attempted.
- An attempt to adjust the speed at the step that has no speed tag causes an error.

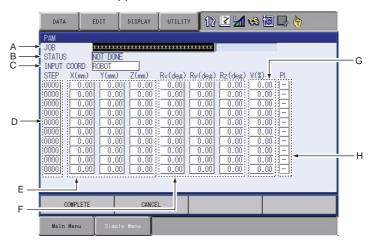
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6.4 PAM Function

6.4.2 Operating Methods

6.4.2.1 Setting Adjustment Data

- 1. Select {JOB} under the main menu.
- 2. Select {JOB}.
 - The JOB CONTENT window (in the teach mode) or the PLAYBACK window (in the playback mode) appears.
- 3. Select {UTILITY} under the pull-down menu.
- 4. Select {PAM}.
 - The PAM window appears.



- 5. Set adjustment data.
 - Set adjustment data.

– A. Job

Set the job name to be adjusted.

Line up the cursor and press [SELECT] to display the JOB LIST window.

Move the cursor to the desired job and press [SELECT] to set the adjusted job.

- B. Status

Shows the status of adjustment in the PAM function.

"NOT DONE" appears when adjustment is not executed. "DONE" appears when the execution of adjustment is completed.

C. Input Coord

Set the desired coordinates.

Line up the cursor and press [SELECT] to display the selection dialog box.

Move the cursor to the desired coordinate system and press [SELECT] to set the input coordinates.

- D. Step Number

Set the step number to be adjusted.

Line up the cursor and press [SELECT] to display the number input buffer line.

Input the step number and press [ENTER] to set the value.

- E. XYZ Coordinate Adjustment

Set the direction and amount of the X, Y, and Z coordinates. Line up the cursor with the data to be adjusted and press [SELECT] 6.4 PAM Function

to display the number input buffer line. Input the number data and press [ENTER] to set the adjusted data.

- F. Rx, Ry, Rz Coordinate Adjustment

Set the direction and amount of the Rx, Ry and Rz posture angles.

Line up the cursor with the data to be adjusted and press [SELECT] to display the number input buffer line.

Input the number data and press [ENTER] to set the adjusted data.

- G. V Coordinate Adjustment

Set the speed.

Line up the cursor and press [SELECT] to display the number input buffer line.

Input the number data and press [ENTER] to set the adjusted data.

- H. PL

The position level of the job to be adjusted for the step set in "4. Step Number" is displayed, and the data can be modified.

When the position level is not decided, [-] is displayed, and cannot be set.

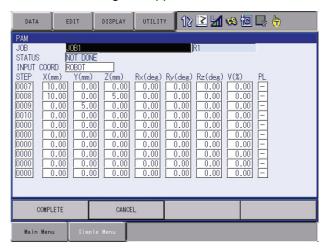
To modify the position level, line up the cursor, press [SELECT], input the number value and press [ENTER].

6.4 PAM Function

6.4.2.2 Executing the Adjustment

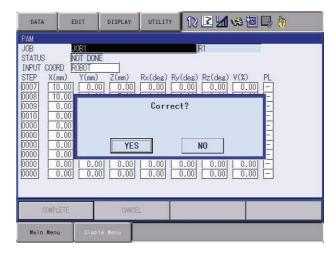
■ Executing the Adjustment

- 1. Touch "COMPLETE" on the screen.
 - The confirmation dialog box appears.



2. Select "YES."

- In the teach mode, the job adjustment can be immediately executed.
 In the play mode, the job can be adjusted just before execution (move operation).
- When the job adjustment is completed, the set data shown in the PAM window is cleared. However, if the step's adjusted position exceeds the software limit, an error occurs, and the data in only that step cannot be cleared on the window.



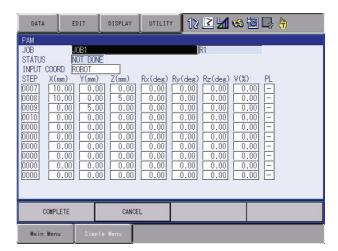
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6.4 PAM Function

■ Cancelling the Execution

In the play mode, during the adjustment wait status, "STOP" is displayed in the PAM window. To cancel the adjustment process, touch "STOP" on the screen. Also, if the following occurs before executing, the process is automatically cancelled.

- If the mode is changed
- If an alarm occurs
- If the power is turned OFF



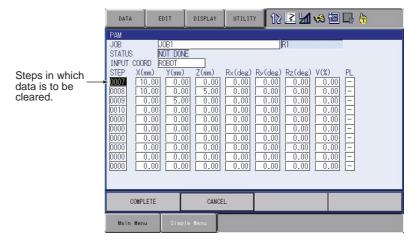
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6.4 PAM Function

■ Clearing Data

If there is a mistake made when adjusting the data, or if the adjustment of the step becomes unnecessary, the data can be cleared.

1. Move the cursor to the step of the data to be cleared.

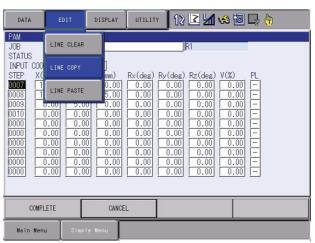


- 2. Select {EDIT} under the pull-down menu.
- 3. Select {LINE CLEAR}.
 - The line data is cleared.

Copying Data

To input the same data as those set previously, perform the following operation.

- 1. Move the cursor to the line to be copied.
- 2. Select {EDIT} under the menu.
 - The pull-down menu appears.



- 3. Select {LINE COPY}.
- 4. Move the cursor to the line where the item is to be copied.
- 5. Select {EDIT} under the menu.
- 6. Select {LINE PASTE}.
 - The desired data is copied to the line.

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- 6.4 PAM Function
 - However, if the line where the data is to be copied does not have a speed value or PL value, it cannot be copied.

■ Canceling the Adjustment

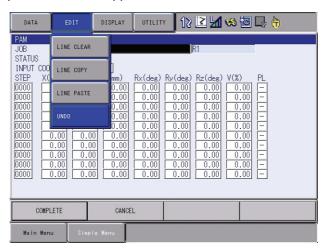
After the position adjustment in the PAM function, the job can be returned to the status before adjustment only during teaching. In this case, follow the procedures below.

Note that the job cannot be undone during playback.

- 1. Move the cursor to the line to be copied.
 - After the position adjustment, the status shows "DONE."



- 2. Select {EDIT} under the menu.
 - The pull-down menu appears.



- 3. Select {UNDO} under the pull-down menu.
 - The confirmation dialog box appears.



- 4. Select "YES"
 - The status turns "NOT DONE" and the job is undone when selecting "YES." The status does not change and the job is not undone when selecting "NO."

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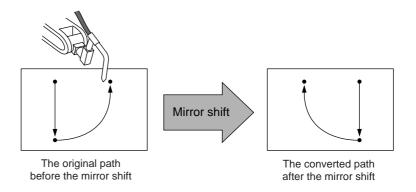
- 6 Convenient Functions
- 6.5 Mirror Shift Function

6.5 Mirror Shift Function

6.5.1 Function Overview

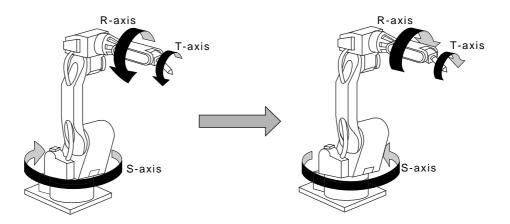
With the mirror shift function, a job is converted to the job in which the path is symmetrical to that of the original job. This conversion can be performed for the specified coordinate among the X-Y, X-Z, or Y-Z coordinate of the robot coordinates and the user coordinates.

The mirror shift function is classified into the following three: the pulse mirror-shift function, the robot-coordinates mirror-shift function, and the user-coordinates mirror-shift function.



6.5.2 Pulse Mirror-shift Function

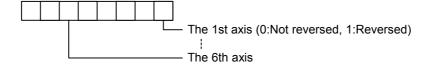
With the pulse mirror-shift function, the mirror shift is performed by reversing the sign (+/-) for the axes which are specified with the parameter in advance.



6.5.2.1 Parameter Setting

Using the following parameter, specify the axes for which the sign is to be reversed.

S1CxG065: Mirror Shift Sign Reversing Axis Specification



6.5.2.2 Object Job

Jobs without group axes and relative jobs cannot be converted.

6.5.2.3 Group Axes Specification

When specifying the group axes for the converted job in a multiple group axes system, the group axes specified in the original and converted jobs must be the same.

• Robot Axis: Same model

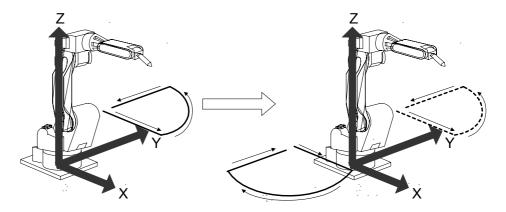
Base Axis: Same configurationStation Axis: Same configuration

6.5.2.4 Position Variables

Position variables are not converted by the mirror shift function.

6.5.3 Robot-coordinates Mirror-shift Function

With the robot-coordinates mirror-shift function, the mirror shift is performed on the X-Z coordinate of the robot coordinates.



6.5.3.1 Object Job

Jobs without group axes cannot be converted.

6.5.3.2 Group Axes Specification

When specifying the group axes for the converted job in a multiple group axes system, the group axes specified in the original and converted jobs must be the same.

· Robot Axis: Same model

· Base Axis: Same configuration

• Station Axis: Same configuration

6.5.3.3 Position Variables

Position variables are not converted by the mirror shift function.

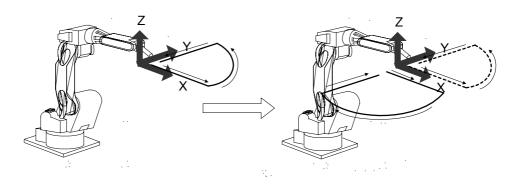
• Mirror shift conversion for the base axis is not performed with the robot-coordinates mirror shift function.



 With the robot-coordinates mirror shift function, mirror shift conversion for the station axis is performed by reversing the sign for the axes specified with the parameter S1CxG065 "Mirror Shift Sign Reversing Axis Specification."

6.5.4 User-coordinates Mirror-shift Function

With the user-coordinates mirror-shift function, the mirror shift is performed on the X-Z, X-Y, or Y-Z coordinate of the specified user coordinates.



6.5.4.1 Object Job

Jobs without group axes cannot be converted.

6.5.4.2 Group Axes Specification

When specifying the group axes for the converted job in a multiple group axes system, the group axes specified in the original and converted jobs must be the same.

· Robot Axis: Same model

• Base Axis: Same configuration

• Station Axis: Same configuration

6.5.4.3 Position Variables

Position variables are not converted by the mirror shift function.



With the user-coordinates mirror shift function, mirror shift conversion for the station axis is performed by reversing the sign for the axes specified with the parameter S1CxG065 "Mirror Shift Sign Reversing Axis Specification."

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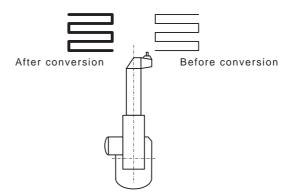
6.5 Mirror Shift Function

6.5.5 Notes on the Mirror Shift Function

For manipulators, such as a polishing wrist, whose center of S-axis rotation and T-axis rotation are offset in the X-coordinate direction, the mirror shift cannot correctly be performed by the pulse mirror-shift function. Be sure to use the robot-coordinates mirror-shift function or use the user-coordinates mirror-shift function with the user coordinates specified on the center of the T-axis rotation.

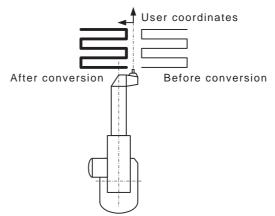
(1) Using the Robot-coordinates Mirror-shift Function When the robot-coordinates mirror-shift function is performed, the mirror shift is performed on the X-Z coordinate of the robot coordinates. The path of the converted job is as follows:

Robot-coordinates Mirror-shift Conversion



(2) Using the User-coordinates Mirror-shift Function
To use the user-coordinates mirror-shift function, specify the user
coordinates on the center of T-axis rotation in advance.

User-coordinates Mirror-shift Conversion



DX100 6.5 Convenient Functions
6.5 Mirror Shift Function

6.5.6 Operation Procedures

6.5.6.1 Calling Up the JOB CONTENT Window

Call up the JOB CONTENT window of the job to be converted as follows:

■ For Current Job

- 1. Select {JOB} under the main menu.
- 2. Select {JOB}.

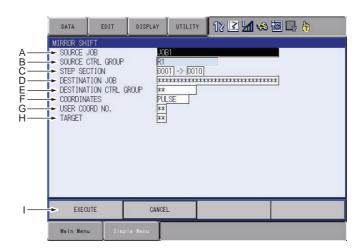
■ For Another Job

- 1. Select {JOB} under the main menu.
- 2. Select {SELECT JOB}.
 - The JOB LIST window appears.
- 3. Select the desired job.

6.5.6.2 Mirror Shift Conversion

- 1. Display the JOB CONTENT window.
- 2. Select {UTILITY} under the pull-down menu.
 - The MIRROR SHIFT window appears.
- 3. Select (MIRROR SHIFT).
 - The MIRROR SHIFT window appears.

6.5.6.3 Explanation of the Mirror Shift Window



A. SOURCE JOB

Selects the conversion source job.

To select another job to be converted, move the cursor to the name and press [SELECT] to call up the list of jobs. Select the desired job and press [SELECT].

B. SOURCE CTRL GROUP

Displays the control group of the conversion source job.

C. STEP SELECTION

Specifies the steps to be converted. From the first step to the last step of the selected job are specified as initial value.

D. DESTINATION JOB

Specifies the converted job name. To enter the name, move the cursor to the name and press [SELECT]. The name of the conversion source job is displayed in the input line as initial value. When "***" is displayed, the name for the converted job is to be the same as that of the conversion source job.

E. DEST CTRL GROUP

Selects the control group for the converted job. When the destination job name is entered, the same control group as the conversion source job is automatically set. To change it, move the cursor to the control group and press [SELECT] to call up the selection dialog box.

F. COORDINATES

Specifies the coordinates used for conversion.

"PULSE": Executes the pulse mirror-shift conversion.

"ROBOT": Executes the mirror-shift conversion on the basis of the cartesian coordinates.

"USER": Executes the mirror-shift conversion on the basis of the specified user coordinates.

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- 6 Convenient Functions
- 6.5 Mirror Shift Function

G. USER COORD NO.

Specifies the user coordinates number when "USER" is selected in "6. COORDINATES".

This item cannot be set when "PULSE" or "ROBOT" is selected in "6. COORDINATES".

H. TARGET

Specifies the coordinate where conversion is to be done when "ROBOT" or "USER" is selected in "6. COORDINATES". "XY," "XZ," or "YZ" can be selected. Always specify "XZ" for "ROBOT."

I. EXECUTE

Mirror shift conversion is executed when pressing "EXECUTE" or [ENTER]. A job is created with the name of conversion source job when a job after conversion is not entered.

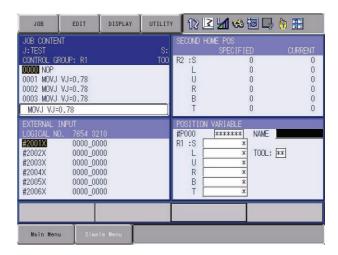
DX100 6.6 Convenient Functions
6.6 Multi Window Function

6.6 Multi Window Function

6.6.1 Function Overview

Multi window function divides the general-purpose display area up to 4 windows and shows them simultaneously.

There are seven dividing patterns to be optionally choose as necessary.



6.6.2 Setting the Dividing Pattern of the General-Purpose Display Area

The dividing pattern of the general purpose display area can be changed in the window exclusive for setting.

Table 6-3: Display the dividing Pattern (Sheet 1 of 2)

	Number of the window	Dividing Pattern
1	1 window	1
2	2 windows	1 2
3	2 windows	1 2
4	3 windows	1 2 3

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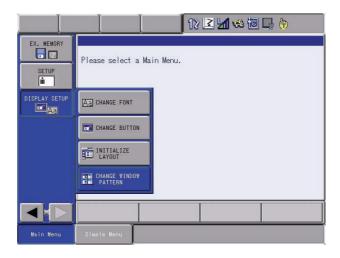
Table 6-3: Display the dividing Pattern (Sheet 2 of 2)

	Number of the window	Dividing Pattern
5	3 windows	1 2 3
6	3 windows	1 2 3
7	4 windows	1 2 3 4

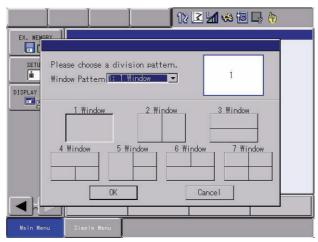
6.6.2.1 Calling Up and Operating Methods of the Display Dividing Pattern Setting Window

Call up the dividing pattern setting window.

1. Select [DEIPLAY SETUP] -[CHANGE WINDOW PATTERN] under the main menu.



2. Dividing pattern setting window appears in the center of the display.



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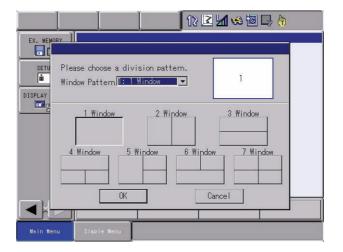
6.6 Multi Window Function

In the dividing pattern setting window, set the dividing pattern of the general-purpose display area.

1. Key operation 1:

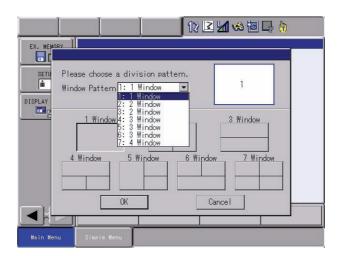
When "Window Pattern" is focused in the window, the option of the dividing pattern shifts as cursor moves upper or lower.

- Choose the desired dividing patter from the "Window Pattern".



2. Key operation 2:

Press Select key when "Window Pattern" is focused. The list of the dividing patterns appears. The list closes and a pattern is set after choosing the desired pattern and press "Select" key.

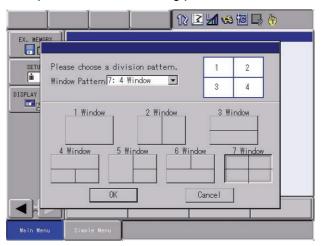


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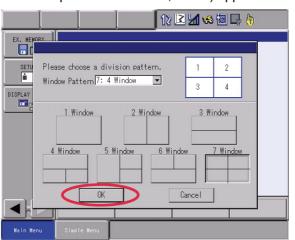
- 6.6 Multi Window Function
- 3. Touching operation:

The desired pattern can be chosen by touching a pattern in the window.

- Choose a pattern from the dividing pattern buttons.



- 4. Touch [OK] button or move the cursor to it and press [SELECT] key.
 - The dividing pattern setting window closes and the chosen pattern (chosen with the procedure either 1, 2 or 3) appears.

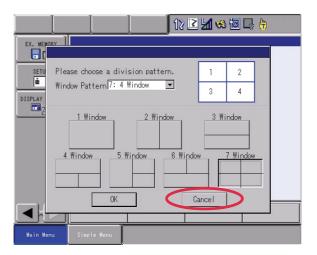


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- 6 Convenient Functions
- 6.6 Multi Window Function

Cancel the setting

- 1. Touch [CANCEL] button or move the cursor to it and press [SELECT] key.
 - Dividing pattern setting window closes. The dividing pattern in the general-purpose display area doesn't change.





The cursor moves by pressing [AREA] key in the dividing pattern setting window.

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6.6 Multi Window Function

6.6.3 Displaying the Multi Window

6.6.3.1 Multi Window Mode and Single Window Mode

Specifying more than two-window pattern in the dividing pattern setting window shows plural windows simultaneously in the general-purpose display area.

This is called multi window mode.

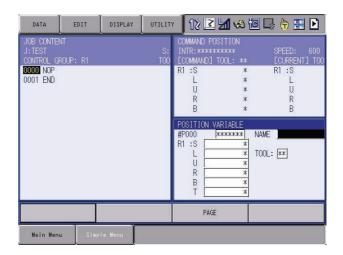
On the other hand, a single active window can be displayed with pressing [SHIFT] + [MULTI] key operation.

This is called single window mode.

Pressing [SHIFT] + [MULTI] key operation switches the display from single window mode to multi window mode. The mode can be changed as necessary.

6.6.3.2 Displaying the Status of Plural (more than two) Window Dividing Pattern Setting

When more than two windows are displayed as a desired pattern, appears on the upper part of the window whereas it doesn't appear when a single window is displayed.



	Convenient Functions	
100	Multi Window Function	

6.6.3.3 Displaying of Active Window and Non-Active Window

When a display is in the multi window mode, one window should be active and the rest is (are) non-active. The title of the active window is displayed in deep blue and non-active window is in light blue.

The active window is the subject of key operation. Also, the menu area or the operational buttons under the general-purpose displaying area are displayed for the operation of the active window.

6.6.3.4 Limited Matters in Multi Window Mode

The content of window when it is in multi window mode can be different from the same window when it is in single window mode because of its limited size. The content becomes normal when the window is displayed in the single window mode.

- The input buffer in the JOB window is displayed only when the window is active.
- No auxiliary window appears.

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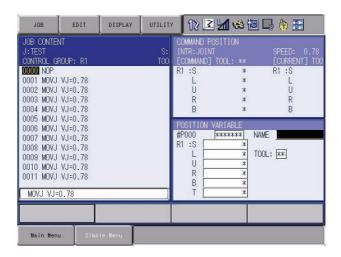
6.6 Multi Window Function

6.6.4 Operation of Multi Window

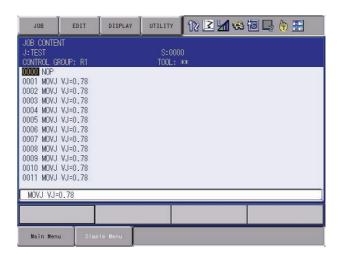
6.6.4.1 Switching of Multi Window Mode and Single Window Mode

When more than two windows are displayed as a dividing pattern of the multi window, it is possible to switch multi window mode to single window mode.

1. Set the mode of the general-purpose displaying area to multi window mode.

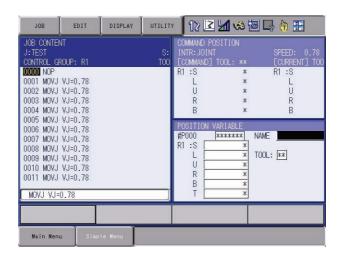


- 2. Press [SHIFT]+[MULTI] keys.
 - Active window is displayed under single window mode in the general-purpose window displaying area.



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- 6 Convenient Functions
- 6.6 Multi Window Function
- 3. Press [SHIFT]+[MULTI] keys in step 2 status.
 - The general-purpose display area changes to already set pattern in multi window mode.



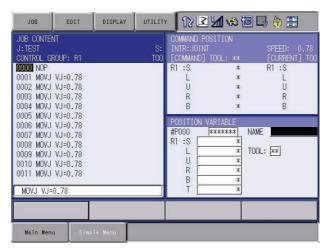
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6.6 Multi Window Function

6.6.4.2 Switching of Active Window

Switch the active window in the multi window displaying mode.

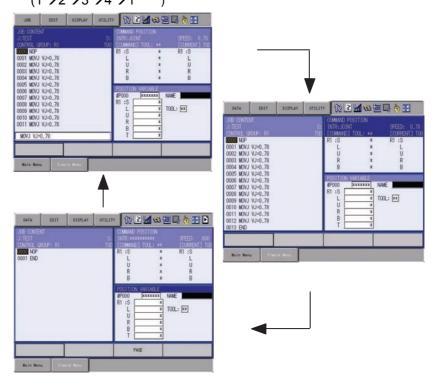
1. Set the mode of the general-purpose displaying area to multi window mode.



2. Key Operation:

Press [MULT] key

The window to be active shifts. The active window shifts in the order mentioned in chapter 6.6.2 "Setting the Dividing Pattern of the General-Purpose Display Area" at page 6-53.
 (1→2→3→4→1······)



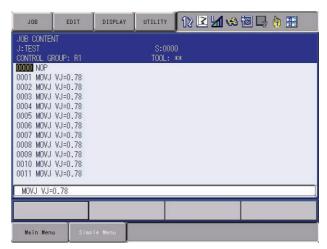
3. Touching Operation: Touch the window to be active.

- The touched window becomes active.

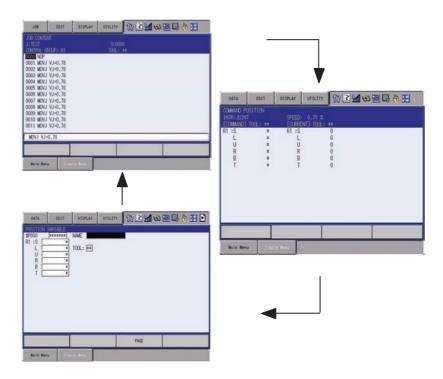
6.6 Multi Window Function

Switch the active window in the single window mode.

1. Set the mode of the general-purpose displaying area to single window mode.



- 2. Press [MULT] key
 - The following windows are displayed in the order mentioned in chapter 6.6.2 "Setting the Dividing Pattern of the General-Purpose Display Area" at page 6-53. (1→2→3→4→1······)



6.6 Multi Window Function

6.6.5 Switching the Axis Operation Control Group

The appropriate control group for axis operation is automatically selected in accordance with the window status or its operation in the active window. Due to this function, when the general-purpose display area is in multi window mode, the control group for axis operation can vary depending on the window which is active at the time.

To avoid unexpected control group to function and for the better safeness, the change of the control group with the [MULTI] key operation or touching operation when switching the active window is notified to the user.

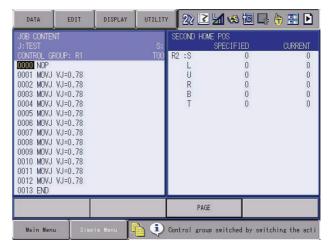


The change of the control group for axis operation due to other than [MULTI] key operation or touching operation; due to the switch of the window by selecting main menu, is not notified to the user.

6.6.5.1 S2C540 "Choosing Method of Notifying the Change of Axis Operation Control Group when Switching the Active Window"

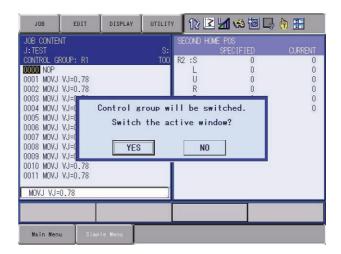
The method to notify the change of control group for axis operation due to the switch of active window can be changed with parameter.

- Setting Value:0
- Keep displaying the message in the human interface display area for three seconds.
- Message "Control group switched by switching the active window" is displayed.



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- 6.6 Multi Window Function
 - Setting Value:1
 - Call up the confirmation dialog box to confirm the switch of the active window.
 - Message "Control group will be changed. Switch the active window?" is displayed
 - "Yes" ····· After switching the window to be active, a message appears in the human interface display area.
 - "No" ····· Cancel the window to be active.



- Setting Value:2
- Do not notify the control group change.

7 External Memory Devices

7.1 Memory Devices

Device	Function	Media (destination of saved/ loaded data)	Optional function requirement
CF: Pendant	Standard	Compact Flash Card (CF card)	No requirement. Programming pendant is equipped with a slot.
USB: Pendant	Standard	USB Memory Stick	No requirement. Programming pendant is equipped with a slot.
FC1	Option ¹⁾	2DD floppy disk, personal computer (FC1 emulator)	"FC1" or personal computer with "FC1 emulator"
FC2	Option ¹⁾	2DD floppy disk, 2HD floppy disk	"FC2"
PC	Option ¹⁾	Personal computer (MOTOCOM32 host)	Via RS-232C: "Data transmission function" and "MOTOCOM32" Via Ethernet: "Ethernet function" plus above two requirements
FTP	Option ¹⁾	FTP server such as personal computer	"Data transmission function", "MOTOCOM32", and "FTP function"

¹ For the operation, refer to instruction manuals for each optional function.

7.1.1 Compact Flash (CF Cards)

The programming pendant is equipped with CF card slot. Use the FAT16 or FAT32 formatted Compact Flash.

7.1.1.1 Recommended Compact Flash Cards

Recommended products used for external memory of DX100 are listed below. Model numbers are subject to be updated due to termination of product and new addition. Contact Yaskawa representative when necessary.

No.	Manufacturer	Model	Note
1	Hagiwara Sys-Com	MCF10P-256MS (IOOA II-YE2)	256MB
2	Hagiwara Sys-Com	MCF10P-512MS	(512MB)
3	Hagiwara Sys-Com	MCF10P-A01GS	(1GB)
4	Hagiwara Sys-Com	MCF10P-A02GS	(2GB)
5	AiliconSystem	SSD-C25M3512	"xxMB" denotes memory size (up to 2GB).

7.1.1.2 Notes on handling Compact Flash

- Do not drop or bend exerting any shock or strong force to the Compact Flash.
- Keep away from water, oil, organic solvent, dust, and dirt.
- Do not use or keep the Compact Flash in places where strong static electricity or electronic noise may occur.
- Do not insert or remove the Compact Flash or turn OFF the power when accessing the Compact Flash (writing-in or reading-out the Compact Flash data.)
- To protect the data, back up the data regularly on other media. Damages or loss of data due to operation errors or accidents can be minimized.

The life span differs depending on products or status of use. However, normal use of Compact Flash as an external memory device for the DX100 does not adversely affect the Compact Flash. For details, refer to instruction manuals for each medium.

^{*}Compact Flash has a limited life span.

7.1.1.3 Inserting a Compact Flash

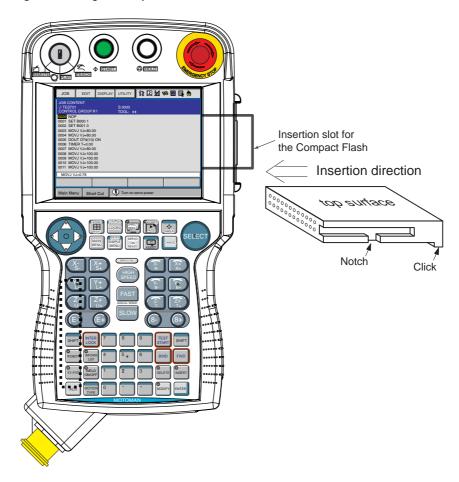
When inserting a Compact Flash, take note of insertion direction.

With the notch and clip of the Compact Flash downward, insert the Compact Flash slowly into the slot of the programming pendant of which display faces up.

Forcible insertion may result in damage to the Compact Flash or CF card slot.

After inserting the card, be sure to close the cover of the slot before starting operation.

Fig. 7-1: Using a Compact Flash Card



7 **External Memory Devices** DX100

7.1 **Memory Devices**

7.1.2 USB Memory Stick

The programming pendant is equipped with a USB connector. Use the FAT16 or FAT32 formatted USB memory stick.

7.1.2.1 Recommended USB Memory Stick

Recommended products used for external memory of DX100 are listed below. Model numbers are subject to be updated due to termination of product and new addition. Contact Yaskawa representative when necessary.

No.	Manufacturer	Model	Note		
1	Hagiwara Sys-Com	UDG3-GA Series	1GB or 2GB		

7.1.2.2 Notes on handling USB Memory Stick

- Do not drop or bend exerting any shock or strong force to the Compact Flash.
- Keep away from water, oil, organic solvent, dust, and dirt.
- Do not use or keep the Compact Flash in places where strong static electricity or electronic noise may occur.
- Do not insert or remove the Compact Flash or turn OFF the power when accessing the Compact Flash (writing-in or reading-out the Compact Flash data.)
- To protect the data, back up the data regularly on other media. Damages or loss of data due to operation errors or accidents can be minimized.

The life span differs depending on products or status of use. However, normal use of USB memory stick as an external memory device for the DX100 does not adversely affect the USB memory stick. For details, refer to instruction manuals for each medium.

^{*}USB memory stick has a limited life span.

7.1.2.3 Inserting a USB Memory Stick

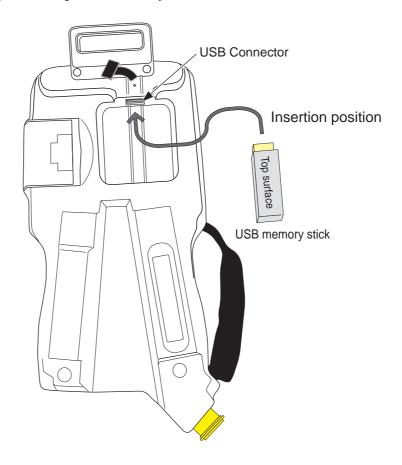
When inserting a USB memory stick, take note of insertion direction.

With the USB memory stick face-up and the connector upwards, insert the stick slowly into the slot of the programming pendant of which display face-down.

Forcible insertion may result in damage to the USB memory stick or USB connector.

After inserting the stick, be sure to close the cover of the connector before starting operation.

Fig. 7-2: Using a USB Memory Stick



When a USB memory stick is used, the waterproofing of programming pendant cannot be maintained.



If the USB memory stick is always set in the programming pendant, the stick may fall out of the pendant.

If it is impossible to maintain the waterproofing of programming pendant or to prevent the USB memory stick from falling out of the programming pendant, use a Compact Flash card instead.

7 External Memory Devices

7.2 Handling Data

7.2 Handling Data

7.2.1 Data Classification

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For the DX100, data that can be saved online are classified into eight categories.

- **1. JOB**
- 2. FILE/GENERAL DATA
- 3. BATCH USER MEMORY*1
- 4. PARAMETER^{*2}
- **5. SYSTEM DATA**
- 6. I/O DATA
- 7. BATCH CMOS^{*3}
- 8. ALL CMOS AREA*4

Data saved on the external memory device can be loaded again into the DX100.

Each data in the eight categories varies depending on applications or options.

When the device is set to "PC" and "FTP", data cannot be handled other than "1. JOB" and "2. FILE/GENERAL DATA."

- *1: "3. BATCH USER MEMORY" includes "1. JOB" and "2. FILE/ GENERAL DATA."
- *2: "PARAMETER BATCH" includes all "P4. PARAMETER."
- *3: "7. BATCH CMOS" includes "3. BATCH USER MEMORY", "4. PARAMETER", "5. SYSTEM DATA", and "6. I/O DATA."
- *4: "ALL CMOS AREA" data cannot be loaded in edit mode and management mode.

PARAMETER, I/O DATA, SYSTEM DATA, PARAMETER BATCH, BATCH CMOS, and ALL CMOS AREA are used for backup.



If those data are loaded by other controllers, unintended data overwriting, unexpected operation, or abnormal system startup may occur.

Do not load those backup data into other controllers.

If two controllers are loaded with the same job, paths of the two manipulators are different due to the home positions or mechanical error of the component parts.

Be sure to check the operation instruction before operation.

7.2

Table 7-1: Data List (Sheet 1 of 2)

Data Classification ALL CMOS AREA		File Name (Saved Data)	Save			Load			
			OPN	EDIT	MAN	OPN	EDIT	MAN	
		ALCMSxx.HEX	0	0	0	Х	Х	Х	
7. BATCH CMOS		CMOSxx.HEX	0	0	0	Х	Х	0	
	3. BATCH USEF	RMEMORY	JOBxx.HEX	0	0	0	Х	0	0
	1. JOB	Single job	JOBNAME.JBI	0	0	0	Х	0	0
		Related job (Job+Condition)	JOBNAME.JBR	0	0	0	Х	0	0
	2 FILE/	Tool data	TOOL.CND	0	0	0	Х	0	0
	GENERAL DATA	Weaving data	WEAV.CND	0	0	0	Х	0	0
	DATA	User coordinate data	UFRAME.CND	0	0	0	Х	0	0
		Variable data	VAR.DAT	0	0	0	Х	0	0
		Arc start condition data	ARCSRT.CND	0	0	0	Х	0	0
		Arc end condition data	ARCEND.CND	0	0	0	Х	0	0
		Welding condition auxiliary data	ARCSUP.DAT	0	0	0	Х	0	0
		Power source characteristic data	WELDER.DAT	0	0	0	Х	0	0
		Power source characteristic definition data	WELDUDEF.DAT	0	0	0	X	0	0
		Shock detection level data	SHOCKLVL.CND	0	0	0	Х	0	0
		Motor gun pressure power data	SPRESS.CND	0	0	0	Х	0	0
		Motor gun dry spot pressure data	SPRESSCL.CND	0	0	0	Х	0	0
		Spot gun characteristic data	SGUN.DAT	0	0	0	Х	0	0
		Spot welding power source characteristic data	SWELDER.DAT	0	0	0	Х	0	0
		Spot I/O allocation data	SPOTIO.DAT	0	0	0	Х	0	0
		Spot welding condition data	SPOTWELD.DAT	0	0	0	Х	0	0
		Short/Full open position data	STROKE.DAT	0	0	0	Х	0	0
		Clearance data	CLEARANCE.DAT	0	0	0	Х	0	0
		Airgun condition data	AIRGUN.DAT	0	0	0	Х	0	0
		Interference area file	CUBEINTF.CND	0	0	0	Х	0	0
	4. PARAMETER	BATCH	ALL.PRM	0	0	0	Х	Х	0
	4. PARA- METER	Robot matching parameter	RC.PRM	0	0	0	Х	Х	0
		System definition parameter	SD.PRM	0	0	0	Х	Х	0

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7.2 Handling Data

Table 7-1: Data List (Sheet 2 of 2)

		Data	Classification	File Name	Save			Load		
				(Saved Data)	OPN	EDIT	MAN	OPN	EDIT	MAN
8.	7.	4. 4. PARA		RO.PRM	0	0	0	Х	Х	0
			System matching parameter	SC.PRM	0	0	0	Х	Х	0
			CIO parameter	CIO.PRM	0	0	0	Х	Х	0
			Function definition parameter	FD.PRM	0	0	0	Х	Х	0
			Application parameter	AP.PRM	0	0	0	Х	Х	0
			Transmission (general) parameter	RS.PRM	0	0	0	Х	Х	0
			Sensor parameter	SE.PRM	0	0	0	Х	Х	0
			Servo parameter	SV.PRM	0	0	0	Х	Х	0
			Servomotor parameter	SVM.PRM	0	0	0	Х	Х	0
			Operation control parameter	AMC.PRM	0	0	0	Х	Х	0
			Servo power block parameter	SVP.PRM	0	0	0	Х	Х	0
			Motion function parameter	MF.PRM	0	0	0	Х	Х	0
			SERVOPACK parameter	SVS.PRM	0	0	0	Х	Х	0
			Converter parameter	SVC.PRM	0	0	0	Х	Х	0
		5. I/O DATA	CIO program	CIOPRG.LST	0	0	0	Х	Х	0
			I/O name data	IONAME.DAT	0	0	0	X	X	0
			Pseudo input signals	PSEUDOIN.DAT	0	0	0	X	Χ	0
			External I/O name data	EXIONAME.DAT	0	0	0	X	Χ	0
			Register name data	IONAME.DAT	0	0	0	X	Χ	0
		6. SYSTEM	User word registration	UWORD.DAT	0	0	0	Χ	Χ	0
		DATA	SV monitor signals	SVMON.DAT	0	0	0	Х	Х	0
			Variable name	VARNAME.DAT	0	0	0	Χ	Χ	0
			Second home position	HOME2.DAT	0	0	0	Χ	Χ	0
			Alarm history data	ALMHIST.DAT	0	0	0	Χ	Χ	Χ
			Home position calibrating data	ABSO.DAT	0	0	0	Х	Х	0
			System information	SYSTEM.SYS	0	0	0	X	X	Х
			Work home position data	OPEORG.DAT	0	0	0	Х	Х	0
			I/O message history data	IOMSGHST.DAT	0	0	0	Х	Х	X
			Function key allocation data	KEYALLOC.DAT	0	0	0	Х	Х	0

^{*} OPN: Operation Mode, EDIT: Edit Mode, MAN: Management Mode O : Can be done, X : Cannot be done

7.2 Handling Data

7.2.2 File Existence

The following data categories show whether the same file name as a file that is going to be saved is in the external memory device or not.

• JOB

No mark appears when the selected folder has the file of the same name.

The asterisk (*) appears when the folder does not have the same name file.

 FILE/GENERAL DATA, PARAMETER, SYSTEM DATA, I/O DATA Black circle (•) appears when the selected folder has the file of the same name.

White circle (\odot) appears when the folder does not have the same name file.



Whether the job after editing is saved or not can be judged by checking "TO SAVE TO FD" in the JOB HEADER window. However, the status of "TO SAVE TO FD" does not change after saving "3. BATCH USER MEMORY" and "7. BATCH CMOS"

Fig. 7-3: Example of JOB

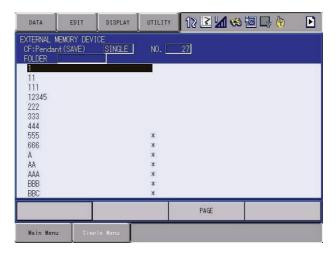
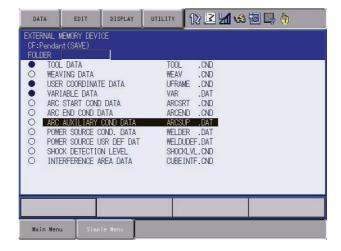


Fig. 7-4: Example of FILE/GENERAL DATA



DX100	7 7.2	External Memory Devices Handling Data

7.2.2.1 Saving by Overwriting

"3. BATCH USER MEMORY", "7. BATCH CMOS", and "8. ALL CMOS AREA" can be overwritten.

As for "1. JOB", "2. FILE/GENERAL DATA", "4. PARAMETER", "5. SYSTEM DATA", and "6. I/O DATA", those data cannot be overwritten. Delete the target file in the device before the saving operation. If Compact Flash is used as the device, the file does not need to be deleted because another folder can be created to save the data.

7.3 Operation Flow

7.3 Operation Flow

The following description is the operation flow for external memory devices.

SELECT DEVICE

Select {FD/PC CARD} --> {DEVICE}, and the destination device for saving.

The device selected is valid after turning the power supply ON again.

*1: Sub menu {FORMAT} appears when selecting FC1 or FC2.

SELECT FOLDER

Select {FD/PC CARD} --> {DEVICE}, and the destination folder for saving.

The folder selected is invalid after turning the power supply ON again.

*2: {FOLDER} appears when using the Compact Flash as a device. *3 The settings of {CREATE NEW FOLDER}, {DELETE FOLDER}, and {ROOT FOLDER} can be set.

SELECT SUB MENU

Select an operation to be performed from {LOAD}, {SAVE}, {VER-IFY}, and {DELETE}.

• SELECT DATA CATEGORY

Select the target data category.

SELECT DATA

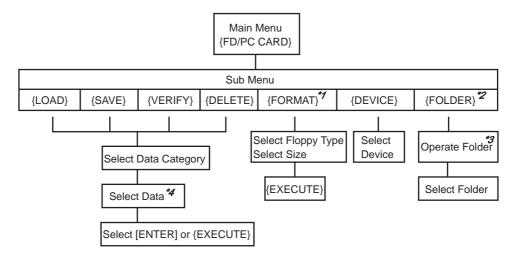
Select the target data.

"3. BATCH USER MEMORY", "7. BATCH CMOS", and "8. ALL CMOS AREA" do not require this operation.

4 Individual selection, batch selection, marker () selection, and canceling selection can be performed.

EXECUTE

Select [ENTER] or {EXECUTE}.



DX100

7.3 Operation Flow

7.3.0.1 Operating a Folder

Folders can be used in order to classify and sort out the data such as jobs and condition files when using the Compact Flash. The folders can be created in hierarchical structure positioning a root folder at the top.

■ Restrictions

Folder name: Up to 8 one-byte characters + 3 characters for extension

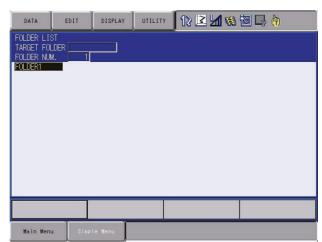
*Long folder names cannot be used such as the name that exceeds the restricted number of characters mentioned above as created in PC, etc.

Maximum path length: 64 one-byte characters

*"ERROR 3360: INVALID FOLDER" appears when selecting the folder of which name exceeds the maximum path length.

■ Selecting a Folder

- 1. Select (FD/PC CARD) under the main menu.
- Select (FOLDER).
 - The FOLDER LIST window appears.
- 3. Move the cursor to a folder and press [SELECT].
 - A folder can be selected.
- 4. To move the hierarchy from a child folder to a parent folder, move the cursor to [..] and press [SELECT].



Creating a Folder

- 1. Change the security to management mode. Select {FD/PC CARD} under the main menu.
- 2. Select (FOLDER).
 - The FOLDER LIST window appears.

DX100

7.3 Operation Flow

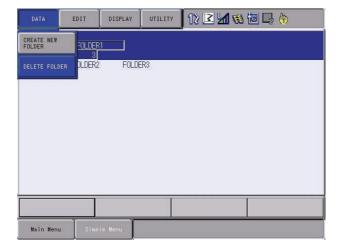
- 3. Move the cursor to a folder and press [SELECT].
 - Select the higher-level folder where a new folder to be created should be contained.
 - When creating a folder in top-level, this step is unnecessary.
- 4. Select {DATA} --> {CREATE NEW FOLDER} under the pull-down menu. Input folder name using the keyboard on the screen and press [ENTER].
 - A folder is created.

Deleting a Folder

- 1. Change the security to management mode. Select {FD/PC CARD} under the main menu.
- 2. Select (FOLDER).
 - The FOLDER LIST window appears.
- 3. Move the cursor to a folder and press [SELECT].
 - Select the higher-level folder where a folder to be deleted is contained.
 - When deleting a folder in top-level, this step is unnecessary.
- 4. Delete the files and subfolders beforehand inside the folder that is to be deleted.
 - A folder cannot be deleted if the folder contains files or subfolders inside.

Move the cursor to the folder to be deleted.

5. Select {DATA} --> {DELETE FOLDER} under the pull-down menu.



DX100

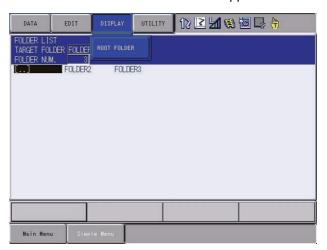
7.3 Operation Flow

■ Initial Folder Setting

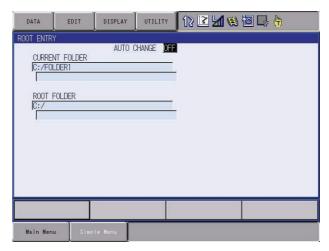
The folder that is contained in a deep hierarchy can be selected in a shortened operation.

When selecting {LOAD}, {SAVE}, {VERIFY}, or {DELETE} from the sub menu of {FD/PC CARD}, the folder that has been set as an initial folder becomes a current folder.

- 1. Change the security to management mode. Select {FD/PC CARD} under the main menu.
- 2. Select (FOLDER).
 - The FOLDER LIST window appears.
- 3. Move the cursor to a folder and press [SELECT].
 - Select a folder that is to be set as a root folder.
- 4. Select {DISPLAY} --> {ROOT FOLDER} under the pull-down menu.
 - The INITIAL FOLDER SETTING window appears.

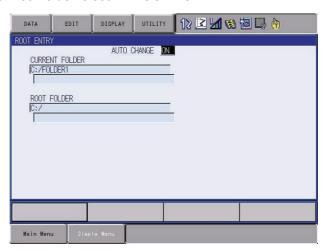


 A folder currently selected appears in "CURRENT FOLDER" and the initial folder appears in "ROOT FOLDER."



DX100

- 7.3 Operation Flow
- 5. Select {EDIT} --> {SETUP FOLDER} under the pull-down menu. Move the cursor to "AUTO CHANGE" and press [SELECT].
 - The initial folder is set in "ROOT FOLDER."



 "AUTO CHANGE" shows "ON" and the initial folder setting becomes valid. Subsequently, every time {FD/PC CARD} --> {FOLDER} is selected, the initial folder that has been set becomes a current folder.



When the initial folder is missing due to exchange of the Compact Flash, etc., "ERROR 3360: INVALID FOLDER" appears when selecting {LOAD}, {SAVE}, {VERIFY}, {DELETE} or {FOLDER} menu from {FD/PC CARD}, and simultaneously the initial folder becomes invalid. Set "ON" in "AUTO CHANGE" when the initial folder setting needs to be valid.

7.3 Operation Flow

7.3.0.2 Saving Data

To download data from the memory of the DX100 to the external memory device, perform the following procedure.

Data such as PARAMETER, SYSTEM DATA, I/O DATA, and the batch data such as PARAMETER BATCH, BATCH CMOS, ALL CMOS AREA, that include PARAMETER, SYSTEM DATA, I/O DATA, contain the information specific to each robot controller.



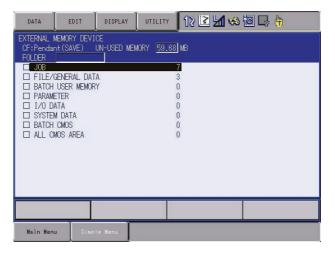
Those data are prepared as backup data for reloading into the controller used for saving.

Loading the data from other controller may result in destruction or loss of critical system information.

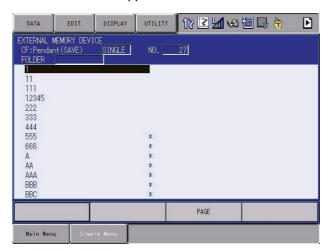
Take extra care for the saved data.

■ Saving a Job

- 1. Select {FD/PC CARD} under the main menu.
- 2. Select {SAVE}.
 - The following window appears.

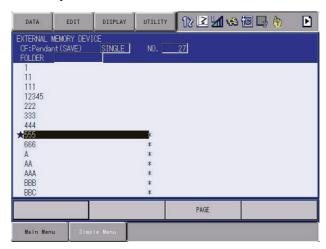


- 3. Select {JOB}.
 - The JOB LIST window appears.



DX100

- 7.3 Operation Flow
- 4. Select a job to be saved.
 - The selected job is marked with "★."



5. Press [ENTER].

- The confirmation dialog box appears.



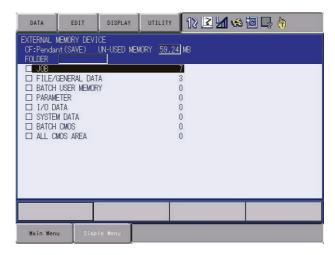
- 6. Select "YES."
 - The selected job is saved.

DX100

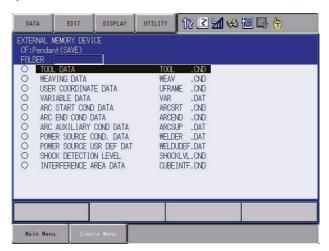
7.3 Operation Flow

Saving a Condition File or General Data

- 1. Select {FD/PC CARD} under the main menu.
- 2. Select {SAVE}.
 - The following window appears.

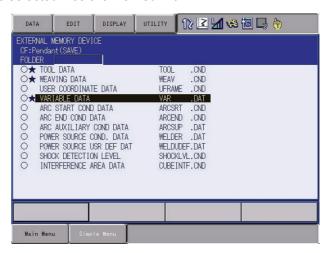


- 3. Move the cursor to {FILE/GENERAL DATA} and select.
 - The selection window appears.
 - The content of the display varies in accordance with applications and options.



DX100

- 7.3 Operation Flow
- 4. Select condition files or general data to be saved.
 - The selected files are marked with "★."



- 5. Press [ENTER].
 - The confirmation dialog box appears.



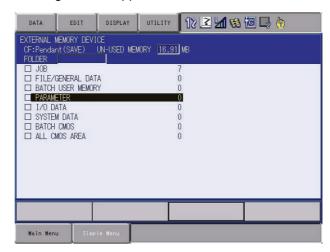
- 6. Select "YES."
 - The selected files are saved.

DX100

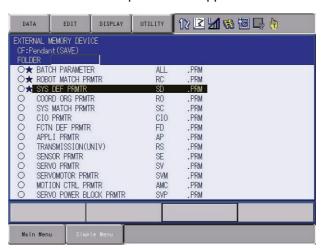
7.3 Operation Flow

■ Saving a Parameter

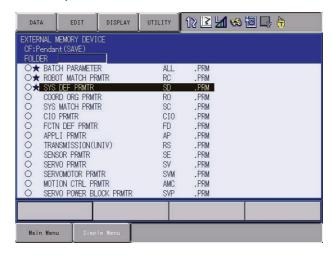
- 1. Select {FD/PC CARD} under the main menu.
- 2. Select {SAVE}.
 - The following window appears.



- 3. Move the cursor to {PARAMETER} and select.
 - The selection window for parameters appears.



- 4. Select parameters to be saved.
 - The selected parameters are marked with "★."



DX100

- 7 External Memory Devices
- 7.3 Operation Flow
- 5. Press [ENTER].
 - The confirmation dialog box appears.



- 6. Select "YES."
 - The selected parameters are saved.

DX100

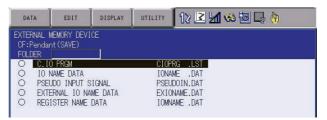
7.3 Operation Flow

Saving I/O Data

- 1. Select {FD/PC CARD} under the main menu.
- 2. Select {SAVE}.
 - The following window appears.



- 3. Move the cursor to {I/O DATA} and select.
 - The selection window for I/O data appears.



- 4. Select I/O data to be saved.
 - The selected I/O data are marked with "★."



- 5. Press [ENTER].
 - The confirmation dialog box appears.



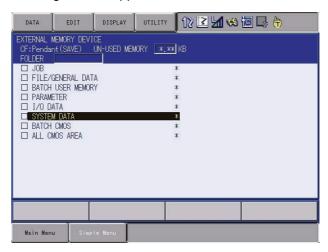
- 6. Select "YES."
 - The selected I/O data are saved.

DX100

7.3 Operation Flow

Saving System Data

- 1. Select {FD/PC CARD} under the main menu.
- Select {SAVE}.
 - The following window appears.



- 3. Move the cursor to {SYSTEM DATA} and select.
 - The selection window for system data appears.



- 4. Select system data to be saved.
 - The selected system data are marked with "★."



- 5. Press [ENTER].
 - The confirmation dialog box appears.



7.3 Operation Flow

6. Select "YES."

- The selected system data are saved.

"BATCH USER MEMORY", "BATCH CMOS", and "ALL CMOS AREA" can be overwritten.



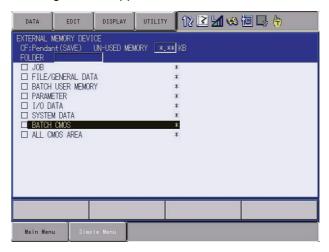
As for "JOB", "FILE/GENERAL DATA", "PARAMETER", "SYSTEM DATA", and "I/O DATA", the data cannot be overwritten. In this case, delete the file of the same name in the folder beforehand or create a new folder so that the data can be stored inside.

7 External Memory Devices7.3 Operation Flow

DX100 7.3

■ Saving All User's Programs

- 1. Select {FD/PC CARD} under the main menu.
- 2. Select {SAVE}.
 - The following window appears.



- 3. Move the cursor to {BATCH USER MEMORY} and select.
- 4. Select "EXECUTE."
 - The confirmation dialog box appears.



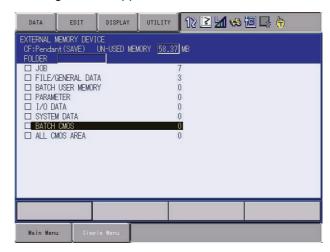
- 5. Select "YES."
 - All user's programs are saved.

DX100

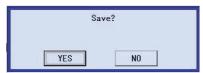
7.3 Operation Flow

■ Saving All CMOS Data

- 1. Select {FD/PC CARD} under the main menu.
- 2. Select {SAVE}.
 - The following window appears.



- 3. Move the cursor to {BATCH CMOS} and select.
- 4. Select "EXECUTE."
 - The confirmation dialog box appears.



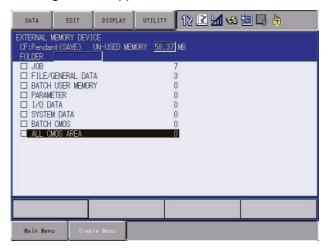
- 5. Select "YES."
 - All CMOS data are saved.

DX100

7.3 Operation Flow

■ Saving All Data in CMOS Area

- 1. Select {FD/PC CARD} under the main menu.
- 2. Select {SAVE}.
 - The following window appears.



- 3. Move the cursor to {ALL CMOS AREA} and select.
- 4. Select "EXECUTE."
 - The confirmation dialog box appears.



- 5. Select "YES."
 - All data in CMOS area are saved.

7.3 Operation Flow

7.3.0.3 Loading Data

DX100

To upload data from the external memory device to the memory of the DX100, follow the procedure in the following.

Data such as PARAMETER, SYSTEM DATA, I/O DATA, and the batch data such as PARAMETER BATCH, BATCH CMOS, ALL CMOS AREA, that include PARAMETER, SYSTEM DATA, I/O DATA, contain the information specific to each robot controller.



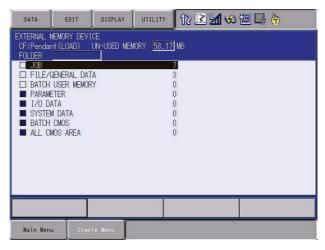
Those data are prepared as backup data for reloading into the controller used for saving.

Loading the data from other controller may result in destruction or loss of critical system information.

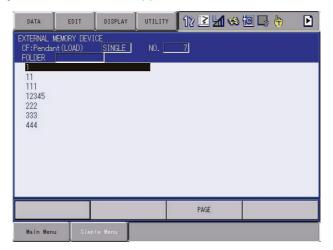
Take extra care for the saved data.

■ Loading a Job

- 1. Select {FD/PC CARD} under the main menu.
- 2. Select {LOAD}.
 - The following window appears.

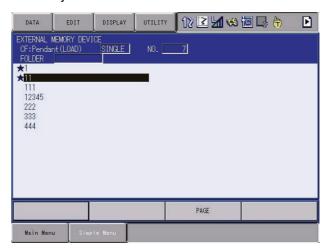


- 3. Select {JOB}.
 - The job selection window appears.



DX100

- 7.3 Operation Flow
- 4. Select a job to be loaded.
 - The selected jobs are marked with "★."



5. Press [ENTER].

- The confirmation dialog box appears.



6. Select "YES."

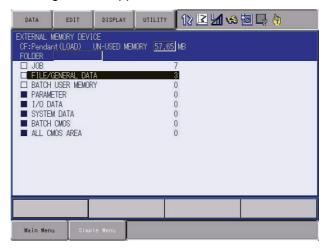
- The selected jobs are loaded.

DX100

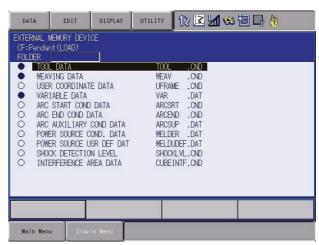
7.3 Operation Flow

Loading a Condition File or General Data

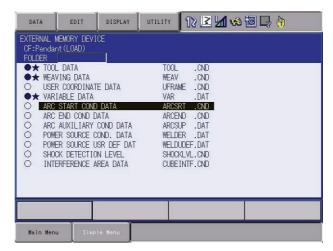
- 1. Select {FD/PC CARD} under the main menu.
- 2. Select {LOAD}.
 - The following window appears.



- 3. Move the cursor to {FILE/GENERAL DATA} and select.
 - The selection window for condition file or general data appears.



- 4. Select a condition file or general data to be loaded.
 - The selected files are marked with "★."



DX100

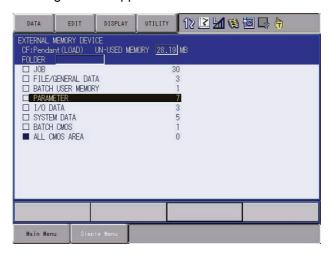
- 7.3 Operation Flow
- 5. Press [ENTER].
 - The confirmation dialog box appears.



- 6. Select "YES."
 - The selected files are loaded.

■ Loading a Parameter

- 1. Select (FD/PC CARD) under the main menu.
- 2. Select {LOAD}.
 - The following window appears.



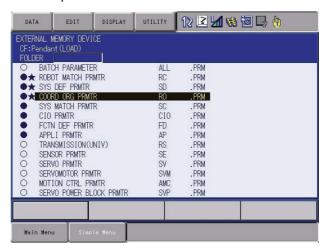
- 3. Move the cursor to {PARAMETER} and select.
 - The selection window for parameters appears.



DX100

7.3 Operation Flow

- 4. Select parameters to be loaded.
 - The selected parameters are marked with "★."



- 5. Press [ENTER].
 - The confirmation dialog box appears.



- 6. Select "YES."
 - The selected parameters are loaded.

DX100

7.3 Operation Flow

■ Loading I/O Data

- 1. Select {FD/PC CARD} under the main menu.
- 2. Select {LOAD}.
 - The following window appears.



- 3. Move the cursor to {I/O DATA} and select.
 - The selection window for I/O data appears.



- 4. Select I/O data to be loaded.
 - The selected I/O data are marked with "★."



- 5. Press [ENTER].
 - The confirmation dialog box appears.



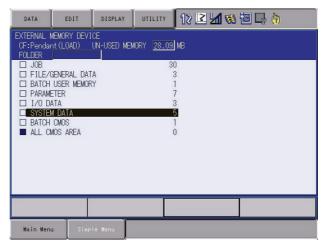
- 6. Select "YES."
 - The selected I/O data are loaded.

DX100

7.3 Operation Flow

Loading System Data

- 1. Select {FD/PC CARD} under the main menu.
- 2. Select {LOAD}.
 - The following window appears.



- 3. Move the cursor to {SYSTEM DATA} and select.
 - The selection window for system data appears.

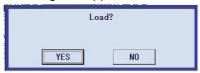


- 4. Select system data to be loaded.
 - The selected system data are marked with "★."



DX100

- 7 External Memory Devices
- 7.3 Operation Flow
- 5. Press [ENTER].
 - The confirmation dialog box appears.



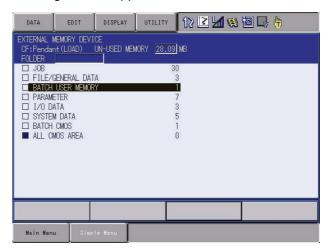
- 6. Select "YES."
 - The selected system data are loaded.

DX100

7.3 Operation Flow

■ Loading All User's Programs

- 1. Select {FD/PC CARD} under the main menu.
- 2. Select {LOAD}.
 - The following window appears.



- 3. Move the cursor to {BATCH USER MEMORY} and select.
- 4. Select "EXECUTE."
 - The confirmation dialog box appears.

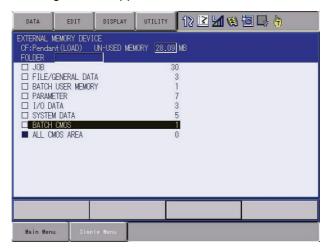


- 5. Select "YES."
 - All user's programs are loaded.

DX100 7.3 Operation Flow

■ Loading All CMOS Data

- 1. Select {FD/PC CARD} under the main menu.
- 2. Select {LOAD}.
 - The following window appears.



- 3. Move the cursor to {BATCH CMOS} and select.
- 4. The confirmation dialog box appears.



- 5. Select "YES."
 - All CMOS data are loaded.

DX100

- 7 External Memory Devices
- 7.3 Operation Flow

7.3.0.4 Verifying Data

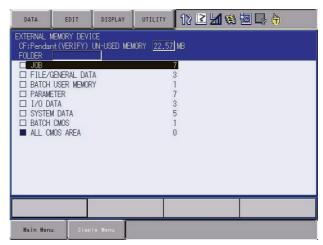
Follow the procedure below to verify data in the memory of the DX100 with data saved in the external memory device.



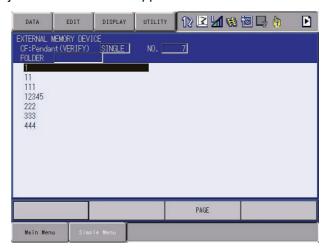
This function cannot be executed with "BATCH USER MEMORY," "BATCH CMOS," or "ALL CMOS AREA" specified.

Verifying a Job

- 1. Select {FD/PC CARD} under the main menu.
- 2. Select {VERIFY}.
 - The following window appears.

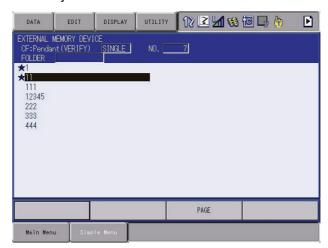


- 3. Select {JOB}.
 - The job selection window appears.



DX100

- 7.3 Operation Flow
- 4. Select a job to be verified.
 - The selected jobs are marked with "★."



- 5. Press [ENTER].
 - The confirmation dialog box appears.



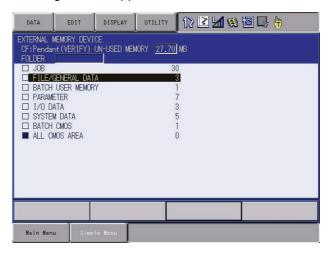
- 6. Select "YES."
 - The selected jobs are verified.

DX100

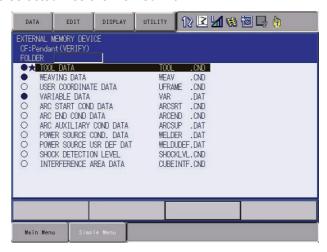
7.3 Operation Flow

Verifying a File

- 1. Select {FD/PC CARD} under the main menu.
- 2. Select {VERIFY}.
 - The following window appears.



- 3. Select the group of the file to be verified.
- 4. Select a file to be verified.
 - The selected files are marked with "★."



- 5. Press [ENTER].
 - The confirmation dialog box appears.



- 6. Select "YES."
 - The selected files are verified.

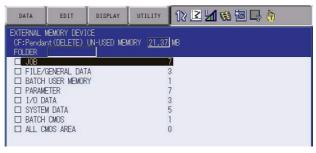
DX100 7 External Memory Devices
7.3 Operation Flow

7.3.0.5 Deleting Data

Follow the procedure below to delete a file or files on an external memory device.

■ Deleting a Job

- 1. Select {FD/PC CARD} under the main menu.
- 2. Select {DELETE}.
 - The following window appears.



- 3. Select {JOB}.
 - The job selection window appears.



- 4. Select a job to be deleted.
 - The selected jobs are marked with "★."



- 5. Press [ENTER].
 - The confirmation dialog box appears.



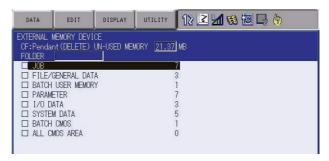
- 6. Select "YES."
 - The selected jobs are deleted.

DX100

7.3 Operation Flow

Deleting a File

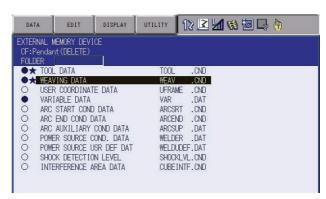
- 1. Select {FD/PC CARD} under the main menu.
- 2. Select {DELETE}.
 - The following window appears.



3. Select the group of the file to be deleted.



- 4. Select a file to be deleted.
 - The selected files are marked with "★."



- 5. Press [ENTER].
 - The confirmation dialog box appears.



- 6. Select "YES."
 - The selected files are deleted.

DX100

7.3 Operation Flow

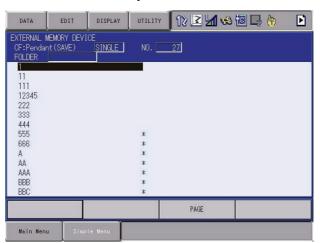
7.3.0.6 Job Selection Mode

The method of selecting a job and various data files when loading, saving, verifying, and deleting are described in the following:

- Individual Selection
 Jobs and data files are selected individually one at a time.
- Batch Selection
 Jobs and data files are selected all at one time.
- Marker (*) Selection
 Loading: selects the files in the external memory device.
 Saving: selects the files in the memory of the DX100.
 Verifying: selects both the files in the external memory device and in the memory of the DX100.

■ Using Individual Selection

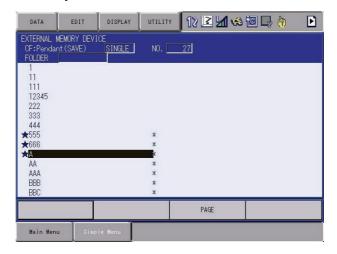
1. In either the external memory JOB LIST window or the file selection window, move the cursor to a job or a file to be selected.



2. Press [SELECT].

Move the cursor to a file needed and press [SELECT] again. *To cancel the selected items, select {EDIT} and then {CANCEL SELECT}.

- The selected jobs are marked with "★."



7 External Memory Devices

DX100

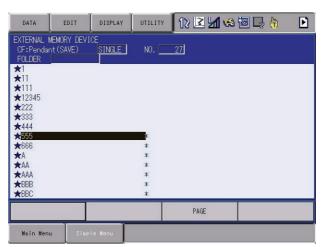
7.3 Operation Flow

■ Using Batch Selection

- 1. In either the external memory JOB LIST window or the file selection window, select {EDIT} under the menu.
 - The pull-down menu appears.



- 2. Select {SELECT ALL}.
 - *To cancel the selected items, select {EDIT} and then {CANCEL SELECT}.
 - All jobs are selected.



7 External Memory Devices

DX100

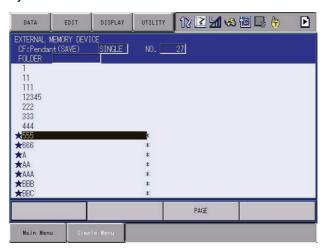
7.3 Operation Flow

■ Using Marker (*) Selection

- 1. In either the external memory JOB LIST window or the file selection window, select {EDIT} under the menu.
 - The pull-down menu appears.



Select {SELECT MARKER (*)}.
 *To cancel the selected items, select {EDIT} and then {CANCEL SELECT}.



8.1 Parameter Configuration

8 Parameter

8.1 Parameter Configuration

The parameters of DX100 can be classified into the following seven:

Motion Speed Setting Parameter

Determines the manipulator motion speed for jog operation at teaching, test operation, or playback operation.

Mode Operation Setting Parameter

Makes the setting for various operations in the teach mode or remote mode.

Parameter according to Interference Area

Limits the P-point maximum envelope of the manipulator or sets the interference area for axis interference or cubic interference.

Parameter according to Status I/O

Sets the parity check or I/O setting for user input/output signals.

Parameter according to Coordinated or Synchronized Operation

Makes the settings for coordinated or synchronized operations between manipulators or between manipulators and stations.

Parameter for Other Functions or Applications

Makes the settings for other functions or applications.

Hardware Control Parameter

Makes the hardware settings for fan alarm or relay operation, etc.

S1CxG Parameters



The initial setting of S1CxG parameters depends on the manipulator model.

For a system in which two manipulators are controlled, the following two types of parameters are used: S1C1G type and S1C2G type.

8.2 Motion Speed Setting Parameters

8.2 Motion Speed Setting Parameters

These parameters set the manipulator motion speed for jog operation at teaching, test operation, or playback operation.

8.2.0.1 S1CxG000: IN-GUARD SAFE OPERATION MAX. SPEED

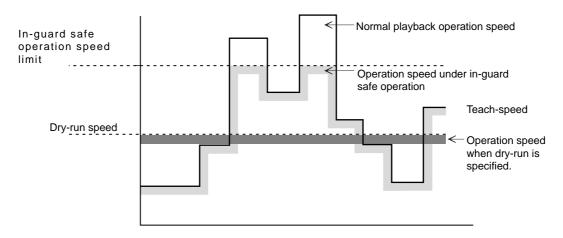
Units: 0.01%

The upper speed limit is set for in-guard safe operation. While the inguard safe operation command signal is being input, the TCP speed is limited to the TCPmax speed.

8.2.0.2 S1CxG001: DRY-RUN SPEED

Units: 0.01%

This is a dry-run operation speed setting value used when checking the path. Take safety into consideration when setting changes are unnecessary.



8.2.0.3 S1CxG002 to S1CxG009: JOINT SPEED FOR REGISTRATION

Units: 0.01%

The value set in these parameters is registered as the joint speed for each speed level when teaching the position data with the programming pendant. The percentage corresponding to the set value at each level is registered as 100% of the value set in the playback speed limit. Values greater than those set as speed limit values cannot be set.

S1CxG002: Level 1 S1CxG003: Level 2

.

S1CxG009: Level 8

	8	Paramete
DX100	8.2	Motion Sp

8.2 Motion Speed Setting Parameters

8.2.0.4 S1CxG010 to S1CxG017: LINEAR SPEED FOR REGISTRATION

Units: 0.1mm/s

The value set in these parameters is registered as the linear speed for each speed level when teaching the position data with the programming pendant. Values greater than those set as playback speed limit values cannot be set.

S1CxG010: Level 1 S1CxG011: Level 2

.

S1CxG017: Level 8

8.2.0.5 S1CxG018 to S1CxG025: POSITION ANGLE SPEED

Units: 0.1°/s

The value set in these parameters is registered as the position angle speed for each speed level when teaching the position data with the programming pendant. Values greater than those set as playback speed limit cannot be set.

S1CxG018: Level 1 S1CxG019: Level 2

.

S1CxG025: Level 8

8.2.0.6 S1CxG026 to S1CxG029: JOG OPERATION ABSOLUTE VALUE SPEED

Units: 0.1mm/s

These are setting values of jog operation speed set by the programming pendant. Values greater than those set as jog operation speed limit value cannot be set.

S1CxG026 Low level : Jog operation speed when "LOW" manual

speed is specified.

S1CxG027 Medium level : Jog operation speed when "MEDIUM" manual

speed is specified.

S1CxG028 High level : Jog operation speed when "HIGH" manual

speed is specified.

S1CxG029 High-speed-level : Jog operation speed when [HIGH SPEED] is

pressed.

8.2 Motion Speed Setting Parameters

8.2.0.7 S1CxG030 to S1CxG032: INCHING MOVE AMOUNT

These parameters specify the amount per move at inching operation by the programming pendant. The referenced parameter differs according to the operation mode at inching operation.

S1CxG030 : Joint Operation (Unit: 1 pulse)

S1CxG031 : Cartesian/cylindrical (Unit: 0.001 mm)
S1CxG032 : Motion about TCP (Unit: 0.001 degree)



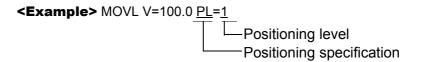
If the value set for S1CxG031 or S1CxG032 is too small, the inching operation does not proceed.



Note that the units of S1CxG031 and S1CxG032 are smaller than those for the NX100.

8.2.0.8 S1CxG033 to S1CxG040: POSITIONING ZONE

This parameter value will be referenced when positioning is specified with the "MOVE" instruction: MOVJ (joint movement) or MOVL (linear movement).



The value set in this parameter specifies the range to enter in relation to the teaching point for that step positioning. After entering the specified positioning zone, the manipulator starts moving to the next step. The system is also set up so inward turning operation is carried out in the moving section when moving to the next path; speed changeover is smooth.

S1CxG033: Positioning level 1 S1CxG034: Positioning level 2

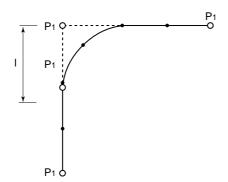
.

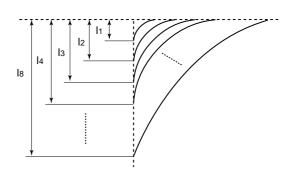
S1CxG040: Positioning level 8

8 Parameter

8.2 Motion Speed Setting Parameters

Since operation will be turning inward during playback, as shown in the following diagram, use setting values taking safety aspects into consideration.







This process becomes effective when change in direction of steps is between 25° and 155° .

Position Level

Position levels are divided into nine stages of 0 to 8 with the "MOV" instruction.

e.g. MOVL V=500 PL=1 (PL:Position Level)

The functions at each level are as follows:

0: Complete positioning to the target point

1 to 8: Inward turning operation

Following are explanations of the respective processing details and their relations with the parameter.

• Level 0



Determines positioning completion when the amount of deviation (number of pulses) to the target point of each axis comes within the position set zone specified by the parameter.

After the positioning completes, the instruction system starts instruction to the next target point.

• Level 1 to 8

Recognizes virtual positioning before the target point. The distance of the virtual target position from the target point is specified at the positioning level.

Distance data corresponding to each level are set in the parameter. Determination of the virtual target position is carried out in the instruction system.

Set zone: The zone of each positioning level set in the parameter. (μm)

	8	Parameter
DX100	8.2	Motion Speed Setting Parameters

8.2.0.9 S1CxG044: LOW-SPEED START

Units: 0.01%

This parameter specifies max. speed at low speed start. Specify the starting method for "initial operation speed of manipulator" (S2C217).

8.2.0.10 S1CxG045 to S1CxG048: JOG OPERATION LINK SPEED

Units: 0.01%

These parameters prescribe the link speed at jog operation by the programming pendant. Specify the percentage (%) for the jog operation speed limit, the joint max. speed.

S1CxG045: Jog operation link speed at level "LOW"

S1CxG046: Jog operation link speed at level "MEDIUM"

S1CxG047: Jog operation link speed at level "HIGH"

S1CxG048: Jog operation link speed at level "HIGH SPEED"

8.2.0.11 S1CxG056: WORK HOME POSITION RETURN SPEED

Units: 0.01%

This parameter specifies the speed for returning to work home position against the maximum speed.

8.2.0.12 S1CxG057: SEARCH MAX. SPEED

Units: 0.1mm/s

This parameter specifies the max. speed for searching.

8.2.0.13 S2C201: POSTURE CONTROL AT CARTESIAN OPERATION OF JOG

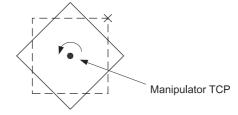
This parameter specifies whether or not posture control is performed at cartesian operation of "JOG" by the programming pendant. Use posture control unless a special manipulator model is used.

0 : With posture control1 : Without posture control

8.2.0.14 S2C202: OPERATION IN USER COORDINATE SYSTEM (WHEN EXTERNAL REFERENCE POINT CONTROL FUNCTION USED)

This parameter specifies the TCP or reference point of motion about TCP when the external reference point control function is used and the user coordinate system is selected by the programming pendant.

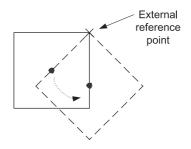
Fig. 8-1: 0: When manipulator TCP is selected



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8.2 Motion Speed Setting Parameters

Fig. 8-2: 1: When external reference point is selected



8.2.0.15 S2C320: CONTROLLED GROUP JOB TEACHING POSITION CHANGE

This parameter is used to change only the job teaching position of controlled group axis.

0 : Not changed1 : Changed

8.2.0.16 S2C422: OPERATION AFTER RESET FROM PATH DEVIATION

8.2.0.17 S2C423: OPERATION AFTER JOB

These parameters specify the method of restarting the manipulator that has deviated from the normal path such as an emergency stop or jog operation.

0 : Move to the indicated step (initial setting).

1 : After moving back to the deviated position, move to the indicated step.

2 : Move back to the deviated position and stop.

Table 8-1: S2C422

Parameter Setting Value	Movement When Restarting			
	Move to next step.			
0	Emergency stop			
	Movement Move to next step. when restarting			
	After moving back to the deviated position, move to the indicated step.			
	Emergency stop			
1	Move back to the deviated position and stop. When restarting, move to the indicated step.			
	Emergency stop (Servo OFF)			
2	Move back the the deviated position and then move to the indicated step.			

8.2 Motion Speed Setting Parameters

Table 8-2: S2C423

Parameter Setting Value	Movement When Restarting		
0	Move to the next step. Movement when restarting Move to next step.		
1	After moving back to the deviated position, move to the indicated step. Emergency stop (Servo OFF) Move back to the deviated position and then move to the indicated step.		
2	Move back to the deviated position and stop. When restarting, move to the indicated step.		



- To the path deviated position, the manipulator moves in a straight line at low speed operation (SICxG044).
 It is linear movement. After resetting from deviation, the speed becomes the same as taught speed.
- The initial setting (prior to shipping) is 0: The manipulator moves in a straight line from the present position to the indicated step.

8.2.0.18 S2C424: DEVIATED POSITION

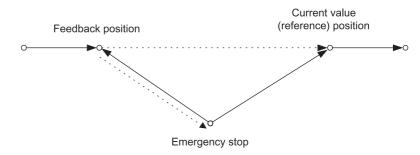
This parameter specifies whether deviated position is to be robot current (reference) position or feedback position.

0 : Return to the feedback position.

1 : Return to the current value (reference) position.

- 8 Parameter
- 8.2 Motion Speed Setting Parameters

When emergency stop is applied during high-speed motion, the deviated position differs from the robot current value (reference) position and feedback position as shown in the following.



8.2.0.19 S2C425: CIRCULAR INTERPOLATION TOOL POSITION CONTROL

This parameter selects tool position control methods at circular interpolation operation.

0 : Fixed angle position

Interpolation is performed depending on the position change viewed from the base coordinate.

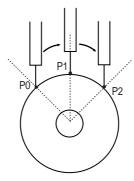
As the figure below (left) shows, when tool position viewed from outside is not significantly changed and that position is mainly taught at teaching, this setting is required.

1 : Rotating position by circular arc path

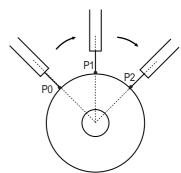
Interpolation is performed depending on the position change corresponding to circular arc path.

As the figure below (right) shows, when tool position corresponding to circular arc path (tool position viewed from the center of the circular arc) is not significantly changed, and that position is mainly taught at teaching, this setting is required.

0: Fixed angle position



1: Rotating position by circular arc path



8.2.0.20 S2C653: EMERGENCY STOP CURSOR ADVANCE CONTROL FUNCTION

This parameter specifies whether to use the cursor advance control function or not.

0: Not use

1: Use

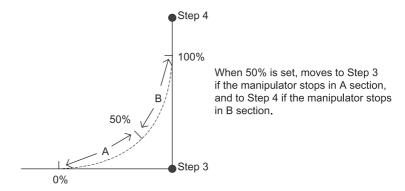
	8	Parameter	
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8.2 Motion Speed Setting Parameters

8.2.0.21 S2C654: EMERGENCY STOP CURSOR ADVANCE CONTROL FUNCTION CONT PROCESS COMPLETION POSITION

Units: %

When the manipulator stops during moving inner corner by CONT process, this parameter specifies which position of the inner corner should be considered as the end of step.



8.2.0.22 S2C655: EMERGENCY STOP ADVANCE CONTROL FUNCTION WORK START INSTRUCTION STEP MOTION COMPLETION DELAY TIME

Units: ms

In order to recognize securely the completion of motion to the step of work start instruction (such as ARCON instruction), this parameter specifies the delay time for motion completion of the work start instruction step only.

8.2.0.23 S2C698: BASE AXIS OPERATION KEY ALLOCATION SETTING

Table 8-3: Parameter Setting and Jog Operation Key Allocation

Coordinates/Parameter	S2C698= "0"	S2C698= "1"	
Joint	Axis number order	Specified	
Cylindrical	Axis number order	Specified	
Cartesian	Specified	Specified	
Tool	Specified	Specified	
User	Specified	Specified	

Axis number order: X: First axis, Y: Second axis, Z: Third axis

Specified: X: X-direction (RECT-X), Y: Y-direction (RECT-Y), Z: Z-direction (RECT-Z)

	8	Parameter
DX100	8.2	Motion Speed Setting Parameters

8.2.0.24 S3C1098 to S3C1102: POSITION CORRECTING FUNCTION DURING PLAYBACK

These parameters specify the necessary data for position correcting function (PAM) during playback operation.

 $S3C1098 \qquad \text{Specifies the limit of position correcting range (Units: } \mu\text{m}) \\ S3C1099 \qquad \text{Specifies the limit of speed correcting range (Units: 0.01%)}$

S3C1100 Specifies the correcting coordinates

0 : Base 1 : Robot 2 : Tool 3 : User 1 to 26:User 24

S3C1102 Specifies the limit of posture angle adjustment range (Units: 0.01°)

8.3 Mode Operation Setting Parameters

8.3 Mode Operation Setting Parameters

These parameters set various operations in the teach mode or remote mode.

Some parameters can be set through $\{SETUP\} \rightarrow \{TEACHING COND\}$ or $\{OPERATE COND\}$.

8.3.0.1 S2C195: SECURITY MODE WHEN CONTROL POWER SUPPLY IS TURNED ON

The operation level when the control power supply is turned ON is set.

0 : Operation Mode1 : Editing Mode2 : Management Mode

8.3.0.2 S2C196: SELECTION OF CARTESIAN/CYLINDRICAL

This parameter specifies whether the cartesian mode or cylindrical mode is affected when cartesian/cylindrical mode is selected by operation (coordinate) mode selection at axis operation of programming pendant. This specification can be done on the TEACHING CONDITION window.

0 : Cylindrical mode1 : Cartesian mode

8.3.0.3 S2C197: COORDINATE SWITCHING PROHIBITED

This parameter prohibits switching coordinates during JOG operation by the programming pendant.

0 : Switching permitted for tool coordinates and user coordinates

1 : Switching prohibited for tool coordinates2 : Switching prohibited for user coordinates

3 : Switching prohibited for tool coordinates and user coordinates

8.3.0.4 S2C198: EXECUTION UNITS AT "FORWARD" OPERATION

This parameter specifies the execution units at step mode of "FORWARD" operation by the programming pendant .

Parameter Setting Value	Operation Units			
0	MOVL DOUT TIMER DOUT MOVL		Stops at every instruction	
1	MOVL DOUT TIMER DOUT MOVL	3	Stops at move instruction	

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8.3 Mode Operation Setting Parameters

8.3.0.5 S2C199: INSTRUCTION (EXCEPT FOR MOVE) EXECUTION AT "FORWARD" OPERATION

This parameter specifies the method of instruction (except for move) execution at "FORWARD" operation by the programming pendant.

0 : Executed by pressing [FWD] + [INTERLOCK]

1 : Executed by pressing [FWD] only

2 : Instruction not executed

8.3.0.6 S2C203: CHANGING STEP ONLY

This parameter specifies whether to permit only step changes in an editing-prohibited job. When permitted, only position data can be changed but additional data such as speed cannot be changed. This specification can be done on the TEACHING CONDITION window.

0 : Permitted1 : Prohibited

8.3.0.7 S2C204: MANUAL SPEED STORING FOR EACH COORDINATE

This parameter specifies whether to assign different manual speeds for the joint coordinates and other coordinates. If "NOT STORED" is selected, manual speed is not affected by changing the coordinates. If "STORED" is selected, manual speeds can be selected separately for the joint coordinates and other coordinates.

0 : Not stored1 : Stored

8.3.0.8 S2C206: ADDITIONAL STEP POSITION

This parameter designates either "before next step" or "after the cursor position (between instructions)" as additional step position. This specification can be done on the TEACHING CONDITION window.

Fig. 8-3: <Example>

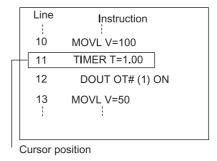


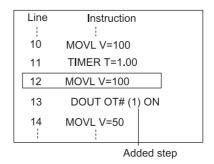
Fig. 8-4: S2C206-0 (Before the Next Step)

8 Parameter

DX100

8.3 Mode Operation Setting Parameters

Fig. 8-5: S2C206-1 (Between Instructions)



8.3.0.9 S2C207: MASTER JOB CHANGING OPERATION

This parameter specifies whether to permit or prohibit master job changing operation. If "PROHIBIT" is specified, the master job cannot be changed (or registered) easily. The specification can be done on the OPERATING CONDITION window.

0 : Permitted1 : Prohibited

8.3.0.10 S2C208: CHECK AND MACHINE-LOCK KEY OPERATION IN PLAY MODE

This parameter specifies whether to permit or prohibit in play mode to change the operation that changes the operation condition. Even if an error occurs because of the operation with the keys, the manipulator does not stop. The specification can be done on the OPERATING CONDITION window.

0 : Permitted1 : Prohibited

8.3.0.11 S2C209: RESERVED WORK JOB CHANGING OPERATION

This parameter specifies whether to permit reserved work job changing operation.

The designation can be done on the OPERATING CONDITION window.

0 : Permitted1 : Prohibited

8.3.0.12 S2C210: MASTER OR SUBMASTER CALL OPERATION IN PLAY MODE

This parameter specifies whether the master or submaster call operation in play mode is permitted or not. When the independent control function is valid, the master job for sub-task is specified at the same time. The specification can be done on the OPERATING CONDITION window.

0 : Permitted1 : Prohibited

8.3 Mode Operation Setting Parameters

8.3.0.13 S2C211: LANGUAGE LEVEL

This parameter specifies the level of the robot language (INFORM III). The levels simplify the instruction registering operation. With the DX100, all robot instructions can be executed regardless of specification of instruction sets. The specification can be done on the TEACHING CONDITION window.

0: Contracted Level

Only frequently used robot instructions are selected to reduce the number of instructions to be registered. Robot instructions displayed on the instruction dialog box are also reduced so that specification is simplified.

1: Standard Level

2: Expanded Level

All the robot instructions are available in standard and expanded levels. The two levels are distinguished by the number of additional information items (tags) that can be used with robot instructions. At the expanded level, the flowing functions are available.

- Local Variables and Array Variables
- Use of Variables for Tags (Example: MOVJ VJ=I000)
 The above functions are not available at the standard level, however, which reduces the number of data required to register instructions, thereby simplifying the operation.

8.3.0.14 S2C214: INSTRUCTION INPUT LEARNING FUNCTION

This parameter specifies whether to set a line of instructions that has been input on the input buffer line when pressing the first soft key for each instruction. If "PROVIDED" is selected, the instructions are set.

0 : Without learning function1 : With learning function

8.3.0.15 S2C215: ADDRESS SETTING WHEN CONTROL POWER IS TURNED ON

This parameter specifies the processing of the job name, step No., and line No. that are set when the control power supply is turned ON.

0 : Reproduces the address when power supply is turned ON.

1 : Lead address (Line"0") of the master job.

8.3.0.16 S2C216: JOB LIST DISPLAY METHOD AT JOB SELECTION

These parameters specify the displaying method on the JOB LIST window at job selection.

0 : Order of Names1 : Order of Date

0	Davanata
0	Parameter

8.3 Mode Operation Setting Parameters

8.3.0.17 S2C217: INITIAL OPERATION OF MANIPULATOR

This parameter specifies the operation speed level of the first section when starting. Specify the operation speed with the low-speed start (S1CxG044). When starting at low-speed, the manipulator stops after reaching the indicated step regardless of the cycle setting. Once the manipulator is paused during the low-speed operation, it moves at teaching speed when restarted.

Specified on the SPECIAL PLAY window. Operates at low speed only when low speed start is set. Operates at taught speed when not instructed.

1 : Starts at low speed after editing regardless of soft key instructions.

8.3.0.18 S2C218: PLAYBACK EXECUTION AT CYCLE MODE "1- STEP"

Parameter Setting Value		Ol	peration Units
0	MOVL DOUT TIMER DOUT MOVL		Stops at every instruction
1	MOVL DOUT TIMER DOUT MOVL		Stops at move instruction



When operating "FORWARD" by the programming pendant, the units for execution are set in another parameter (S2C198).

8.3.0.19 S2C219: EXTERNAL START

This parameter specifies whether a start instruction from external input is accepted or not. The specification can be done on the OPERATING CONDITION window.

9 : Permitted1 : Prohibited

8.3.0.20 S2C220: PROGRAMMING PENDANT START

This parameter specifies whether a start instruction from the programming pendant is accepted or not.

0 : Permitted1 : Prohibited

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8.3 Mode Operation Setting Parameters

8.3.0.21 S2C221: SPEED DATA INPUT FORM

This parameter specifies the units for speed data input and display.

mm/s: in units of 0.1 mm/s cm/min: in units of 1cm/min inch/min: in units of 1 inch/min mm/min: in units of 1 mm/min

The specification can be done on the OPERATING CONDITION window.

0 : mm/sec1 : cm/min2 : inch/min3 : mm/min

8.3.0.22 S2C222: RESERVED START

This parameter specifies whether a reserved start instruction from the programming pendant is accepted or not. The specification can be done on the OPERATING CONDITION window.

0 : Permitted1 : Prohibited

8.3.0.23 S2C224: JOB SELECTION AT REMOTE FUNCTION (PLAY MODE)

This parameter specifies whether a job selection in play mode at remote function is prohibited or not.

0 : Permitted1 : Prohibited

8.3.0.24 S2C225: EXTERNAL MODE SWITCH

This parameter specifies whether mode switching from the outside is accepted or not. The specification can be done on the OPERATING CONDITION window.

0 : Permitted1 : Prohibited

8.3.0.25 S2C227: EXTERNAL CYCLE SWITCHING

This parameter specifies whether cycle switching from the outside is accepted or not. The specification can be done on the OPERATING CONDITION window.

0 : Permitted1 : Prohibited

	8	Parameter
DX100	8.3	Mode Operation Setting Parameters

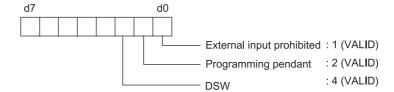
8.3.0.26 S2C228: PROGRAMMING PENDANT CYCLE SWITCHING

This parameter specifies whether cycle switching from the programming pendant is accepted or not. The specification can be done on the OPERATING CONDITION window.

PermittedProhibited

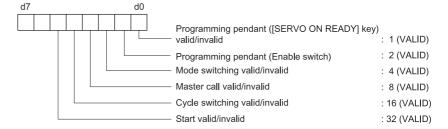
8.3.0.27 S2C229: SERVO ON FROM EXTERNAL PP PROHIBITION

This parameter specifies whether a servo ON instruction is accepted or not. More than one instruction can be specified. For example, to permit the servo ON instruction from an external input only, set "2." In this case, servo ON instruction from the programming pendant is not accepted. The specification can be done on the OPERATING CONDITION window.



8.3.0.28 S2C230: PROGRAMMING PENDANT OPERATION WHEN "IO" IS SELECTED FOR REMOTE MODE

This parameter specifies whether each operation of the following is valid when "IO" is selected for remote function selection. IO and command are available for remote function selection: "IO" is set prior to shipping. "Command" is valid when transmission function (optional) is specified.



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8.3 Mode Operation Setting Parameters

8.3.0.29 S2C234: STEP REGISTRATION AT TOOL NO. CHANGE

The registration of the step when the tool number is changed allows the setting to be made as prohibited.

If this parameter is set to "1" (prohibited), the following operations are prohibited.

0 : Permitted1 : Prohibited

· Modification of a step

When the tool number of the teaching step differs from the currentlyselected tool number, the step cannot be modified.

· Deletion of a step

Even if the teaching step position coincides with the current position, the step cannot be deleted when the tool number of the teaching step differs from the currently-selected tool number.

Addition of a step

When the tool number of the teaching step indicated by the cursor differs from the currently-selected tool number, the step cannot be added.

8.3.0.30 S2C293: REMOTE FIRST CYCLE MODE

This parameter sets the cycle that changes from the local mode to the remote mode.

The setting can be made on the OPERATING CONDITION window.

0 : Step

1 : 1 cycle

2 : Continuous

3 : Setting retained

8.3.0.31 S2C294: LOCAL FIRST CYCLE MODE

This parameter sets the cycle that changes from the remote mode to the local mode.

The setting can be made on the OPERATING CONDITION window.

0 : Step

1 : 1 cycle

2 : Continuous

3 : Setting retained

8.3.0.32 S2C312: POWER ON FIRST CYCLE MODE

This parameter sets the first cycle mode for when the power is turned ON.

The setting can be made on the OPERATING CONDITION window.

0 : Step

1 : 1 cycle

2 : Continuous

3 : Setting retained

DX100	-	Parameter Mode Operation Setting Parameters

8.3.0.33 S2C313: TEACH MODE FIRST CYCLE MODE

This parameter sets the cycle that changes from the play mode to the teach mode.

The setting can be made on the OPERATING CONDITION window.

0 : Step1 : 1 cycle2 : Continuous3 : Setting retained

DX100	-	Parameter Mode Operation Setting Parameters

8.3.0.34 S2C314: PLAY MODE FIRST CYCLE MODE

This parameter sets the cycle that changes from the teach mode to the play mode.

The setting can be made on the OPERATING CONDITION window.

0 : Step1 : 1 cycle2 : Continuous3 : Setting retained

8.3.0.35 S2C316: START CONDITION AFTER ALARM-4107 ("OUT OF RANGE (ABSO DATA)")

This parameter specifies the activating method after the alarm 4107 ("OUT OF RANGE (ABSO DATA)") occurs.

0 : Position check operation required

1 : Low-speed start up

8.3.0.36 S2C395: SIGNAL NAME ALIAS FUNCTION

On the JOB CONTENT window, the name registered to the user input/ output signal number can be displayed as alias instead of the signal number itself.

Table 8-4: S2C395

Parameter Setting Value	Valid/Invalid
0	Function invalid
1	Function valid

- 1. With this function valid, the confirmation dialog box "Register by name (alias)?" is displayed when a signal (IN#(), OT#(), IG#(), OG#(), IGH#(), OGH#()) is selected on the DETAIL EDIT window.
- Select "YES" and the signal select window appears. Then select the target signal of number and press [ENTER], and the registered name is displayed instead of the signal number. However, if the signal number's name is not yet registered, it is displayed by number as usual.

<Example> Registration of the name of user output OUT#0001 as "OUTPUT 1"

In the case of DOUT instruction:

S2C395=0: DOUT OT#(1) ON

S2C395=1: DOUT OT#(OUTPUT 1) ON

Select {IN/OUT} → {UNIVERSAL INPUT/OUTPUT} to edit signal names on the window. Up to 16 characters can be entered as a signal name. However, when this function is valid, if the content below is entered, the error message shows and the name cannot be registered.

- · The name already registered
- Letters beginning with a number
- Letters including the signs below:(,),[,],=,<,>, space, comma
- Letters beginning with "alphabets representing variables" + "number"



<Example> B0..., I0..., BP1..., LEX2...

Alphabets representing variables: B, I, D, R, S, P, BP, EX, PX, LB, LI LD, LR, LS, LP, LBP, LEX, LPX

When the name begins with "'", it is regarded as a comment and the same comment can be registered for two or more signals. In this case, although this function is valid, the number is displayed on the JOB CONTENT window instead of the name.

<Example> Registration of the name of user output OUT#0002 as " 'OUTPUT 2"

S2C395=0 : DOUT OT#(2) ON S2C395=1 : DOUT OT#(2) ON

8.3.0.37 S2C396: VARIABLE NAME ALIAS FUNCTION

On the JOB CONTENT window, the name registered to the variable (including local variables) can be displayed as alias instead of the variable number.

Table 8-5: S2C396

Parameter Setting Value	Valid/Invalid
0	Function invalid
1	Function valid

- With this function valid, the confirmation dialog box "Register by name (alias)?" is displayed when you select the variable on the DETAIL EDIT window.
- Select "YES" and the variable select window appears. Then select the target variable of number and press [ENTER], and the registered name is displayed instead of the variable number. However, if the variable number's name is not yet registered, it is displayed by number as usual.

Example> Registration of the byte type variable B000 as "WORK KIND" In the case of SET instruction

S2C396=0 : SET B000 128 S2C396=1 : SET WORK KIND 128

Select {VARIABLE} from the menu to select each variable and edit the variable name. Up to 16 characters can be entered as a variable name. However, when this function is valid, if the content below is entered, the error message shows and the name cannot be registered.

- · The name already registered
- Letters beginning with a number
- Letters including the signs below:(,) , [,] , = , < , > , space, comma
- Letters beginning with "alphabets representing variables" + "number"



<Example> B0..., I0..., BP1..., LEX2...

Alphabets representing variables: B, I, D, R, S, P, BP, EX, PX, LB, LI LD, LR, LS, LP, LBP, LEX, LPX

When the name begins with "'", it is regarded as a comment and the same comment can be registered for two or more variables. In this case, although this function is valid, the number is displayed on the JOB CONTENT window instead of the name.

<Example> Registration of the byte type variable B001 as "WORKNUM"

S2C396=0 : SET B001 10 S2C396=1 : SET B001 10

8.3.0.38 S2C397: I/O VARIABLE CUSTOMIZE FUNCTION

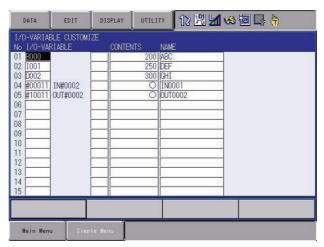
This function enables registration of any particular input/output signal/variable. Reference and editing of signals/variables are possible on the same window.

Table 8-6: S2C397

Parameter Setting Value	Valid/Invalid
0	Function Invalid
1	Function Valid

With this function valid, the sub-menu {I/O-VARIABLE CUSTOMIZE} opens under the main menu {ARC WELDING}, {SPOT WELDING}, {GENERAL}, {HANDLING} (differs by application). Select {I/O-VARIABLE CUSTOMIZE}, and the I/O-VARIABLE CUSTOMIZE window appears as follows.

Fig. 8-6: I/O VARIABLE CUSTOMIZE Window



On the I/O-VARIABLE CUSTOMIZE window, any of the input/output signals/variables can be selected and registered (up to 32 items). Registrable signals/variables are as follows:

Table 8-7: Registrable Items on the I/O-VARIABLE CUSTOMIZE Window

Input/Output Signals	USER INPUT SIGNAL USER OUTPUT SIGNAL PSEUDO INPUT SIGNAL
Variables	BYTE TYPE VARIABLE (B VARIABLE) INTEGER TYPE VARIABLE (I VARIABLE) DOUBLE-PRECISION INTEGER TYPE VARIABLE (D VARIABLE)

The contents and names of the registered signals/variables can be checked and edited on this window.

In addition, the data list of registered signals/variables can be loaded, saved, verified or deleted with an external memory unit.

Only when this function is valid, "I/O-VARIABLE CUSTOMIZE (file name: USRIOVAR.DAT)" is displayed and can be selected. To display the "I/O-

VARIABLE CUSTOMIZE (file name: USRIOVAR.DAT)", select {FD/CF} → {LOAD} {SAVE} {VERIFY} {DELETE} → {SYSTEM DATA}

8	Parameter
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8.3 Mode Operation Setting Parameters

8.3.0.39 S2C415 to S2C419: TIME RESET

These parameters specify whether resetting operation of the specified times is permitted or not.

S2C415 : CONTROL POWER ON TIME S2C416 : SERVO POWER ON TIME

S2C417 : PLAYBACK TIME S2C418 : WORK TIME S2C419 : WEAVING TIME

0 : Prohibit Resetting1 : Permit Resetting

"PERMIT" is set as the initial value for the work time and motion time.

8.3.0.40 S2C431: TOOL NO. SWITCHING

This parameter specifies whether tool number switching is permitted or not.

0 : Prohibited (Only number "0" can be used.)

1 : Permitted (64 type of tools from number "0" to "63" can be used.)

8.3.0.41 S2C433: POSITION TEACHING BUZZER

This parameter specifies whether the buzzer sound at position teaching is used or not.

0 : With buzzer1 : Without buzzer

8.3.0.42 S2C434: JOB LINKING DESIGNATION (When Twin Synchronous Function Used)

This parameter specifies whether the manipulator at the synchronizing side is to be linked when the manipulator and the station at the synchronized side are performing FWD/BWD or test run, by using the twin synchronous function.

0 : Not operating1 : Linking

Fig. 8-7: 0 : Does not operate the synchronizing side while teaching the synchronized side.

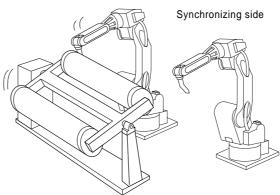
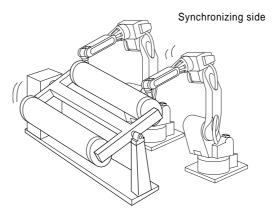


Fig. 8-8: 1 : Links the synchronizing side while teaching the synchronized side.



8.3.0.43 S2C437: PLAYBACK OPERATION CONTINUATION FUNCTION

This function is used to decide where to resume the playback on the start operation after suspending the playback and moving the cursor or selecting other jobs.

- 0: Starts operation where the cursor is located in the job displayed at the moment.
- 1: The playback continuation window appears. Select "YES" and the playback resumes where the cursor has been located when the playback suspended. If "NO" is selected, the playback resumes where the cursor is located in the job displayed at the moment.

Table 8-8: S2C437

Parameter Setting Value	Where the Playback Resumes		
0	Resumes where the cursor is located in the job displayed at the moment.		
1	Resumes where the cursor has been located when the playback suspended OR where the cursor is located in the job displayed at the moment. <example> Suspended at step 0003 during the playback of job A Displays job B Starts operation On the playback operation continuation window When "YES" selected, the playback resumes from step 0003 of job A</example>		
	When "NO" selected, the playback resumes from the current position in job B		

* When this function is valid (S2C437=1), a light blue cursor is displayed at the instruction section of step where the playback has been stopped. When "YES" is selected, the playback resumes where this cursor is located.





If a job has been edited or FWD/BWD/TEST RUN operation(s) have been executed, the playback cannot resume where it has suspended. Also this function is invalid if the reserved start function is set valid (S2C222=0).

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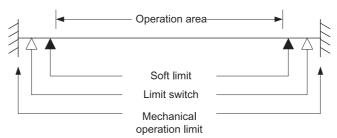
8.4 Parameters according to Interference Area

8.4 Parameters according to Interference Area

These parameters limit the P-point maximum envelope of the manipulator or set the interference area for axis interference or cubic interference.

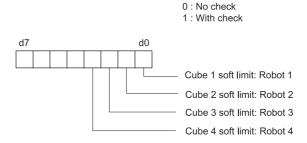
8.4.0.1 S1CxG400 to S1CxG415: PULSE SOFT LIMIT

Soft limit is set independently for each axis by pulse value setting. Set current value (pulse value) of the axis at the soft limit set up position.



8.4.0.2 S2C001: CUBE SOFT LIMIT CHECK

This parameter specifies whether to check the cube soft limit. More than one soft limit can be specified.



If "WITH CHECK" is selected, set up the following parameters.

Units: µm

Cube Soft Limit (Base Coordinates of Robot TCP)

S3C000: Robot 1: + side: X S3C001: Robot 1: + side: Y S3C002: Robot 1: + side: Z S3C003: Robot 1: - side: X S3C004: Robot 1: - side: Y S3C005: Robot 1: - side: Z S3C006: Robot 2: + side: X

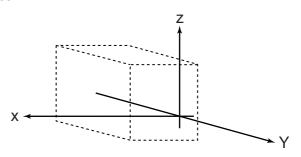
Soft Limit

Soft limit is a software-type function to limit the range of movement of the manipulator.

If the TCP reaches the soft limit during operation, the manipulator automatically stops and no longer moves in that same direction. An alarm occurs if this soft limit is exceeded during playback. This soft limit is classified into two types.

Cube Soft Limit
 Soft limit is set with the absolute value on the base coordinates.





 Pulse Soft Limit (Independent Axis Soft Limit)
 Refer to chapter 8.4.0.1 "S1CxG400 to S1CxG415: PULSE SOFT LIMIT" at page 8-28.

8.4.0.3 S2C002: S-AXIS INTERFERENCE CHECK

This parameter specifies whether to check for interference with each manipulator. If "WITH CHECK" is selected, set up the following parameters.

Units: Pulse

S3C048: S-axis Interference Area Robot 1 (+)

S3C049: S-axis Interference Area Robot 1 (-)

S3C050: S-axis Interference Area Robot 2 (+)

S3C051: S-axis Interference Area Robot 2 (-)

.

S3C055: S-axis Interference Area Robot 4 (+)

8.4.0.4 S2C003 to S2C066: CUBE/AXIS INTERFERENCE CHECK

1. Designation of checking

These parameters specify the cube/axis interference to be used by bit.

0 : Cube Interference/Axis Interference Not

Used : Robot 1

1 : Robot 1 2 : Robot 2

....

8 : Robot 89 : Base Axis 110 : Base Axis 2

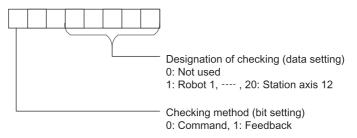
16 : Base Axis 817 : Station Axis 118 : Station Axis 2

.....

40 : Station Axis 24

2. Checking method

Designates whether checking is performed by command or feedback.



Checking method

The checking method differs according to ON/OFF status of servo power supply.



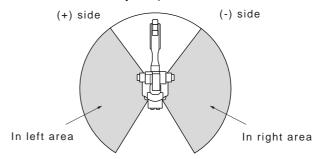
Checking Method Designation	Servo Power Supply ON	Servo Power Supply OFF
Command	Command	Feedback
Feedback	Feedback	Feedback

During the servo float function operation, checking is performed by feedback regardless of the checking method designation.

Interference Area

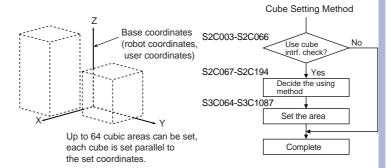
It is possible to output whether the TCP during operation is inside or outside as a status signal, and to set the area to control the position by parameters S2C003 to S2C194. When the manipulator attempts to enter this area, the corresponding input signal (e.g. an "entrance prohibit signal") is detected. The manipulator stops immediately if there is an input signal and goes into waiting status until this signal is cleared. This signal is processed in the I/O section. Three methods of interference area settings are prepared for manipulators and stations. For a system with one manipulator, use robot 1.

• S-axis Interference Area Position is controlled by the pulse value of the S-axis.

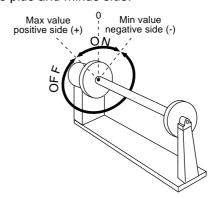


 Cubic Interference Area
 Up to 64 cubic areas can be set. The edges of the cubes are set parallel to the robot coordinates or the user coordinates.





Axis Interference Area
 Up to 64 areas can be set. Each operation area maximum
 and minimum value are set for the robot, base axis, and
 station axis plus and minus side.



8.4.0.5 S2C067 to S2C194: CUBE USING METHOD

These parameters specify the coordinates for defining the cube. If the user coordinates are selected, also specify the user coordinate system numbers. Set cubic area referring to the cubic interference areas shown below.

Coordinate specification

0 : Pulse (axis interference)

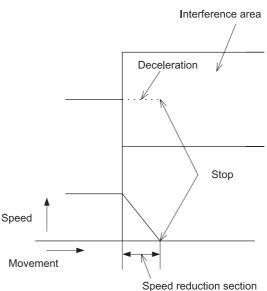
Base coordinates
 Robot coordinates
 User coordinates

Coordinate No.: Specify the user coordinate number when selecting "3: User Coordinates."

Units: 1µm

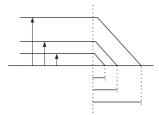
Precaution When Setting the Interference Area

It will be necessary to consider the following when setting the cubic interference and S-axis interference areas. The manipulator is processed to decelerate to stop from the point where it enters in the area. Therefore, set the areas in consideration of the amount of the manipulator movement in the deceleration section shown in the figure below.





The move amount in the speed reduction section is dependent on the moving speed of the manipulator at that time:



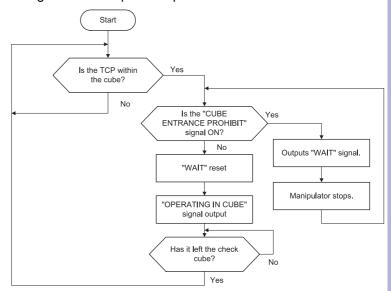
V = 1500mm/s \rightarrow approx. 300mm (Max.)

V = 1000mm/s \rightarrow approx. 160mm V = 30mm/s \rightarrow approx. 3 to 4 mm

V = 20mm/s \rightarrow approx. 2mm

Interference Prevention in Interference Area

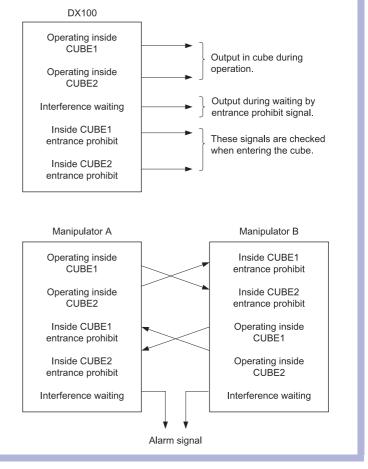
Processing to prevent interference is executed in the I/O processing section. The relation between the DX100 I/O signal and manipulator operation is shown below.



In wait status with the entrance prohibit signal, the manipulator just barely enters the area for speed reduction processing and then stops.

Fig. 8-9: Connection Example Where Two Manipulators are Operated in the Same Area





DV400	-	Parameter
DX100	8.4	Parameters according to Interference Area

8.4.0.6 S3C000 to S3C047: CUBE SOFT LIMIT

These parameters specify auxiliary functions of S2C001 parameter. For details, see *chapter 8.4.0.2* "S2C001: CUBE SOFT LIMIT CHECK" at page 8-28.

8.4.0.7 S3C048 to S3C063: S-AXIS INTERFERENCE AREA

These parameters specify auxiliary functions of S2C002 parameter. For details, see *chapter 8.4.0.3* "S2C002: S-AXIS INTERFERENCE CHECK" at page 8-29.

8.4.0.8 S3C064 to S3C1087: CUBIC INTERFERENCE AREA

These parameters specify auxiliary functions of S2C003 to S2C066 parameters. For details, see *chapter 8.4.0.4* "S2C003 to S2C066: CUBE/AXIS INTERFERENCE CHECK" at page 8-30.

8.4.0.9 S3C1089 to S3C1096: ROBOT INTERFERENCE AREA

These parameters specify auxiliary functions of S2C236 to S2C263 parameters. For details, see *chapter 8.4.0.6* "S3C000 to S3C047: CUBE SOFT LIMIT" at page 8-34.

8.4.0.10 S3C1097: A SIDE LENGTH OF WORK-HOME-POSITION CUBE

Units: 1µm

This parameter specifies a side length of the cube for the work home position.

8	Paramete

DX100

8.5 Parameters according to Status I/O

8.5 Parameters according to Status I/O

These parameters set the parity check or I/O setting for user input/output signals.

8.5.0.1 S2C235: USER OUTPUT RELAY WHEN CONTROL POWER IS ON

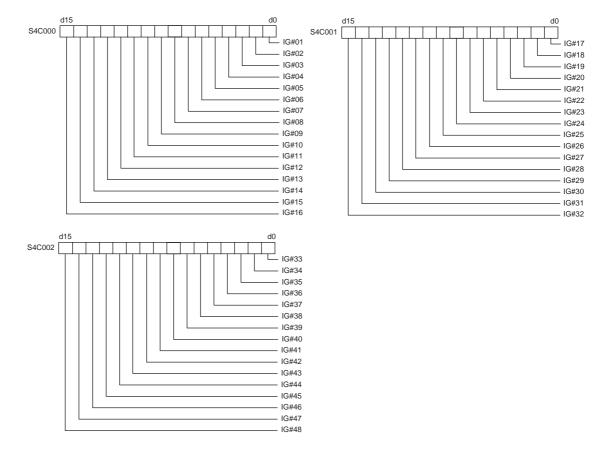
This parameter specifies the state of the user output relays when the control power is turned ON. Since the power OFF state, including peripheral devices, cannot be completely reproduced, take note when restarting.

0 : Reset to the power OFF state1 : Initialized (all user relays OFF)

8.5.0.2 S4C000 to S4C015: PARITY OF USER INPUT GROUPS

These parameters specify whether to execute priority checks with parameters when instructions covering the input group (1G#) are executed. The instructions covering the input groups are as shown below.

- IF Sentence (JUMP, CALL, RET, PAUSE)
- Pattern Jump, Pattern Job Call
- DIN
- WAIT



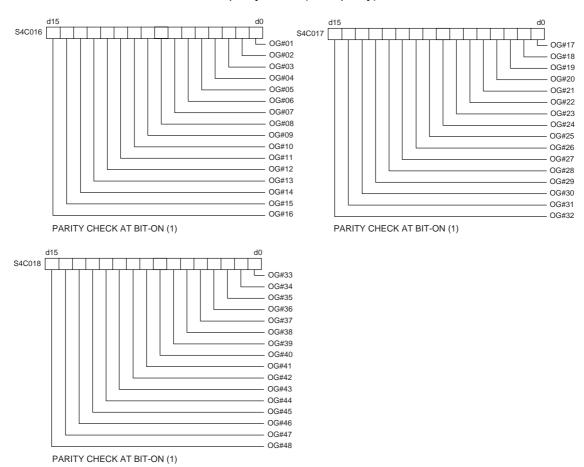
Parity bits are set as the highest level bits of each input group and are written in even parity. If an error is detected during parity check, an alarm occurs and the manipulator stops. Remains unchanged if no parity check is specified.

	8	Parameter
DX100	8.5	Parameters

3.5 Parameters according to Status I/O

8.5.0.3 S4C016 to S4C031: PARITY OF USER OUTPUT GROUPS

These parameters specify whether the output group instruction is executed with parity check (even parity).



Parity bits are set as the highest level bits of each output group. For example, if OG#01 is specified with parity and DOUT OG# (1) 2 is executed, the result will be 00000010 if 2 is binary converted. Since there will be only one bit (odd) ON at this time, the parity bit (highest level bit) will be set to ON and 10000010 (130) will be output to OG# (1).

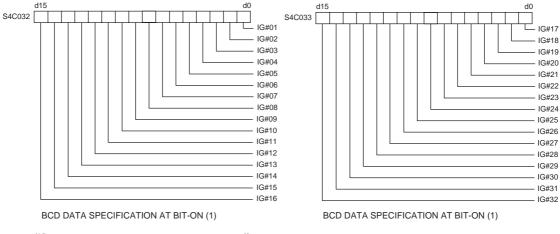
As in the case of a variable such as DOUT OG# (1) B003 parity bits are added to the contents of the variable data. However, if the contents of the variable exceed 127, as in the case of DOUT OG# (1) 128, an alarm will occur. Remains unchanged if no parity check is specified.

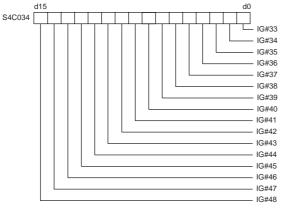
8.5 Parameters according to Status I/O

8.5.0.4 S4C032 to S4C047: DATA OF USER INPUT GROUPS

These parameters specify whether to handle the input group data as binary data or as BCD data when an instruction for the input group (1G#) is executed. The instructions covering the input groups are as shown below.

- IF Sentence (JUMP, CALL, RET, PAUSE)
- Pattern Jump, Pattern Job Call
- DIN
- WAIT



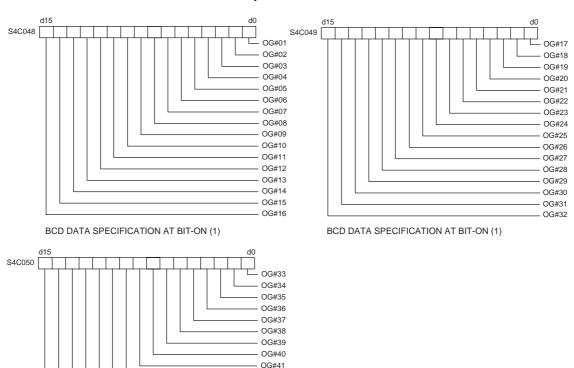


BCD DATA SPECIFICATION AT BIT-ON (1)

8.5 Parameters according to Status I/O

8.5.0.5 S4C048 to S4C063: DATA OF USER OUTPUT GROUPS

These parameters specify whether the output group instruction is executed with binary data or BCD data.



OG#42 OG#43 OG#44 OG#45 OG#46 OG#47 OG#48

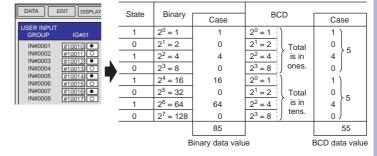
BCD DATA SPECIFICATION AT BIT-ON (1)

SUPPLE-MENT

Differences Between Binary Data and BCD Data

For the input group and output group, the result will depend on whether the binary or BCD formula is used.

<Example> When the input function is [01010101]



However, in the case of BCD data, because the upper bound value is 99, it is not possible to use any value which exceeds nine in the one or ten digit place.

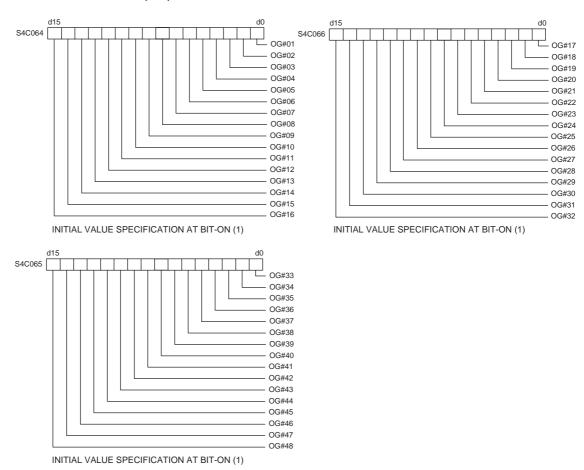
8 F	Paramete
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DX100

8.5 Parameters according to Status I/O

8.5.0.6 S4C064 to S4C079: USER OUTPUT GROUP TO BE INITIALIZED AT SWITCHING MODE

Set the user output group with bit to be initialized at switching mode. Use these parameters when using user output signals as work instructions for peripheral devices.



8.5.0.7 S4C240: USER OUTPUT NO. WHEN MANIPULATOR DROP ALLOWABLE RANGE ERROR OCCURS

This parameter specifies the user output number to output the manipulator drop allowable range error alarm occurrence externally.

When this function is not used, set "0."

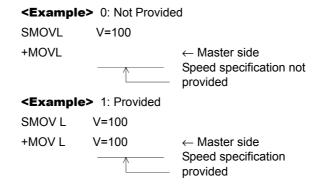
	8	Parameter
DX100	8.6	Parameters according to Coordinated or Synchronized Operation

8.6 Parameters according to Coordinated or Synchronized Operation

These parameters make the settings for coordinated or synchronized operations between manipulators or between manipulators and stations.

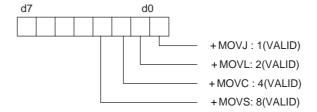
8.6.0.1 S2C212: +MOV or +SMOV INSTRUCTION SPEED INPUT

This parameter specifies whether the speed inputting for move instructions of the master robot in a coordinated job is permitted or not.



8.6.0.2 S2C213: +MOV INSTRUCTION INTERPOLATION INPUT

This parameter specifies which interpolation is permitted for move instructions for the master robot in a coordinated job. More than one instruction can be specified.



8.6.0.3 S2C231: OPERATION METHOD AT FWD/BWD OPERATION OR TEST RUN BY INDEPENDENT CONTROL

This parameter specifies the operation method at FWD/BWD operation or test run by independent control.

0 : The job of the task that is currently displayed operates.

1 : Jobs of all the tasks operate.

8 Parameter

DX100

Parameters according to Coordinated or Synchronized Operation 8.6

① When master task is currently displayed: : Not operating Sub task 1 Master task : Operating Sub task 2 ② When sub task 1 is currently displayed: Sub task 1 Sub task 1 Master Master task task Sub task 2 Sub task 2 3 When sub task 2 is currently displayed: Sub task 1 Master task Sub task 2 0: One of the task jobs that are currently

displayed operates.

1: All task jobs operate.

8.6.0.4 S2C232: JOB AT CALLING MASTER OF SUBTASK 1, 2, 3, 4, 5, 6, 7 BY INDEPENDENT CONTROL

This parameter specifies the job which is called up when the master of the subtask is called up by independent control.

0 : Master job 1 : Root job

Master Job: Job registered in the master control window

Root Job: Job activated by PSTART instruction

8.6.0.5 S2C264: STATION AXIS CURRENT VALUE DISPLAY FUNCTION

This parameter specifies whether the function to display the current value of the station axis in the following units is valid/invalid.

: Invalid 1 : Valid

Rotary axis : Angle (deg) Servo track: Distance (mm)

Regarding whether to specify the rotary axis or the servo track, refer to chapter 8.6.0.6 "S2C265 to S2C288: STATION AXIS DISPLAYED UNIT".

8.6.0.6 S2C265 to S2C288: STATION AXIS DISPLAYED UNIT

This parameter specifies the station axis displayed unit (bit specification).

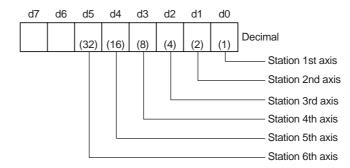
0 : Display angle (deg) 1 : Display in distance (mm) 8 Parameter

DX100

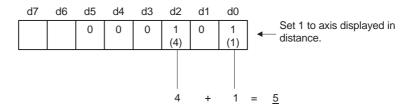
8.6 Parameters according to Coordinated or Synchronized Operation

■ Setting Method

Set a numerical value (decimal) where the bit of the axis to be displayed in the units of distance becomes 1.



Example> When 1st and 3rd axes of station 1 are displayed in the units of distance:



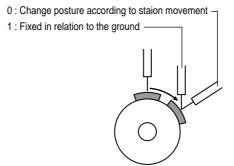
Therefore, set parameter S2C265 of station 1 to 5.

8.6.0.7 S2C420: POSTURE CONTROL OF SYNCHRONIZED MANIPULATOR (When Twin Synchronous Function Used)

This parameter specifies the posture control method for synchronized manipulator performing compensation during playback by using the twin synchronous function.

0 : Change posture according to station movement

1 : Fixed in relation to the ground



8.6.0.8 S2C421: POSTURE CONTROL OF MANIPULATOR IN MULTI-JOB (When Twin Synchronous Function Used)

This parameter specifies the posture control method for manipulator executing compensation at the linking side when job linking is performed during FWD/BWD operation by the twin synchronous function.

0 : Change posture according to station movement

1 : Fixed in relation to the ground

8.6 Parameters according to Coordinated or Synchronized Operation

8.6.0.9 S2C687: OPERATION OF JOB WITHOUT CONTROL GROUP SPECIFICATION

When the servo power supply is individually turned OFF where jobs in multiple number of tasks are operated using the independent control function, the job execution of the control group whose servo power supply is turned OFF is interrupted. The jobs of other control groups continue their execution.

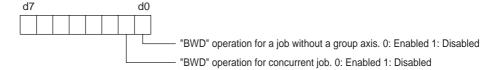
For the jobs without control group specification such as master job, the conditions for execution can be set by the parameter.

0 : Execution possible only when servo power supply to all the axes have been turned ON.

1 : Execution possible when servo power supply to any axis is turned ON.

8.6.0.10 S2C688: EXECUTION OF "BWD" OPERATION

This parameter prohibits step-back operation of a job without a step.

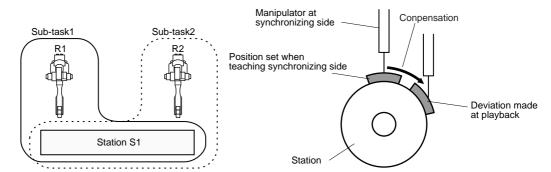


8.6.0.11 S3C1101: MAXIMUM DEVIATION ANGLE OF CURRENT STATION POSITION (When Twin Synchronous Function Used)

Used when the twin synchronous function is used. This parameter specifies the maximum deviation between the teaching position and the current station position.

0 : No deviation check

Other than 0 : Deviation angle (units : 0.1°)



In the above figure on the left, the follower R2 executes the job of subtask 2 in synchronization with the motion of the station axis which is moved by the R1 job. In this procedure, the job of subtask 2 controls only the R2 robot axis.

If the teaching position of the station in the subtask 2 differs from the station current position (controlled by the subtask 1 job), the difference is automatically offset so that R2 keeps the taught position in relation to the station.

Difference between the taught and the station current positions is always monitored. If the difference exceeds a set value of the parameter, the message "PULSE LIMIT (TWIN COORDINATED)" appears.

	8	Parameter
DX100	8.7	Parameters for Other Functions or Applications

8.7 Parameters for Other Functions or Applications

These parameters make the settings for other functions or applications.

8.7.0.1 S1CxG049 to S1CxG051: SMALL CIRCLE CUTTING

These parameters prescribe cutting operation at small circle cutting.

S1CxG049 (Minimum diameter) : Set the minimum diameter of a figure in the units of μm that can be processed by small-circle cutting machine.

S1CxG050 (Maximum diameter) : Set the maximum diameter of a figure in the units of um that can be processed by small-circle cutting machine.

S1CxG051

: Set the maximum cutting speed at operation by CUT

(Maximum speed)

instruction in the units of 0.1mm/s.

8.7.0.2 S1CxG052 to S1CxG053: SMALL CIRCLE CUTTING DIRECTION LIMIT VALUE

These parameters set the cutting direction limits at small circle cutting.

: Set the limit value in the positive direction of cutting S1CxG052 (+ direction) angle DIR set by CUT instruction, in the units of 0.01°. : Set the limit value in the negative direction of cutting S1CxG053 angle DIR set by CUT instruction, in the units of 0.01°. (- direction)

8.7.0.3 S1CxG054 to S1CxG055: SMALL CIRCLE CUTTING OVERLAP VALUE

These parameters set the overlapped value at small circle cutting.

S1CxG054 (Operation radius) : Set the operation radius at inner rotation in the units of 1

μm after overlapping by CUT instruction.

S1CxG055

: Set the rotation angle at inner rotation in the units of 0.1°

(Rotation angle)

after overlapping by CUT instruction.

8.7.0.4 S1CxG063, S1CxG064: PATTERN CUTTING DIMENSION

These parameters set the minimum diameter (S1CxG063) and the maximum diameter (S1CxG064) for the pattern cutting in units of μm .

8.7.0.5 S1CxG065: MIRROR SHIFT SIGN INVERSION

This parameter sets which axis to be shifted (mirror-shift: invert the sign).



8.7.0.6 S2C430: RELATIVE JOB OPERATION METHOD

This parameter specifies how to operate a relative job. A method to convert a relative job into a standard job (pulse), and a conversion method to calculate the aimed position (pulse position) when a relative job is operated can be specified.

: Previous step with priority (B-axis moving distance minimized.)

: Form with priority

Previous step with priority (R-axis moving distance minimized.)

DX100 8.7 Parameters for Other Functions or Applications	DX100	8 Parameter8.7 Parameters for Other Functions or Applications
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8.7.0.7 S3C1111 to S3C1190: ANALOG OUTPUT FILTER CONSTANT (When analog output corresponding to speed function is used)

By setting a constant to filter, a filter processing can be performed for the output analog signal.

8.7.0.8 S3C1191: CUT WIDTH CORRECTION VALUE (When form cutting function is used)

This parameter specifies the path correction value for pattern cutting operation. A value 1/2 of the cut width is set in units of μm .

	8	Parameter
DX100	8.8	Hardware (

8.8 Hardware Control Parameters

8.8 Hardware Control Parameters

These parameters make the hardware settings for fan alarm or relay operation, etc.

8.8.0.1 S2C646: ANTICIPATOR FUNCTION

This parameter specifies anticipation output.

0 : Invalid1 : Valid

The anticipator function is a function to quicken or slow the ON/OFF timing of four user output signals and two user output groups. Using this function, signal output can be carried out before or after the step is reached. As a result, timing deviation due to delayed motion of peripheral devices and robot motion can be adjusted.

Setting the time to a negative value (-) advances the signal output.

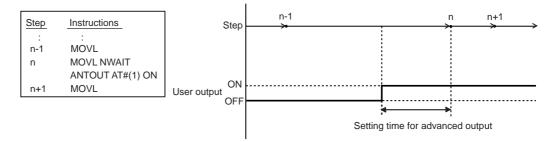
This setting is effective when adjusting timing deviation due to delayed motion of peripheral devices.

Setting the time to a positive value (+) delays the signal output.

This setting is effective when adjusting timing deviation due to delayed robot motion.

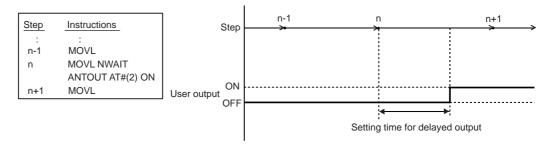
<Advanced Signal Output>

Signal output is carried out before the step is reached.



<Delayed Signal Output>

Signal output is carried out after the step is reached.



DX100	8	Parameter Hardware Control Parameters
DX 100	0.0	natuwate Control Parameters

8.8.0.2 S2C786 to S2C788: COOLING FAN ALARM DETECTION

This parameter specifies a detection for cooling fan 1 to 3 with alarm sensor, connected to power ON unit.

0 : No detection

1 : Detected with message display

2 : Detected with message and alarm display

8.8.0.3 S4C327 to S4C390; SETTING OF OPERATING RELAY NO.

Up to 64 output signals can be turned ON/OFF with the programming pendant. The object relay No. is set in these parameters. Although it is possible to set optional values for output No. 1 to 1024 in the parameters, the following must be taken into consideration.

- · Avoid setting duplicate numbers.
- The signal turned ON or OFF with the programming pendant is operated again or remains unchanged until the instruction is executed.

8.8.0.4 S4C391 to S4C454: OPERATING METHOD OF RELAYS

These parameters specify the operating method of output signals by the programming pendant. The operating method can be specified for each output signal.

Parameter Setting Value	Operation of Output Signal
0	†ON
1	+ON ON/OFF with the key ON while the key is pressed —O ON OFF if the key is not pressed —O OFF

DX100	8 8.8	Parameter Hardware Control Parameters

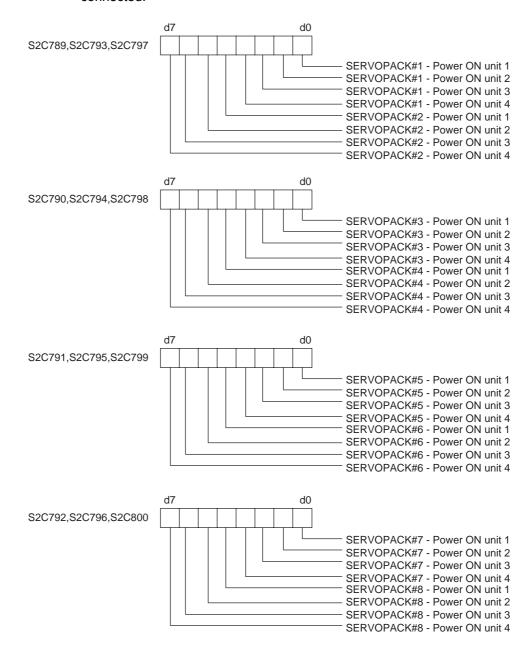
8.8.0.5 S2C789 to S2C792: COOLING FAN ALARM 1 OPERATION

8.8.0.6 S2C793 to S2C796: COOLING FAN ALARM 2 OPERATION

8.8.0.7 S2C797 to S2C800: COOLING FAN ALARM 3 OPERATION

These parameters specify the operation of cooling fan 1 to 3 with alarm sensor, connected to power ON unit.

Each bit specifies the power ON unit to which the detecting sensor is connected.



8.8.0.8 S2C801 to S2C804: FAN ALARM 1 POWER SOURCE STATUS

8.8.0.9 S2C805 to S2C808: FAN ALARM 2 POWER SOURCE STATUS

8.8.0.10 S2C809 to S2C812: FAN ALARM 3 POWER SOURCE STATUS

	8	Parameter
DX100	8.9	TRANSMISSION PARAMETERS

8.9 TRANSMISSION PARAMETERS

These parameters are used when the optional FC1, FC2, or data transmission function is used.

For details, refer to the optional manual "DX100 DATA TRANSMISSION FUNCTION."

8.10 Application Parameters

8.10.1 Arc Welding

8.10.1.1 AxP000: APPLICATION

This parameter specifies the application. Set "0" for arc welding.

8.10.1.2 AxP003: WELDING ASSIGNMENT OF WELDING START CONDITION FILE

This parameter specifies the beginning condition number in the welding start condition file to be assigned to Power Source 2. Condition files of a lower number are automatically assigned to Power Source 1. For a system with one Power Source, set "49" (maximum value).



8.10.1.3 AxP004: WELDING ASSIGNMENT OF WELDING END CONDITION FILES

This parameter specifies the beginning condition number in the welding END condition file to be assigned to Power Source 2. Condition files of a lower number are automatically assigned to Power Source 1. For a system with one Power Source, set "13" (maximum value).



8.10.1.4 AxP005: WELDING SPEED PRIORITY

This parameter specifies whether the welding speed is specified by the "ARCON" instruction, by the welding start condition file, or by the additional times of the "MOV" instruction.

8.10.1.5 AxP009: WORK CONTINUING

This parameter specifies whether to output an "ARCON" instruction to restart after the manipulator stopped while the "ARCON" instruction is being output.

	8	Parameter
DX100	8.10	Application Parameters

8.10.1.6 AxP010: WELDING INSTRUCTION OUTPUT

This parameter specifies the beginning number (0 to 12) of the analog output channel to the Power Source. "0" indicates that no Power Source exists.

8.10.1.7 AxP011, AxP012: MANUAL WIRE OPERATION SPEED

These parameters specify the manual wire operation speed as a percentage of the maximum instruction value. Instruction polarity is determined by the current instruction in the Power Source characteristic file. The setting range is from 0 to 100.

8.10.1.8 AxP013, AxP014: WELDING CONTROL TIME

These parameters specify the welding control time in units of minutes. The setting range is from 0 to 999.

8.10.1.9 AxP015 to AxP017: NUMBER OF WELDING CONTROL

These parameters specify the number of welding controls. The setting range is from 0 to 99.

8.10.1.10 AxP026 to AxP029: TOOL ON/OFF USER OUTPUT NO. (Jigless system)

These parameters specify the user output number for the tool open/close operation by specific keys.

8.10.2 Handling Application

8.10.2.1 AxP002, AxP004: f1 KEY FUNCTION

These parameters set the output signal to assign for f1 key.

0: Not specified

1 to 4: Specific outputs for HAND-1 to HAND4-1

5: User output (No. is specified by AxP004).

8.10.2.2 AxP003, AxP005: f2 KEY FUNCTION

These parameters set the output signal to assign for f2 key.

0: Not specified

1 to 4: Specific outputs for HAND-2 to HAND4-2

5: User output (No. is specified by AxP005)

8.10.3 Spot Welding

8.10.3.1 AxP003: MAXIMUM NUMBER OF CONNECTED POWER SOURCES

This parameter specify the maximum number of power sources which are to be used. The value is automatically set at start-up. No modification is needed.

8 Parameter

DX100 8.10 Application Parameters

8.10.3.2 AxP004: GUN FULL OPEN STROKE ON/OFF SIGNAL

This parameter specifies which stroke switching signal is output ON or OFF to make the gun fully-opened for each gun.

Bit specification (1 for 01) for 8 guns. The initial setting is "0."

 $0 \;\; 0 \;\; 0 \;\; 0 \;\; 0 \;\; 0 \;\; 0$

8 7 6 5 4 3 2 1 Gun number

8.10.3.3 AxP005: STROKE CHANGE ANSWER TIME LIMIT

When using the X2 gear mechanical stopper gun and switching gun stroke, this parameter sets the time from the stroke-switching-sequence start until the pressure instruction end.

The initial setting is "0," with which the switching signal is output for the "stopper-type stroke switching time" set in the file, and then the gun pressure instruction is turned OFF.

8.10.3.4 AxP006: PARITY SPECIFICATION FOR WELDING CONDITIONS

When adding the parity signal to the welding condition signal with the Power Source connected to each welding gun, this parameter specifies odd or even parity.

Bit specification for 4 Power Sources. (0 : odd number, 1 : even number) The initial setting is "0."

4 3 2 1 Power Source number

8.10.3.5 AxP007: ANTICIPATE TIME

When executing the GUNCL or SPOT instruction with NWAIT specified in the previous move instruction but the time is not specified by ATT in the GUNCL or SPOT instruction, this parameter specifies the anticipate condition (time). The initial setting is "0," with which the each instruction is executed as soon as the taught position of the previous move instruction is reached, as normal operation.

8.10.3.6 AxP015: WELDING ERROR RESET OUTPUT TIME

This parameter sets the output time of the welding error reset signal to the Power Source when the alarm reset signal is input.

If the setting is "0," the welding error reset signal is not output to the Power Source even if the alarm reset signal is input.

8.10.3.7 AxP016, AxP017: ELECTRODE WEAR AMOUNT ALARM VALUE

These parameters set the electrode wear amount alarm values (AxP016: movable side, AxP017: fixed side) at the wear detection.

	8	Parameter
DX100	8.10	Application Parameters

8.10.4 General-purpose Application

8.10.4.1 AxP009: WORK CONTINUE PROHIBIT

This parameter specifies whether to output TOOLON instruction or not at restarting when the work is stopped for some reasons during the output of TOOLON instruction.

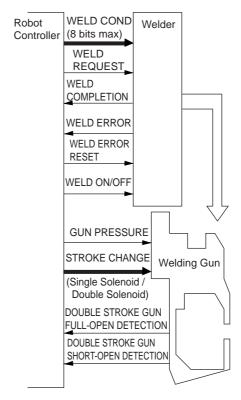
9.1 System Overview of Spot Welding System Using an Air Gun

9 Spot Welding Application Using an Air Gun

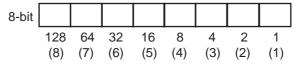
9.1 System Overview of Spot Welding System Using an Air Gun

An I/O signal diagram of a typical spot welding system is shown below.

Fig. 9-1: I/O Signal Diagram for Spot Welding System



- WELD COND (level signal)
 - Sets the welding conditions for the welder.
 - The output format can be set as binary or discrete.
 - Can handle up to 255 conditions (for binary).



* Values in parentheses are for discrete.

- WELD REQUEST (level/pulse)
 Outputs the start instruction to the welder.
- WELD ERROR RESET (level)
 Resets the welding alarm status of the welder.
- GUN PRESSURE (level)
 Outputs gun pressure instruction to the welding gun.

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- 9 Spot Welding Application Using an Air Gun
- 9.1 System Overview of Spot Welding System Using an Air Gun
 - STROKE CHANGE (level)

Select the stroke of the gun.

- In case of single solenoid: Change by 1 signal
- In case of double solenoid: Change by 2 signal



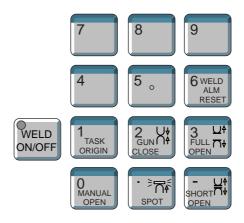
For details on signal contents, refer to *chapter 9.6 "Spot Gun Motion Control" at page 9-27.*

For details on I/O allocation, refer to *chapter 9.6.5* "I/O Allocation" at page 9-37.

9.2 Function Keys

9.2 Function Keys

Each function used for spot welding is allocated on the Numeric keys of the programming pendant. These keys become available when the WORK HOME POSITION is on the display.



O MANUAL OPEN	Displays the MANUAL SPOT window.
1 TASK ORIGIN	Displays the WORK HOME POSITION window. [FWD] + [TASK ORIGIN] With the WORK HOME POSITION window in the teach mode, press these keys to move the manipulator to the work home position.
SPOT	Displays the SPOT instruction in the input buffer to register welding operations. [INTERLOCK] + [SPOT] With the MANUAL SPOT window displayed, press these keys to perform manual welding.
2 U∜ GUN ∩ ↑ CLOSE	Displays the GUNCL instruction in the input buffer to register dry spot welding operations. [INTERLOCK] + [GUN CLOSE] With the MANUAL SPOT window displayed, press these keys to perform manual dry spot welding.
WELD ON/OFF	[INTERLOCK] + [WELD ON/OFF] Press these keys to turn on or off the welding ON/OFF signal.

9.2 Function Keys



Instruction to change the stroke to the short open position when using a double stroke gun:

Displays the STROKE SHORT instruction in the input buffer.

The SHORT OPEN POSITION SETTING window appears the first time the key is pressed.

The selection No. for the short open position appears from the second time the key is pressed.

[INTERLOCK] + [SHORT OPEN]

The movable side electrode moves to the selected short open position.



Instruction to change the stroke to the full open position when using a double stroke gun:

Displays the STROKE LONG instruction in the input buffer.

The FULL OPEN POSITION SETTING window appears the first time the key is pressed.

The selection number for the full open position appears from the second time the key is pressed.

[INTERLOCK] + [FULL OPEN]

The movable side electrode moves to the selected full open position.



[INTERLOCK] + [WELD ALM RESET]

A Power Source alarm reset signal is output to the Power Source only while these keys are held down.

The welding conditions, gun pressure and weld request are reset with this function.

9.3 Teaching

9.3 Teaching

In order to use the air gun function, first perform teaching as described below.

9.3.1 Manual Spot Welding Function

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To perform manual spot welding, carry out the following operation.

1. Press [MANUAL OPEN].



2. Press [INTERLOCK] + [SPOT] simultaneously.





To perform manual spot welding, press these keys simultaneously while the MANUAL SPOT window is called up.

The conditions displayed in the MANUAL SPOT window are used for manual spot welding.

Regarding the condition setting, refer to *chapter 9.4.1* "Settings for Manual Spot Welding" at page 9-17.

When registering the welding instruction [SPOT], the values set in the MANUAL SPOT window are used as the initial data.

9.3.1.1 Manual Dry Spotting

To perform manual dry spotting, carry out the following operation.

1. Press [MANUAL OPEN].



2. Press [INTERLOCK] + [GUN CLOSE] simultaneously.





To perform manual dry spotting, press these keys simultaneously while the MANUAL SPOT window is called up.

The conditions displayed in the MANUAL SPOT window are used for manual dry spotting.

Note that the numbers specified in the MANUAL SPOT window are used as the initial values for the gun number of the gun to be operated and the gun number used when registering the dry spot instruction GUNCL.

While the key is being pressed, the dry spotting motion is performed. When the key is released, the operation stops.

9.3 Teaching

9.3.1.2 Stroke Switching

 Press the [INTERLOCK] and the [FULL OPEN] simultaneously to switch to the full open position.





• Press the [INTERLOCK] and the [SHORT OPEN] simultaneously to switch to the short open position.





Note that the numbers specified in the MANUAL SPOT window are used as the initial values for the gun number of the gun to be operated and the gun number used when registering the stroke switching instruction STROKE.

AP parameter specifies whether the stroke signal should be set ON or OFF to make the stroke full open. (The initial setting is OFF.)

9.3.1.3 Welding On/Off





Press the [INTERLOCK] and the [WELD ON/OFF] simultaneously in the teach mode to turn on or off the welding ON/OFF signal to all connected welders.

A user message appears when the welding ON/OFF signal is turned ON in the teach mode.

During manual spot welding, the welding current flows only when this message appears.

The output destination must be allocated in the spot input/output allocation information window before this function is used.



For information on the signal allocation method, see *chapter 9.6.5* "I/O Allocation" at page 9-37.

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- 9 Spot Welding Application Using an Air Gun
- 9.3 Teaching

9.3.1.4 Resetting Alarms





The alarm reset signal to all connected welders remains ON while the [INTERLOCK] and the [WELD ALM RESET] are being pressed simultaneously. The welding conditions, gun pressure and weld request are reset with this function.

The output destination must be allocated in the spot input/output allocation information window before this function is used.



For information on signal allocation method, see *chapter 9.6.5 "I/O Allocation" at page 9-37.*

9.3 Teaching

9.3.2 Registering Work Instructions

The function keys [GUNCL](GUNCL instruction), [SPOT](SPOT instruction), [SHORT OPEN]/[FULL OPEN](STROKE instruction) can be used for registering the work instructions.

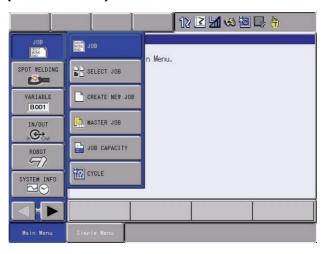
The STRWAIT instruction is registered using the [INSTRUCTION LIST] key.

Table 9-1: Registering Work Instructions

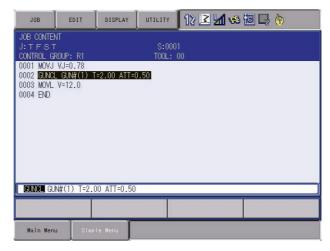
Specific Keys	Instructions
[GUN CLOSE]	GUNCL instruction
[SPOT]	SPOT instruction
[SHORT OPEN] [FULL OPEN]	STROKE instruction

Instructions are registered during the teach mode when the cursor is in the address area of the job content window.

- 1. Select {JOB} from the {Main Menu}.
- 2. Select (JOB CONTENT).



- The JOB CONTENT window is displayed.



3. Move the cursor to the address area.

0001 MOVJ VJ=0.78 0002 GUNP(1) T=2.00 ATT=0.50 0003 MOVL V=12.0 DX100

- 9 Spot Welding Application Using an Air Gun
- 9.3 Teaching

9.3.2.1 GUNCL Instruction

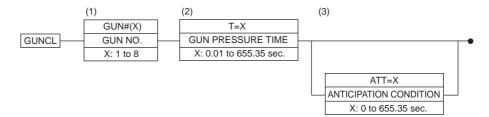
This is the dry spotting instruction. It performs dry spotting for the specified time. The gun performs dry spotting then returns to the start position after the time-up timer counts out. Use this instruction when spotting is required, such as after automatic tip dressing or automatic tip replacement.



Be sure to use this instruction in the short open status with a double stroke gun other than X double stroke mechanical stopper type gun.

The instruction controls only one gun at one time. Two guns cannot perform dry spotting simultaneously. When GUNCL instruction is executed, it takes a time for the stroke action and dry spotting time is shortened.

Additional Items



- (1) Gun# (X) Specifies a gun to be pressed.
- (2) T = X
 Specifies the time when the gun is closed.
- (3) ATT = X
 Starts execution of GUNCL X second(s) before reaching the move instruction located immediately before it. However, it is necessary to specify "NWAIT" to the move instruction immediately before the GUNCL instruction.

DX100

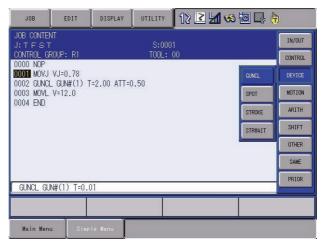
9.3 Teaching

Operation Procedure

- 1. Move the cursor to the line before the place where the GUNCL instruction is to be registered.
- 2. Press the number key [2/GUN CLOSE] or [INSTRUCTION LIST].
- 3. Select the {GUNCL} instruction.
 - When the number key [2/GUN CLOSE] is pressed, the "GUNCL" instruction appears in the input buffer line.



 When the [INSTRUCTION LIST] key is pressed, the instruction list dialog appears. Select "GUNCL" from the list.



4. Move the cursor to the address area.



- 5. Add items and modify the number data.
- 6. Press [ADD], then press [ENTER].
 - The GUNCL instruction is registered.

■ Example

The gun pressure signal is turned ON 0.5 seconds before the manipulator reaches the step 5 position and then turns OFF after 2 seconds (1.5 seconds after reaching there) and moves to the execution of step 6.

```
0005 MOVL V=1000.0 NMAIT
0006 SPOT GUN#(1) MODE=2 WTM=5 ATT=0.50
0007 MOVL V=1000.0
```

9.3 Teaching

9.3.2.2 SPOT Instruction

This instruction starts the spot welding sequence. It outputs the gun pressure signal then executes the welding sequence appropriate for the gun type. The function key [SPOT] can be used for its registration.

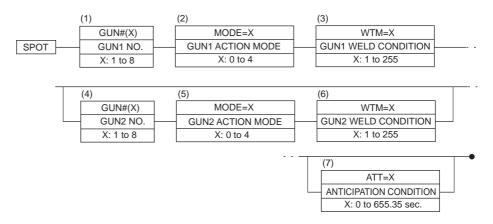
The condition number used for the registration of the spot instruction is a value set on the manual spot condition window.

Two guns can be controlled simultaneously.



Under two-gun control, this instruction is completed when the gun with the slower welding sequence completes welding. See *chapter 9.6 "Spot Gun Motion Control" at page 9-27* for information on the welding sequence executed by this instruction.

■ Additional Items



- GUN #(X)
 Specifies the number of welding condition set to the welder.
- (2) MODE = X
 Specifies the gun move operation mode.
 In the case of double stroke, specifies the open status before and after the welding.

Setting Data	Before Welding →	After Welding
0	Single Gun	
1	Short Open →	Short Open
2	Short Open →	Full Open
3	Full Open →	Short Open
4	Full Open →	Full Open

(3) WTM=X Specifies the number of welding conditions set to the welder.

(4) GUN#(X) Specifies the second gun at two-gun control. Cannot be omitted at simultaneous two-gun control. Do not set when only one gun is used.

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9.3 Teaching

(5) (5) MODE=X

Specifies the operation mode of the second gun at two-gun control. Specifies the open status before and after welding in the case of double stroke.

Do not set when only one gun is used.

Setting data is the same as shown in the table in (2).

(6) (6) WTM=X

Specifies the number of the welding conditions set to the second welder at two-gun control.

Do not set when only one gun is used.

(7) (7)ATT=X

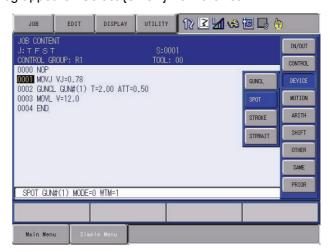
Starts execution of SPOT X second(s) before reaching the move instruction immediately before it. However, it is necessary to specify "NWAIT" to the move instruction immediately before the SPOT instruction. By omitting this item, the SPOT instruction is executed as usual after reaching the move instruction.

Operation Procedure

- 1. Move the cursor to the line before the place where the SPOT instruction is to be registered.
- 2. Press the number key [./SPOT] or [INSTRUCTION LIST].
 - When the number key [./SPOT] is pressed, the "SPOT" instruction appears in the input buffer line.



 When the [INSTRUCTION LIST] key is pressed, the instruction list dialog appears. Select {SPOT} from the list.



- 3. Add items and modify the number data.
- 4. Press [ADD], then press [ENTER].
 - The SPOT instruction is registered.

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9 Spot Welding Application Using an Air Gun

9.3 Teaching

■ Examples

The sequence of the SPOT instruction is started from the short open 0.5 seconds before the manipulator reaches the position of step 5. After completion of the sequence, the status becomes full open to move to the execution of step 6.

```
0005 MOVL V=1000.0 NWAIT
0006 SPOT GUN#(1) MODE=2 WTM=5 ATT=0.50
0007 MOVL V=1000.0
```

If the manipulator starts moving before the gun opens when gun open status is not verified, adjust the timing with the TIMER instruction as shown below.

```
0005 MOVL V=1000.0 NWAIT
0006 SPOT GUN#(1) MODE=2 WTM=5 ATT=0.50
0007 TIMER T=0.10
0008 MOVL V=1000.0
```



Do not use the "ATT" unless it is indispensable. As the gun will be closed during the robot move operation by the use of ATT, the robot might possibly move with its gun closed.

Set the ATT value after setting the ATT minimum value (0.01 seconds) and execute a confirmatory operation.

9.3 Teaching

9.3.2.3 STROKE Instruction

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This is an instruction to alternate short open and full open of a double stroke gun at any time other than welding.

It executes the stroke changes sequence with an X double stroke mechanical stopper type gun, and with the other double stroke guns, it changes the change signal to full open or to short open status.

This instruction can control only one gun at a time. Two guns cannot be pressed at the same time.

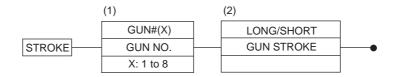


For details on the stroke change sequence of an X double stroke mechanical stopper type gun to be executed by this instruction, see *chapter 9.6 "Spot Gun Motion Control" at page 9-27*.



When using an X double stroke mechanical stopper type gun, stroke change is enabled only at pressing. With an execution of this instruction, the gun performs dry spotting: the stroke can be changed while the dry spotting is executed. (In case of the other types of guns, this instruction only turns the stroke change signal ON/OFF.)

Additional Items



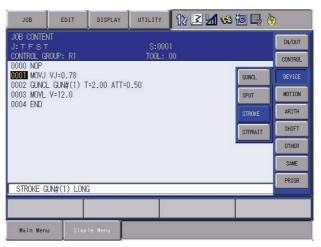
- (1) GUN# (X)
 Specifies a gun characteristic file number of stroke to be changed.
- (2) LONG or SHORT Specifies the stroke status by alternating LONG and SHORT.

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9.3 Teaching

■ Operation Procedure

- 1. Move the cursor to the line before the place where the STROKE instruction is to be registered.
- 2. Press the number key [-/SHORT OPEN], [3/FULL OPEN], or [INSTRUCTION LIST].
 - The "STROKE GUN#(1) SHORT" instruction appears in the input buffer line when the number key [-/SHORT OPEN] is pressed; the "STROKE GUN#(1) LONG" instruction appears in the input buffer line when the key [3/FULL OPEN] is pressed.
 - When the [INSTRUCTION LIST] key is pressed, the instruction list dialog appears. Select {STROKE} from the list.



- 3. Add items and modify the number data.
- 4. Press [ADD], then press [ENTER].
 - The STROKE instruction is registered.

■ Example

Stroke is fully opened in order to avoid interference when the manipulator reaches the position of step 5. Then the manipulator moves to step 6 to avoid interference.



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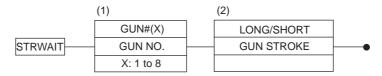
9.3 Teaching

9.3.2.4 STRWAIT Instruction

This is an instruction to verify the double stroke gun status short open or full open, at any time other than welding. It waits until a signal to verify full open or short open is turned ON.

This instruction can control only one gun at a time; it cannot control two guns simultaneously.

Additional Items



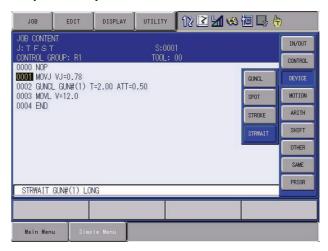
(1) GUN# (X)

Specified a gun characteristic file number of which stroke is verified.

(2) LONG or SHORT Specifies the stroke status to be verified by alternating LONG and SHORT.

■ Operation Procedure

- 1. Move the cursor to the line before the place where the STRWAIT instruction is to be registered.
- 2. Select the {STRWAIT} from the instruction list.



- 3. Add items and modify the number data.
- 4. Press [ADD], then press [ENTER].
 - The STRWAIT instruction is registered.

■ Example

Stroke is fully opened in order to avoid interference when the manipulator reaches the position of step 5. Then the STRWAIT instruction verifies that the stroke has become full open status and the manipulator moves to step 6 to avoid interference.

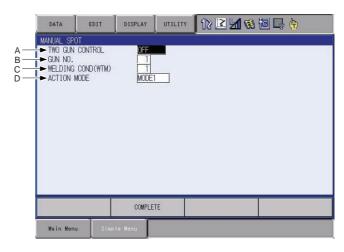
```
0003 MOVL V=1000.0
0006 STROKE GUN#(1) LONG
0007 STRWAIT GUN#(1) LONG
0008 MOVL V=1000.0
```

9.4 Setting Welding Conditions (for Air Gun)

9.4 Setting Welding Conditions (for Air Gun)

9.4.1 Settings for Manual Spot Welding

■ Manual Spot Window



A. TWO GUN CONTROL

Specifies whether the simultaneous control is turned ON or OFF when using two guns.

B. GUN NO.

Specifies the gun number of the gun to be used for manual spot welding.

C. WELDING COND (WTM)

Specifies the manual spot welding condition number to be used for welding.

D. ACTION MODE

Specifies the gun operation mode.

Shows the gun open status before and after the welding.

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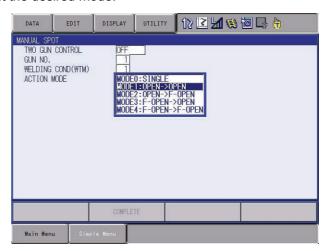
- 9 Spot Welding Application Using an Air Gun
- 9.4 Setting Welding Conditions (for Air Gun)

Operation Procedure

1. Press the number key [0/MANUAL OPEN].



2. Select the desired mode.



3. Select the item to be set.

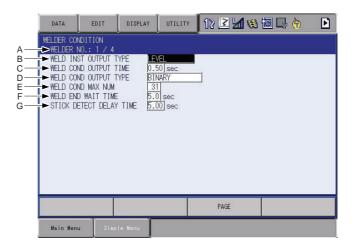
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9.4 Setting Welding Conditions (for Air Gun)

9.4.2 Spot Welder Condition Data Setting

The spot welder condition data file makes the welder-related settings using the welding sequence I/O signal control method.

■ Welder Condition Window



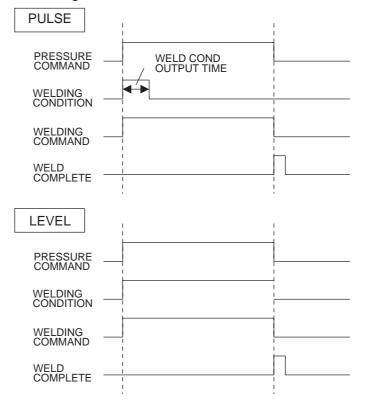
A. WELDER NO.

Welder (system) numbers are specified.

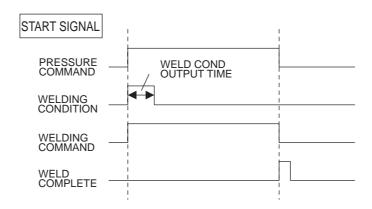
B. WELD INST OUTPUT TYPE

Specifies welder output start timing.

In the start timing, there are "PULSE", "LEVEL", and "START SIGNAL".



9.4 Setting Welding Conditions (for Air Gun)



C. WELD INST OUTPUT TIME

When "WELD INST OUTPUT TYPE" is specified as "PULSE" or "START SIGNAL", set the welder condition signal to the pulse output time.

When "WELD INST OUTPUT TYPE" is specified as "LEVEL", the time cannot be set.

D. WELD COND OUTPUT TYPE

Specifies welding condition output form.

There are two output forms: "BINARY" and "DISCRETE".

E. WELD COND MAX NUM

Specifies the number of welding conditions that can be set. When "WELD COND OUTPUT TYPE" is "DISCRETE", the number of welding conditions cannot be set.

F. WELD END WAIT TIME

Specifies how many seconds to monitor the welding complete signal after the welding command is output from the SPOT instruction execution.

An alarm occurs if the welding complete signal is not received within the set time.

G. STICK DETECT DELAY TIME

Once the welding end signal has been input, set the length of wait time that the wire sticking signal should be observed.

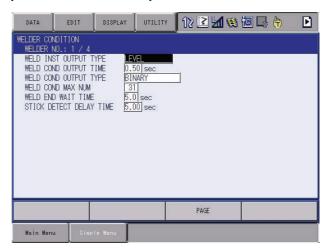
After this wait time has elapsed, if a wire sticking signal has been input, an alarm occurs.

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- 9 Spot Welding Application Using an Air Gun
- 9.4 Setting Welding Conditions (for Air Gun)

■ Operation Procedure

- 1. Select {SPOT WELDING} from the {Main Menu}.
- 2. Select {WELDER CONDITION}.



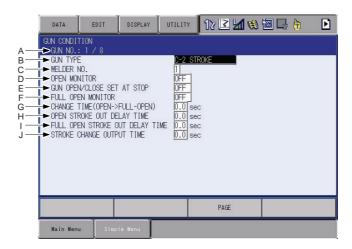
3. Select the item to be set.

9.4 Setting Welding Conditions (for Air Gun)

9.4.3 Spot Gun Condition Data File

Set the type of a gun, the number of the welder to be used, etc. for welding gun numbers 1 to 8.

Gun Condition Window



A. GUN NO.

Sets the gun condition file number.

B. GUN TYPE

Specifies the type of the welding gun. The sequence to be executed is specified by this value.

Four gun-types are available:

- Single Gun
- C double stroke cylinder type gun
- X double stroke mechanical stopper type gun
- X double stroke cylinder type gun

When the gun type other than the single gun is set, the new setting items are displayed.

C. WELDER NO.

Specifies the welder to which the gun is connected.

D. OPEN MONITOR

Specifies whether the short-open status is verified or not at welding sequence execution.

E. GUN OPEN/CLOSE SET AT STOP

Specifies the gun open/close setting for when a hold, emergency stop, or alarm occurs during welding instruction execution.

- ON: welding instruction, welding condition, and pressure instruction are turned off.
- OFF: welding instruction, welding condition are turned off.

F. FULL OPEN MONITOR

Specifies whether the full-open status is verified or not at welding sequence execution.

G. CHANGE TIME (OPEN -> FULL-OPEN)

Sets the time from when the welding completion signal is received to when the manipulator actually starts moving after becoming the short-open status or the full-open status.

Valid when the full open monitor is OFF.

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- 9 Spot Welding Application Using an Air Gun
- 9.4 Setting Welding Conditions (for Air Gun)

H. OPEN STROKE OUT DELAY TIME

Specifies the timing to change the stroke change signal to the shortopen status after the gun pressure instruction is output (ON) when a mechanical stopper type gun is used. (Used when changing from the full-open status to the short-open status.)

This function can be used when the LS pressure is not set.

I. FULL OPEN STROKE OUT DELAY TIME

Specifies the timing to change the stroke change signal to the full-open status after the gun pressure instruction is output (ON) when a mechanical stopper type gun is used. (Used when changing from the short-open status to the full-open status.)

This function can be used when the LS pressure is not set.

J. STROKE CHANGE OUTPUT TIME

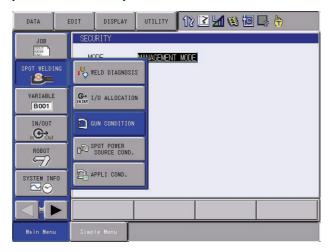
Sets the time to output the stroke change signal when a mechanical stopper type gun is used.

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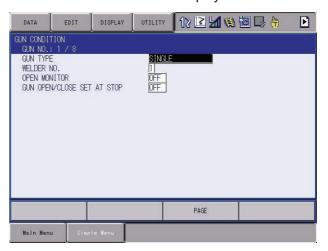
9.4 Setting Welding Conditions (for Air Gun)

Operation Procedure

- 1. Select {SPOT WELDING} from the {Main Menu}.
- 2. Select (GUN CONDITION).



- The GUN CONDITION window is displayed.



3. Select the item to be set.

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9.5 Spot Welding Diagnosis

9.5 Spot Welding Diagnosis

9.5.1 Spot Welding Diagnosis Window

This window shows the maintenance information for tip replacement.

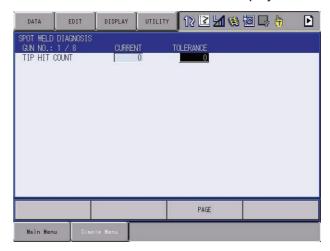
It shows the set number of welds to tip replacement and the number currently completed.

9.5.1.1 Setting Tolerance Value

- 1. Select {SPOT WELDING} from the {Main Menu}.
- 2. Select {WELD DIAGNOSIS}.



- The SPOT WELD DIAGNOSIS window is displayed.



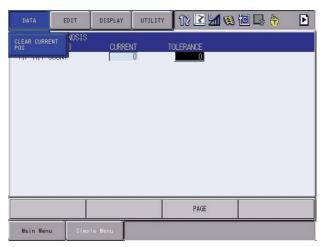
- 3. Select "GUN NO."
 - Enter the desired gun number, and press [ENTER].
- 4. Select "TOLERANCE".
 - Input the desired tip replacement value, and press [ENTER].

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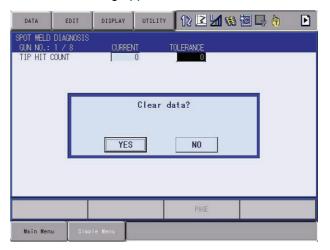
9.5 Spot Welding Diagnosis

9.5.1.2 Tip Hit Count Clear

- 1. Select {SPOT WELDING} from the {Main Menu}.
- 2. Select {WELD DIAGNOSIS}.
 - The SPOT WELD DIAGNOSIS window appears.
- 3. Select {CLEAR CURRENT POS} from {DATA}.



- 4. Select "YES".
 - The confirmation dialog appears.



- The current tip hit count is cleared.

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- 9 Spot Welding Application Using an Air Gun
- 9.6 Spot Gun Motion Control

9.6 Spot Gun Motion Control

As regards to the guns for each stroke methods, the motion control described in *chapter 9.6.1* "Gun Motion Control" can be executed.

The following gun types are available:

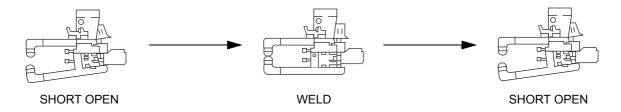
- X, C types single stroke method
- X type double stroke method
- C type double stroke method

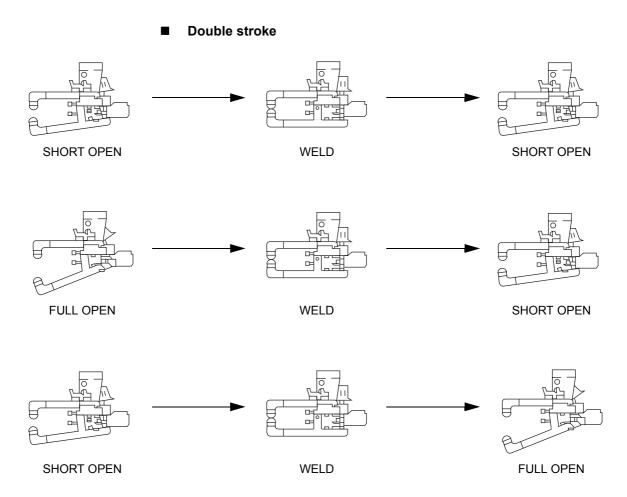
9.6.1 Gun Motion Control

The ways to control the gun motions are shown on the following pages.

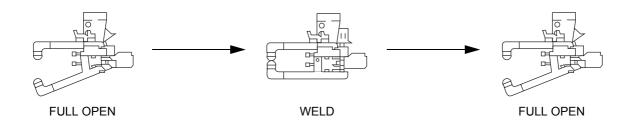
9.6.1.1 X Type Gun

■ Single stroke

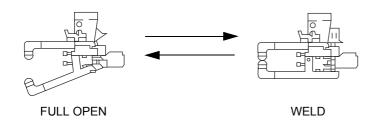




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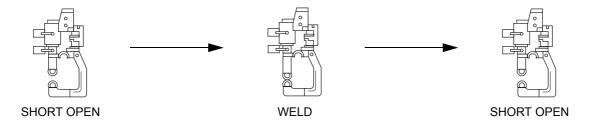


Stroke change

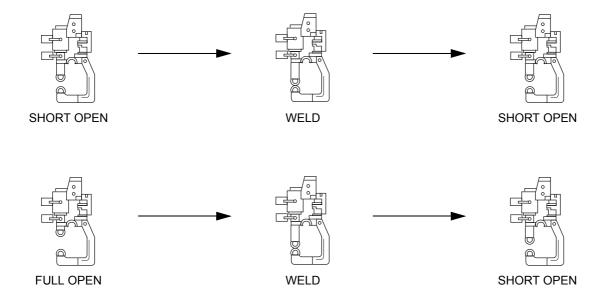


9.6.1.2 C Type Gun

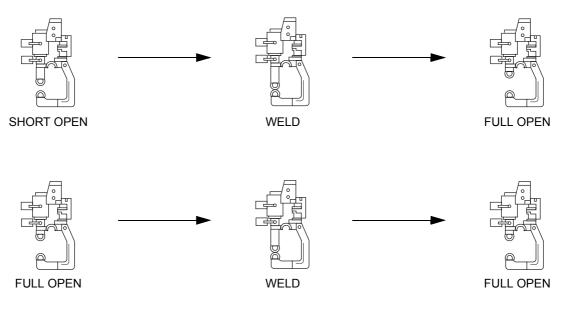
Single stroke



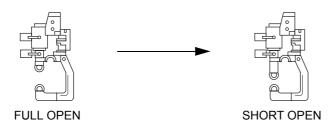
Double stroke



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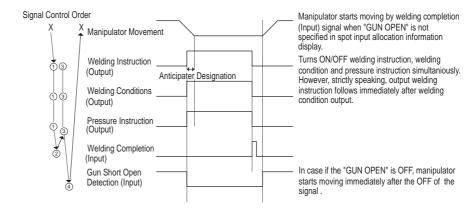
Stroke change



9.6.2 Process Timing

9.6.2.1 OPERATION MODE = 0 (SINGLE GUN, OPEN → WELDING → OPEN)

■ Gun Motion Control (With X gun, C gun, single type)

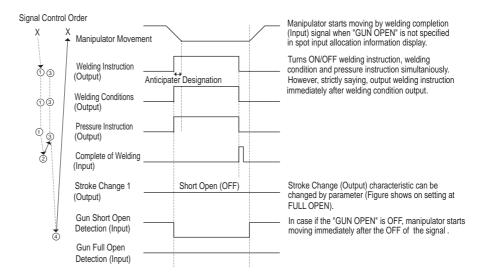




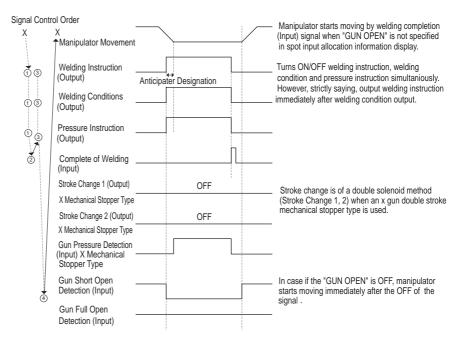
Connect "OPEN DETECTION" signal for "GUN OPEN" signal in case of using a single gun.

9.6.3 OPERATION MODE = 1 (SHORT OPEN → WELDING → SHORT OPEN)

Gun Motion Control (With C gun double stroke) (With X gun double stroke, cylinder type)

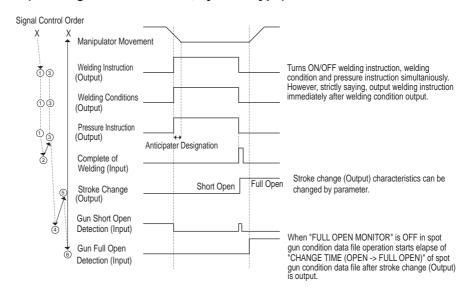


Gun Motion Control (With X gun double stroke, mechanical stopper type)

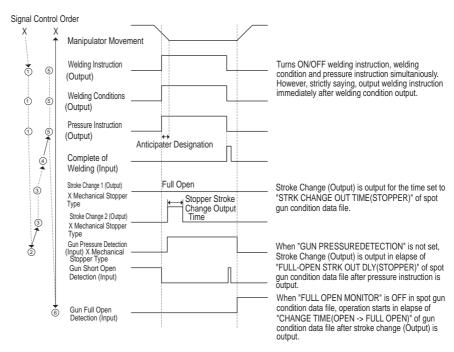


9.6.3.1 OPERATION MODE = 2 (SHORT OPEN → WELDING → FULL OPEN)

Gun Motion Control (With C gun double stroke) (With X gun double stroke, cylinder type)



■ Gun Motion Control (With X gun double stroke, mechanical stopper type)

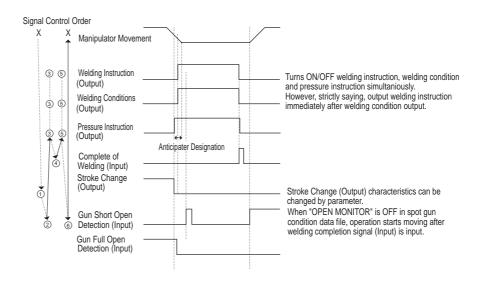


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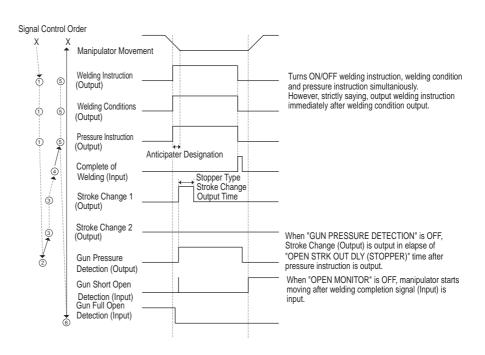
9.6.3.2 OPERATION MODE = 3 (FULL OPEN → WELDING → SHORT OPEN)

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Gun Motion Control (With C gun double stroke) (With X gun double stroke, cylinder type)

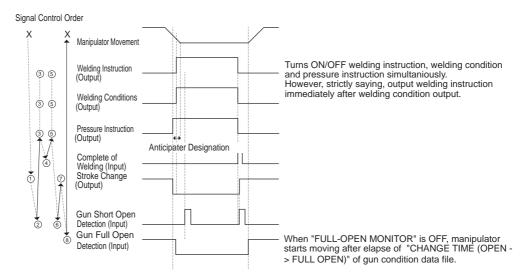


Gun Motion Control (With X gun double stroke, mechanical stopper type)

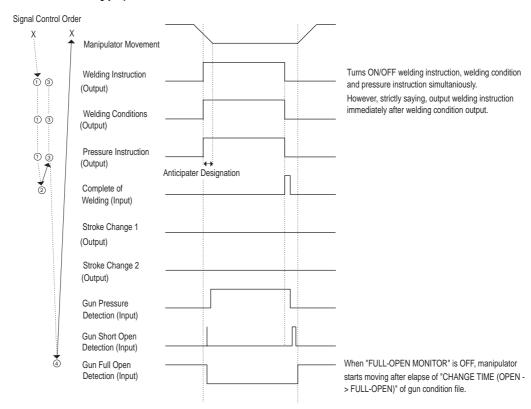


9.6.3.3 OPERATION MODE = 4 (FULL OPEN → WELDING → FULL OPEN)

Gun Motion Control (With C gun double stroke) (With X gun double stroke, cylinder type)



■ Gun Motion Control (With X gun double stroke, mechanical stopper type)



9.6.4 Stroke Change Control Method

9.6.4.1 Single Gun, C Double Gun, X Double Cylinder Gun

When OPEN (SHORT) is specified, change the stroke change signal (general output) to short open; when FULL OPEN (LONG) is specified, change the stroke change 1 signal (general output) to full open. However, the stroke change signal ON/OFF characteristics depend on the AP parameter setting.

For the use of C double gun, X double cylinder gun with double solenoid specifications:

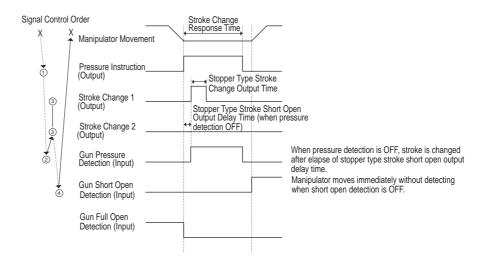


Set signal numbers for stroke change 1 and 2 in the spot I/O allocation information window. The inverse signal of stroke change 1 is output as stroke change 2 signal.

9.6.4.2 X Double Mechanical Stopper Type

Stroke change signal (output) is output with double solenoid specifications. The stroke change signal ON/OFF characteristics depend on the AP parameter setting.

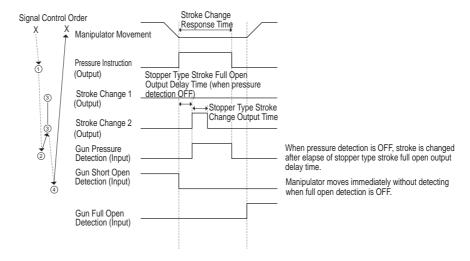
When OPEN (SHORT) is Specified Process Timing



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9.6 Spot Gun Motion Control

When FULL OPEN (LONG) is Specified Process Timing



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9.6 Spot Gun Motion Control

9.6.5 I/O Allocation

The I/O necessary for each welder can be set in the general-purpose I/O signal. The following signals are specified on the pseudo input signal window.

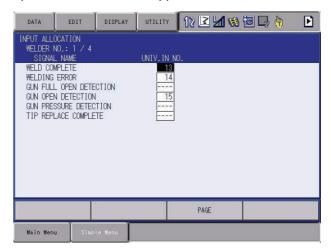
- Timer Cooling Water Error
- Gun Cooling Water Error
- Transthermo Error
- Air Pressure Decrease
- Weld On/Off

9.6.5.1 Input Allocation Window

- 1. Select {SPOT WELDING} from the {Main Menu}.
- 2. Select {I/O ALLOCATION}.



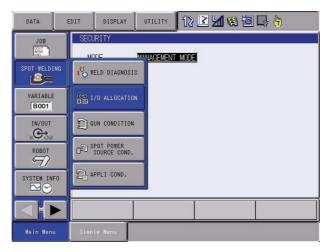
- The input allocation window appears.



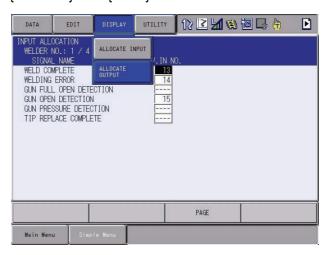
- 3. Specify the signal number.
 - Input the numerical value of the desired signal number, and press [ENTER].

9.6.5.2 Output Allocation Window

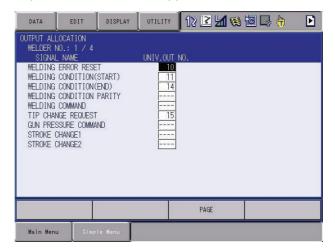
- 1. Select {SPOT WELDING} from the {Main Menu}.
- 2. Select {I/O ALLOCATION}.



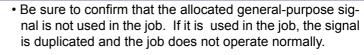
- The input allocation window appears.
- 3. Select {DISPLAY} from {DATA}.



- 4. Select {ALLOCATE OUTPUT}.
 - The output allocation window appears.



- 9.6 Spot Gun Motion Control
- 5. Specify the signal number.
 - Input the numerical value of the desired signal number, and press [ENTER].

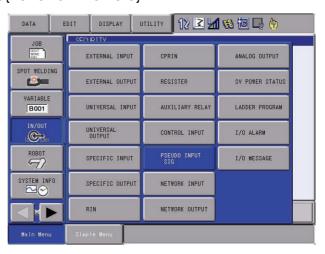




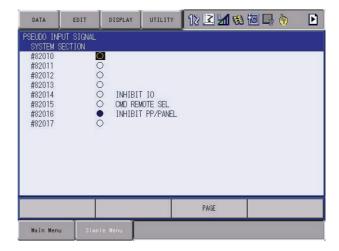
- When the output "WELDING CONDITION PARITY" is set, the parity number is automatically output during welding condition output. The setting of the parity whether it is odd or even is established in the parameter.
- In case if the stroke switching signal is the double-solenoid type (X type 2 step stroke gun mechanical stopper type), allocate two guns; in case if it is the single-solenoid type (other guns), allocate one gun.

9.6.5.3 Pseudo Input Signal Window

- 1. Select {IN/OUT} under the {Main Menu}.
- 2. Select (PSEUDO INPUT SIG).



- The pseudo input signal window appears.



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	3. Move the cursor to "ON or "OFF", and press [INTERLOCK]+[SELECT].
	 Each time [INTERLOCK] + [SELECT] is pressed, "○ (OFF)" and "● (ON)" alternate.

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9.6	Spot Gun Motion Control

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9.6.6 Allocation Signal Meanings

Table 9-2: Robot Controller Input Signal

Signal	Content	Source	Standard Setting
WELD COMPLETE	This signal specifies that welding has been completed. When the welding command manual spot operation is executed, it is used as a confirmation signal. When there is no LS open/close confirmation, the welding sequence ends and the next step is executed.	Welder	IN13
WELD ERR	This signal specifies an error in welding results or in the welder. During welding, an alarm occurs and the robot stops.	Welder	IN14
WIRE STICK DETECT	Specifies when a wire stick is detected. An alarm occurs and the robot stops.	Wire Stick Detector, Welder	NOT USED
TMR COOL WTR ERR	Specifies a timer cool water error. An alarm occurs and the robot stops. The servo power stays on.	Cool Water Flow Switch	IN9
GUN COOL WTR ERR	Specifies a gun cool water error. An alarm occurs and the robot stops. The servo power stays on.	Cool Water Flow Switch	IN10
TRANSTHERMO ERROR	Specifies an error from the gun transformer is transmitted directly to the robot controller. It is normally ON (NC), and when OFF, an alarm occurs. The servo power stays on.	Gun Transformer	IN11
WELD ON/OFF (from PLC)	Interlock Board, etc. PLC welder ON/OFF select switch. Welder status signal which outputs welder ON/OFF signal. While in the ON status, if the welder is switched OFF, spot welding is not performed.	Interlock Board, etc.	CN308-B6
TIP REPLACE COMPLETE	If this signal occurs after tip replacement, turn off the tip replacement demand signal, and the tip hit count is cleared.	Interlock Board, etc.	IN16
GUN FULL OPEN DETECT	When there is a 2 step stroke gun, this signal specifies stroke full open status.	Welding Gun (Full Open Status Detect LS)	NOT USED
GUN OPEN DETECT	The open/close confirmation LS of a single gun and short open confirmation LS of the 2 step stroke gun are connected, and the gun open/close confirmation is performed.	Welding Gun (Open/Close Confirmation Detect LS)	IN15
GUN PRESS DETECT	Specifies the gun pressure status.	Welding Gun (Pressure Status Detect LS)	NOT USED
AIR PRESS LOW	An alarm occurs if the air pressure is low. The servo power stays on.		IN12

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Table 9-3: Robot Controller Output Signal

Signal	Content	Source	Standard Setting
WELD COND (Level Signal) 1 (1) 2 (2) 4 (3)	Specifies the welding condition for the welder. Binary/discrete (bit number) can be selected as the output format Corresponding to 255 conditions or less (Parity Bit (Specification) is the most significant bit).	Welder	OUT19 used from 4 bit
8 (4) 16 (5) 32 (6) 64 (7) 128 (8)			OUT19 OUT20 OUT21 OUT22
WELD COND PARITY			NOT USED
WELD COMMAND	The start instruction is output to the welder. It is not necessary for welders which assume the welding condition signal is a start instruction.	Welder	NOT USED
WELD ERR RESET	Resets the welder after welder error status. Programming pendant operation output.	Welder	OUT18
WELD ON/OFF	Screens the robot situation when a signal is input from the interlock board, etc., and outputs.	Welder	OUT17
TIP CHANGE REQUEST	Specifies when the set tip hit count limit has been reached.	Interlock Board, etc.	OUT9
GUN PRESS COMMAND	Outputs gun pressure command.	Welding Gun	NOT USED
STROKE CHANGE Single Solenoid Double Solenoid	When using a 2 step stroke gun, welder open/close status can be changed.	Welding Gun	NOT USED

9	Spot Welding Application Using an Air Gun
96	Spot Gun Motion Control

9.6.7 Monitor Function for Spot Welding Equipment

Table 9-4: Function List

DX100

Function	Content	Signal Condition	Method of Use
AIR PRESS LOW Input Signal	When the air pressure is low and this signal turns on, an alarm occurs. The servo power stays on. This function signal must be set in the Concurrent I/O Parameter.	Normal: OFF (NO) Signal Function	This signal can be used during the low air pressure signal in the spot input allocation display if the set general-purpose input external input is on. To reset the alarm, turn the signal off, and it will return to the alarm reset operation.
TIMER COOL WATER ERROR GUN COOL WATER ERROR	When the water cooling is low and this signal turns on, an alarm occurs. The servo power stays on. This function signal must be set in the Concurrent I/O Parameter.	Normal: OFF (NO) Signal Function	This signal can be used during the low water cooling signal in the spot input allocation display if the set general-purpose input external input is on. To reset the alarm, turn the signal off, and it will return to the alarm reset operation.
TRANSTHERMO ERROR	When a gun transformer error occurs, this input turns off and an alarm occurs. The servo power stays on. This function signal must be set in the Concurrent I/O Parameter.	Normal: ON (NC) Signal Function	Even though usually a timer error is transmitted to the timer from the gun, and the main signal is transmitted from the gun transformer, an alarm may occur. Also if the pressure, full open status, short open status signal, etc. is transmitted from the robot controller, the signal line from the timer to the gun becomes a transthermo error only. If this signal is checked on the robot side, the signal line transmitted to the timer disappears, and the cable handling is made easier.

9.6.8 Spot Welding Exclusive Signal Allocation List

O:Connector

⊙:Connector and terminal block

Table 9-5: Spot Welding Exclusive Signal Allocation List (20010 to 20037)

Input	Input	Signal Name		
Signal Number	Method	No Allocation Set	Allocation Set	
20010	0	EXTERNAL START	EXTERNAL START	
20011	0	-	-	
20012	0	MASTER JOB CALL	MASTER JOB CALL	
20013	0	ALARM/ ERROR RESET	ALARM/ ERROR RESET	
20014	0	-	-	
20015	0	SELECT PLAY MODE	SELECT PLAY MODE	
20016	0	SELECT TEACH MODE	SELECT TEACH MODE	
20017	0	-	-	
20020	0	INTERFERENCE 1 ENTRANCE PROHIBITED	INTERFERENCE 1 ENTRANCE PROHIBITED	
20021	0	INTERFERENCE 2 ENTRANCE PROHIBITED	INTERFERENCE 2 ENTRANCE PROHIBITED	
20022	0	-	WELD ON/OFF	
20023	0	-	WELD INTERRUPT	
20024	•	INTERFERENCE 3 ENTRANCE PROHIBITED	INTERFERENCE 3 ENTRANCE PROHIBITED	
20025	•	INTERFERENCE 4 ENTRANCE PROHIBITED	INTERFERENCE 4 ENTRANCE PROHIBITED	
20026	•	-	-	
20027	•	-	-	
20030	•	IN1	IN1	
20031	•	IN2	IN2	
20032	•	IN3	IN3	
20033	•	IN4	IN4	
20034	•	IN5	IN5	
20035	•	IN6	IN6	
20036	•	IN7	IN7	
20037	•	IN8	IN8	

O:Connector

:Connector and terminal block

Table 9-6: Spot Welding Exclusive Signal Allocation List (30010 to 30037)

Output	Input	Signal Name		
Signal Number	Method	No Allocation Set	Allocation Set	
30010	0	DURING RUNNING	DURING RUNNING	
30011	0	SERVO ON	SERVO ON	
30012	0	MASTER JOB HEAD	MASTER JOB HEAD	
30013	0	DURING ALARM/ERROR OCCURRENCE	DURING ALARM/ERROR OCCURRENCE	
30014	0	BATTERY ALARM	BATTERY ALARM	
30015	0	REMOTE MODE SELECTED	REMOTE MODE SELECTED	
30016	0	PLAY MODE SELECTED	PLAY MODE SELECTED	
30017	0	TEACH MODE SELECTED	TEACH MODE SELECTED	
30020	0	IN CUBE 1	IN CUBE 1	
30021	0	IN CUBE 2	IN CUBE 2	
30022	0	TASK ORIGIN	TASK ORIGIN	
30023	0	INTERMEDIATE START OK (SEQUENCE CONTINUING)	INTERMEDIATE START OK (SEQUENCE CONTINUING)	
30024	•	IN CUBE 3	IN CUBE 3	
30025	•	IN CUBE 4	IN CUBE 4	
30026	•	-	-	
30027	•	-	-	
30030	•	OUT1	OUT1	
30031	•	OUT2	OUT2	
30032	•	OUT3	OUT3	
30033	•	OUT4	OUT4	
30034	•	OUT5	OUT5	
30035	•	OUT6	OUT6	
30036	•	OUT7	OUT7	
30037	•	OUT8	OUT8	

O:Connector

⊙ :Connector and terminal block

Table 9-7: Spot Welding Exclusive Signal Allocation List (20040 to 20067)

Output	Input	Signal Name	
Signal Number	Method	No Allocation Set	Allocation Set
20040	0	IN17	IN17
20041	0	IN18	IN18
20042	0	IN19	IN19
20043	0	IN20	IN20
20044	0	IN21	IN21
20045	0	IN22	IN22
20046	0	IN23	IN23
20047	0	IN24	IN24
20050	0	IN9	TIMER COOL WATER ERROR
20051	0	IN10	GUN COOL WATER ERROR
20052	0	IN11	TRANSTHERMO ERR
20053	0	IN12	AIR PRESS LOW
20054	0	IN13	WELD COMPLETE
20055	0	IN14	WELD ERR
20056	0	IN15	GUN OPEN DETECT
20057	0	IN16	TIP REPLACE COMPLETE
20060	0	IN25	IN25
20061	0	IN26	IN26
20062	0	IN27	IN27
20063	0	IN28	IN28
20064	0	IN29	IN29
20065	0	IN30	IN30
20066	0	IN31	IN31
20067	0	IN32	IN32

9.6

O:Connector

:Connector and terminal block

Table 9-8: Spot Welding Exclusive Signal Allocation List (30040 to 30067)

Output	Input	Signal Name		
Signal Number	Method	No Allocation Set	Allocation Set	
30040	0	OUT17	OUT17	
30041	0	OUT18	OUT18	
30042	0	OUT19	OUT19	
30043	0	OUT20	OUT20	
30044	0	OUT21	OUT21	
30045	0	OUT22	OUT22	
30046	0	OUT23	OUT23	
30047	0	OUT24	OUT24	
30050	0	OUT9	WELD ON/OFF	
30051	0	OUT10	WELD ERR RESET	
30052	0	OUT11	WELD COND 1	
30053	0	OUT12	WELD COND 2	
30054	0	OUT13	WELD COND 3	
30055	0	OUT14	WELD COND 4	
30056	0	OUT15	GUN PRESS COMMAND	
30057	0	OUT16	TIP CHANGE REQUEST	
30060	0	OUT25	OUT25	
30061	0	OUT26	OUT26	
30062	0	OUT27	OUT27	
30063	0	OUT28	OUT28	
30064	0	OUT29	OUT29	
30065	0	OUT30	OUT30	
30066	0	OUT31	OUT31	
30067	0	OUT32	OUT32	

9 Spot Welding Application Using an Air Gun DX100 9.7 Instruction List	
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9.7 Instruction List

Data variables are denoted in parentheses "<>". If multiple items are shown in one section, select one of the items.

Table 9-9: Spot Welding Instructions

GUNCL	Function	Presses a gun.		
	Format	GUN # (<gun no.="">) 1-8</gun>		
		T= <gun (sec.)="" pressing="" time=""></gun>	0.01-655.35	
		ATT= <anticipator (sec.)="" condition=""></anticipator>	0-655.35	
	Example	MOVL V=1000 NWAIT GUNCL GUN # (1) T=2.0 ATT=0.5 MOVL V=1000		
SPOT	Function	Start up the welding sequence from gun pressure.		
	Format	GUN # (<gun 1="" no.="">)</gun>	1-8	
		MODE= <gun 1="" mode="" operation="" specification=""></gun>	0-4	
		WTM= <gun 1="" condition="" welding=""></gun>	1-255	
		GUN # (<gun 2="" no.="">)</gun>	1-8	
		MODE= <gun 2="" mode="" operation="" specification=""></gun>	0-4	
		WTM= <gun 2="" condition="" welding=""></gun>	1-255	
		ATT= <anticipator (sec.)="" condition=""></anticipator>	0-655.35	
	Example	MOVL V=1000 NWAIT SPOT GUN # (1) MODE=2 WTM=2 ATT=0.5 MOVL V=1000		
STROKE	Function	Alternates short open and full open of a double stroke gun at any time than welding.		
	Format	GUN # (<gun no.="">)</gun>	1-8	
		LONG SHORT		
	Example	MOVL V=1000 STROKE GUN #(1) LONG MOVL V=1000		

10 T	able	of E	Basic	Instructions
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DX100

10.1 Move Instructions

10 Table of Basic Instructions

- <> indicates numerical or alphabetical data.
- If multiple items are shown in one section, select one of the items.

10.1 Move Instructions

MOVJ	Function	Moves to a taught point with joint interpolation type	aught point with joint interpolation type.		
Additional Item		Position data, Base axis position data, Station axis position data	These data do not appear on the screen.		
		VJ= <play speed=""></play>	VJ: 0.01 to 100.00%		
		PL= <position level=""></position>	PL:0 to 8		
		NWAIT			
		UNTIL statement			
		ACC=(acceleration adjustment ratio)	ACC: 20 to 100%		
		DEC=(deceleration adjustment ratio)	DEC: 20 to 100%		
	Example	MOVJ VJ=50.00 PL=2 NWAIT UNTIL IN#(16)=0	DN		
MOVL	Function	Moves to a taught point with linear interpolation t	уре.		
	Additional Item	Position data, Base axis position data, Station axis position data	These data do not appear on the screen.		
		V= <play speed="">, VR=<play of="" posture="" speed="" the="">, VE=<play axis="" external="" of="" speed=""></play></play></play>	V:0.1 to 1500.0 mm/s 1 to 9000.0 cm/min VR:0.1 to 180.0 deg/s VE:0.01 to 100.00%		
		PL= <position level=""></position>	PL:0 to 8		
		CR=(corner radius)	CR: 1.0 to 6553.5mm		
		NWAIT			
		UNTIL statement			
		ACC=(acceleration adjustment ratio)	ACC: 20 to 100%		
		DEC=(deceleration adjustment ratio)	DEC: 20 to 100%		
	Example	MOVL V=138 PL=0 NWAIT UNTIL IN#(16)=ON	•		
MOVC	Function	Moves to a taught point with circular interpolation	ı type.		
	Additional Item	Position data, Base axis position data, Station axis position data	These data do not appear on the screen.		
		V= <play speed="">, VR=<play of="" posture="" speed="" the="">, VE=<play axis="" external="" of="" speed=""></play></play></play>	Same as MOVL.		
		PL= <position level=""></position>	PL:0 to 8		
		NWAIT			
		ACC=(acceleration adjustment ratio)	ACC: 20 to 100%		
		DEC=(deceleration adjustment ratio)	DEC: 20 to 100%		
	Example	MOVC V=138 PL=0 NWAIT	I		

10 Table of Basic Instructions DX100

10.1 Move Instructions

MOVS	Function	Moves to a taught point with spline interpolation type.			
	Additional Item	Position data, Base axis position data, Station axis position data	These data do not appear on the screen.		
		V= <play speed="">, VR=<play of="" posture="" speed="" the="">, VE=<play axis="" external="" of="" speed=""></play></play></play>	Same as MOVL.		
		PL= <position level=""></position>	PL:0 to 8		
		NWAIT			
		ACC=(acceleration adjustment ratio)	ACC: 20 to 100%		
		DEC=(deceleration adjustment ratio)	DEC: 20 to 100%		
	Example	MOVS V=120 PL=0			
IMOV	Function	Moves the specified increment from the current printerpolation type.	position with linear		
	Additional Item	P <variable number="">, BP<variable number="">, EX<variable number=""></variable></variable></variable>			
		V= <play speed="">, VR=<play of="" posture="" speed="" the="">, VE=<play axis="" external="" of="" speed=""></play></play></play>	Same as MOVL.		
		PL= <position level=""></position>	PL:0 to 8		
		NWAIT			
		BF,RF,TF,UF# (<user coordinate="" number="">)</user>	BF: base coordinates RF: robot coordinates TF: tool coordinates UF: user coordinates		
		UNTIL statement			
		ACC=(acceleration adjustment ratio)	ACC: 20 to 100%		
		DEC=(deceleration adjustment ratio)	DEC: 20 to 100%		
	Example	IMOV P000 V=138 PL=1 RF			
REFP	Function	Defines a reference point (e.g. wall point for wea	aving).		
	Additional Item	<reference number="" point=""></reference>	wall point 1 for weaving :1 wall point 2 for weaving :2		
		Position data, Base axis position data, Station axis position data	These data do not appear on the screen.		
	Example	REFP 1			
SPEED	Function	Sets play speed.			
	Additional Item	VJ= <joint speed="">, V=<tcp speed="">, VR=<play of="" posture="" speed="" the="">, VE=<play axis="" external="" of="" speed=""></play></play></tcp></joint>	VJ:Same as MOVJ. V,VR,VE: Same as MOVL.		
	Example	SPEED VJ=50.00	I		

DX100 Table of Basic Instructions
10.2 I/O Instructions

10.2 I/O Instructions

Function Additional Item OT# (<output number="">), OGH# (<output group="" number="">), OG# (<output group="" number="">) Number of addressed output signals: OT#(xx)=1;OGH#(xx)=4(per group); OG#(xx)=8(per group) OGH#(xx) is not subject to parity check; only the binal specification is allowed. FINE</output></output></output>			
		OGH# (<output group="" number="">), OG# (<output group="" number="">) Number of addressed output signals: OT#(xx)=1;OGH#(xx)=4(per group); OG#(xx)=8(per group) OGH#(xx) is not subject to parity check; only the binary specification is allowed.</output></output>	With a high degree of
			accuracy
	Example	DOUT OT#(12) ON	
PULSE	Function	Outputs a pulse signal as an external output signal.	
	Additional Item	OT# (<output number="">), OGH# (<output group="" number="">), OG# (<output group="" number="">)</output></output></output>	
		T= <time (seconds)=""></time>	0.01 to 655.35 s 0.30 s unless otherwise specified
	Example	PULSE OT# (10) T=0.60	
DIN	Function Sets input signals in variables.		
	Additional	B <variable number=""> IN# (<input number=""/>), IGH# (<input group="" number=""/>), IG# (<input group="" number=""/>), OT# (<output number="">), OGH# (<output group="" number="">), OG# (<output group="" number="">), SIN# (<system input="" number="">), SOUT# (<system number="" output="">) Number of addressed input signals: IN#(xx)=1;IGH#(xx)=4(per group); IG#(xx)=8(per group) Number of addressed output signals: OT#(xx)=1;OGH#(xx)=4(per group); OG#(xx)=8(per group) IGH#(xx) and OGH#(xx) are not subject to parity check; only the binary specification is allowed.</system></system></output></output></output></variable>	
	Example	DIN B016 IN#(16) DIN B002 IG#(2)	1

	10	Table of Basic Instructions
DX100	10.2	I/O Instructions

WAIT	Function	Waits until the external input signal status matches the specified status.				
	Additional Item	IN# (<input number=""/>), IGH# (<input group="" number=""/>), IG# (<input group="" number=""/>), OT# (<user number="" output="">), OGH# (<output group="" number="">), SIN# (<system input="" number="">), SOUT# (<system number="" output="">)</system></system></output></user>				
		<status>,B<variable number=""></variable></status>				
		T= <time (seconds)=""></time>	0.01 to 655.35 s			
	Example	WAIT IN# (12)=ON T=10.00 WAIT IN# (12)=B002				
AOUT	Function	Outputs the specified voltage to the general-purpose analog output port.				
	Additional	AO# (<output number="" port="">)</output>	1 to 40			
	Item	<pre><output voltage(v)=""></output></pre> -14.0 to 14.0				
	Example	AOUT AO# (2) 12.7				
ARATION	Function	Starts the analog output corresponding to the speed.				
	Additional	AO#(<output number="" port="">)</output>	1 to 40			
	Item	BV = <basic voltage=""></basic>	-14.00 to 14.00			
		V = <basic speed=""></basic>	0.1 to 150.0 mm/s 1 to 9000 cm/min			
		OFV = <offset voltage=""></offset>	-14.00 to 14.00			
	Example	ARATION AO#(1) BV=10.00 V=200.0 OFV=2.00				
ARATIOF	Function	Ends the analog output corresponding to the speed.				
	Additional Item	AO#(<output number="" port="">) 1 to 40</output>				
	Example	ARATIOF AO#(1)	•			

DX100 Table of Basic Instructions
10.3 Control Instructions

10.3 Control Instructions

JUMP	Function	Jumps to the specified label or job.	
	Additional Item	* <label character="" string="">, JOB:<job name="">, IG# (<input group="" number=""/>), B<variable number="">, I<variable number="">, D<variable number=""></variable></variable></variable></job></label>	
		UF# (user coordinates number)	
	Example	JUMP JOB:TEST1 IF IN#(14)=OFF	
*	Function	Indicates a jump destination.	
(label)	Additional	<pre><jump destination=""></jump></pre>	8 characters or
(label)	Item	Jump destination	less
	Example	*123	
CALL	Function	Calls the specified job.	
	Additional Item	JOB: <job name="">, IG# (<input group="" number=""/>), B<variable number="">, I<variable number="">, D<variable number=""></variable></variable></variable></job>	
		UF# (user coordinates number)	
		IF statement	
	Example	CALL JOB:TEST1 IF IN# (24)=ON CALL IG#(2) (The job is called by the patterns of input signal. cannot be called.)	In this example, Job 0
RET	Function	Returns to the call source job.	
	Additional Item	IF statement	
Example		RET IF IN#(12)=OFF	
END	Function	Declares the end of a job.	
	Additional Item		
	Example	END	
NOP	Function	No operation.	
	Additional Item		
	Example	NOP	
TIMER	Function	Stops for the specified time.	
	Additional Item	T= <time (seconds)=""></time>	0.01 to 655.35 s
	Example	TIMER T=12.50	
IF statement	Function	Evaluates the specified condition and makes a jude Described after an instruction that specifies a cereformat:	

	10	Table of Basic Instructions
DX100	10.3	Control Instructions

UNTIL **Function** Monitors the specified input signal during an action and stops the action when the specified signal status is observed. Described after an instruction statement that specifies a certain action. Additional IN# (<input number>) Item <status> Example MOVL V=300 UNTIL IN#(10)=ON **PAUSE Function** Instructs a pause. Additional IF statement Item **Example** PAUSE IF IN#(12)=OFF **Function** Dispalys a comment. 32 characters or **Additional** <comment> (comment) Item less Example 'Draws 100mm size square. CWAIT **Function** Waits for execution of the instruction on the next line. Used with the NWAIT tag which is an additional item of a move instruction. **Additional** Item **Example** MOVL V=100 NWAIT DOUT OT#(1) ON **CWAIT** DOUT OT#(1) OFF MOVL V=100 **ADVINIT Function** Initializes the prereading instruction processing. Used to adjust the access timing for variable data. **Additional** Item **ADVINIT** Example **ADVSTOP Function** Stops the prereading instruction processing. Used to adjust the access timing for variable data. **Additional** Item Example **ADVINIT**

	10	Table of Basic Instructions
DX100	10.4	Shift Instructions

10.4 Shift Instructions

SFTON	Function	Starts a shift	operation.			
	Additional Item	P <variable no<br="">BP<variable EX<variable BF,RF,TF, UF#(<user co<="" th=""><th>BF: base coordinates RF: robot coordinates TF: tool coordinates UF: user coordinates</th></user></variable </variable </variable>	BF: base coordinates RF: robot coordinates TF: tool coordinates UF: user coordinates			
	Example	SFTON P001	1 UF#(1)			
SFTOF	Function	Stops a shift	operation.			
	Additional Item					
	Example	SFTOF				
MSHIFT	Function	Obtains the shift value in the specified coordinate system from Data 2 and 3, and stores the obtained element values in Data 1. Format:MSHIFT <data1><coordinate><data2><data3></data3></data2></coordinate></data1>				
	Additional	Data1	PX <variable number=""></variable>			
	Item	Coordinate	BF,RF,TF, UF# (<user coordinate="" number="">), MTF</user>	BF: base coordinates RF: robot coordinates TF: tool coordinates UF: user coordinates MTF: tool coordinates for the master		
		Data2	PX <variable number=""></variable>			
		Data3	PX <variable number=""></variable>			
	Example MSHIFT PX000 RF PX001 PX002					

	10	Table of Basic Instructions
DX100	10.5	Operating Instructions

10.5 Operating Instructions

ADD	Function	Adds Data1 and Data2, and stores the result in Data1. Format:ADD <data1><data2></data2></data1>				
Additional Item	Data1	B <variable number="">, I<variable number="">, D<variable number="">, R<variable number="">, P<variable number="">, BP<variable number="">, EX<variable number="">,</variable></variable></variable></variable></variable></variable></variable>	Data1 must always be a variable.			
		Data2	Constant, B <variable number="">, I<variable number="">, D<variable number="">, R<variable number="">, P<variable number="">, BP<variable number="">, BY<variable number="">, EX<variable number=""></variable></variable></variable></variable></variable></variable></variable></variable>			
	Example	ADD 1012 1013				
SUB	Function	Subtracts Data2 from Data1, and stores the result in Data1. Format:SUB <data1><data2></data2></data1>				
	Additional Item	Data1	B <variable number="">, I<variable number="">, D<variable number="">, R<variable number="">, P<variable number="">, BP<variable number="">,</variable></variable></variable></variable></variable></variable>	Data1 must always be a variable.		
			EX <variable number=""></variable>			
		Data2				

	10	Table of Basic Instructions
DX100	10.5	Operating Instructions

MUL	Function	-	Data1 by Data2, and stores the result in Da L <data1><data2></data2></data1>	ata1.
		Pxxx(0):all Pxxx(2):Y-a	be an element in a position variable. axis data, Pxxx(1):X-axis data, axis data, Pxxx(3):Z-axis data, -axis data, Pxxx(5):Ty-axis data, -axis data	
Additional Item	Additional Item	Data1	B <variable number="">, I<variable number="">, D<variable number="">, R<variable number="">, P<variable number=""> (<element number="">), BP<variable number=""> (<element number="">), EX<variable number=""> (<element number="">),</element></variable></element></variable></element></variable></variable></variable></variable></variable>	Data1 must always be a variable.
		Data2	Constant, B <variable number="">, I<variable number="">, D<variable number="">, R<variable number=""></variable></variable></variable></variable>	
	Example	MUL 1012 I MUL P000	013 (3) 2 (Multiply the Z-axis data by 2.)	
DIV Function		Data1 can Pxxx(0):all Pxxx(2):Y-a	ta1 by Data2, and stores the result in Data / <data1><data2> be an element in a position variable. axis data, Pxxx(1):X-axis data, axis data, Pxxx(3):Z-axis data, -axis data, Pxxx(5):Ty-axis data, -axis data</data2></data1>	a1.
	Additional Item	Data1	B <variable number="">, I<variable number="">, D<variable number="">, R<variable number="">, P<variable number=""> (<element number="">), BP<variable number=""> (<element number="">), EX<variable number=""> (<element number="">),</element></variable></element></variable></element></variable></variable></variable></variable></variable>	Data1 must always be a variable.
		Data2	Constant, B <variable number="">, I<variable number="">, D<variable number="">, R<variable number=""></variable></variable></variable></variable>	
	Example	DIV 1012 10 DIV P000 (13 3) 2 (Divide the Z-axis data by 2.)	
INC	Function	Increments	the value of the specified variable by 1.	
	Additional Item	B <variable D<variable< th=""><th>number>,l<variable number="">, number></variable></th><th></th></variable<></variable 	number>,l <variable number="">, number></variable>	
	Example	INC 1043		•
DEC	Function	Decrement	s the value of the specified variable by 1.	
	Additional Item	B <variable D<variable< th=""><th>number>,I<variable number="">, number></variable></th><th></th></variable<></variable 	number>,I <variable number="">, number></variable>	
	Example	DEC 1043		I

DX100	10 10		Basic Instructions g Instructions				
AND	Function		Obtains the AND of Data1 and Data2, and stores the result in Data1. Format:AND Data1>				
	Additional	Data1	B <variable number=""></variable>				
	Item	Data2	B <variable number="">, Constant</variable>				
Ex	Example	AND B012 E	3020	I.			
OR	Function		OR of Data1 and Data2, and stores the res Data1> <data2></data2>	sult in Data1.			
A	Additional	Data1	B <variable number=""></variable>				
	Item	Data2	B <variable number="">, Constant</variable>				
	Example	OR B012 B0)20	1			
NOT	Function		NOT of Data2, and stores the result in Dat <data1><data2></data2></data1>	a1.			
	Additional	Data1	B <variable number=""></variable>				
	Item	Data2	B <variable number="">, Constant</variable>				
1	Example	NOT B012 E	3020				
XOR Function	Data1.	exclusive OR of Data1 and Data2, and sto <a>R<data1><data2></data2></data1>	res the result in				
	Additional	Data1	B <variable number=""></variable>				
	Item	Data2	B <variable number="">, Constant</variable>				
Examp	Example	XOR B012 E	3020				
SET	Function	Sets Data2 to Data1. Format:SET <data1><data2></data2></data1>					
	Additional Item	Data1	B <variable number="">, I<variable number="">, D<variable number="">, R<variable number="">, P<variable number="">, S<variable number="">, BP<variable number="">, EX<variable number="">,</variable></variable></variable></variable></variable></variable></variable></variable>	Data1 must always be a variable.			
		Data2	Constant, B <variable number="">, I<variable number="">, D<variable number="">, R<variable number="">, S<variable number="">, S<pre>S<variable number="">, EXPRESS</variable></pre></variable></variable></variable></variable></variable>				
	Example	SET 1012 102	20				
SETE	Function	Sets data to	an element in a position variable.				
	Additional Item	Data 1	P <variable number=""> (<element number="">), BP<variable number=""> (<element number="">), EX<variable number=""> (<element number="">)</element></variable></element></variable></element></variable>				
		Data 2	D <variable number="">, <double-precision constant="" integer="" type=""></double-precision></variable>				
	Example	SETE P012 (3) D005					

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10 Table of Basic Instructions

10.5 Operating Instructions

GETE	Function	Extracts an	element in a position variable.				
	Additional	D <variable number=""></variable>					
	Item	BP <variable< th=""><th>number> (<element number="">), e number> (<element number="">), e number> (<element number="">)</element></element></element></th><th></th></variable<>	number> (<element number="">), e number> (<element number="">), e number> (<element number="">)</element></element></element>				
	Example	GETE D00	6 P012 (4)				
GETS	Function	Sets a syst	em variable to the specified variable.				
Additional Item	Additional Item	I <variable r<br="">D<variable R<variable< th=""><th colspan="4">B<variable number="">, I<variable number="">, D<variable number="">, R<variable number="">, PX<variable number=""></variable></variable></variable></variable></variable></th></variable<></variable </variable>	B <variable number="">, I<variable number="">, D<variable number="">, R<variable number="">, PX<variable number=""></variable></variable></variable></variable></variable>				
		\$B <variable number="">, \$I<variable number="">, \$D<variable number="">, \$R<variable number="">, \$PX<variable number="">, \$ERRNO, Constant, B<variable number=""></variable></variable></variable></variable></variable></variable>					
	Example	GETS B000 \$B000 GETS I001 \$I[1] GETS PX003 \$PX001					
CNVRT	Function	Converts the position variable (Data2) into a position variable of the specified coordinate system, and stores the converted variable in Data1. Format:CNVRT <data1><data2><coordinate></coordinate></data2></data1>					
	Additional	Data1	PX <variable number=""></variable>				
	Item	Data2	PX <variable number=""></variable>				
		BF,RF,TF,U	F# (<user coordinate="" number="">),MTF</user>	BF: base coordinates RF: robot coordinates TF: tool coordinates UF: user coordinates MTF:tool coordinates for the master			
	Example	CNVRT PX	000 PX001 BF				

DX100 10.5 Table of Basic Instructions
Operating Instructions

CLEAR	Function	variables as	the variable number in Data1, clears (set specified by a number in Data2. AR <data1><data2></data2></data1>	s to zero) as many			
	Additional Item	Data1	B <variable number="">, I<variable number="">, D<variable number="">, R<variable number="">, \$B<variable number="">, \$I<variable number="">, \$I<variable number="">, \$D<variable number="">, \$R<variable number="">,</variable></variable></variable></variable></variable></variable></variable></variable></variable>				
		Data2	<number of="" variables="">, ALL,STACK</number>	ALL:Clears variables of the variable number in Data1 and of all the variable numbers that follow. STACK:Clears all variables in the job call stack.			
	Example	CLEAR B00 CLEAR STA					
SIN	Function	Obtains the sine of Data2, and stores the result in Data1. Format:SIN <data1><data2></data2></data1>					
	Additional Item	Data1	R <variable number=""></variable>	Data1 must always be a real type variable.			
		Data2	<constant>, R<variable number=""></variable></constant>				
000	Example	SIN R000 R001 (Sets the sine of R001 to R000.)					
cos	Function	Obtains the cosine of Data2, and stores the result in Data1. Format:COS <data1><data2></data2></data1>					
	Additional Item	Data1	R <variable number=""></variable>	Data1 must always be a real type variable.			
		Data2	<constant>, R<variable number=""></variable></constant>				
	Example	COS R000 I	COS R000 R001 (Sets the cosine of R001 to R000.)				
ATAN	Function		arc tangent of Data2, and stores the resul N <data1><data2></data2></data1>	t in Data1.			
	Additional Item	Data1	R <variable number=""></variable>	Data1 must always be a real type variable.			
		Data2	<constant>, R<variable number=""></variable></constant>				
	Example	ATAN R000	R001 (Sets the arc tangent of R001 to R0	000.)			
SQRT	Function		square root of Data2, and stores the resurce RT <data1><data2></data2></data1>	It in Data1.			
	Additional Item	Data1	R <variable number=""></variable>	Data1 must always be a real type variable.			
		Data2	<constant>, R<variable number=""></variable></constant>				
	Example	SQRT R000	R001 (Sets the square root of R001 to R	000.)			

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10 Table of Basic Instructions

10.5 Operating Instructions

MFRAME	Function	as definition p data, <data2> definition poin Format: MFR</data2>	er coordinate using the position data for the points. <data1> indicates the definition position data, and the definition point XX position data, and the XY position data. AME <user coordinate=""> <data1> <data2></data2></data1></user></data1>	oint ORG position I <data3> the</data3>			
	Additional	UF#(<user co<="" th=""><th colspan="5">UF#(<user coordinate="" number="">) 1 to 24</user></th></user>	UF#(<user coordinate="" number="">) 1 to 24</user>				
	Item	Data1	PX <variable number=""></variable>				
		Data2	PX <variable number=""></variable>				
		Data3	PX <variable number=""></variable>				
	Example	MFRAME UF	#(1) PX000 PX001 PX002				
MULMAT	Function	Data1.	natrix product of Data2 and Data3, and sto	ores the result in			
	Additional	Data1	P <variable number=""></variable>				
	Item	Data2	P <variable number=""></variable>				
		Data3	P <variable number=""></variable>				
	Example	MULMAT POO	0 P001 P002				
INVMAT	Function		verse matrix of Data2, and stores the resulAT <data1> <data2></data2></data1>	ult in Data1.			
	Additional	Data1	P <variable number=""></variable>				
	Item	Data2	P <variable number=""></variable>				
	Example	INVMAT P000 P001					
SETFILE	Function	Changes the contents data of a condition file into the numeric data of Data1. The contents data of a condition file to be changed is specified by the element number.					
Addition Item	Additional Item	Contents data of a condition file	WEV#(<condition file<br="">number>)(<element number="">)</element></condition>				
		Data1	Constant, D <variable number=""></variable>				
	Example	SETFILE WE	V#(1)(1) D000				
GETFILE	Function		ntents data of a condition file in Data1. The be obtained is specified by the element				
	Additional	Data1	D <variable number=""></variable>				
	Item	Contents data of a condition file	WEV#(<condition file="" number="">)(<element number="">)</element></condition>				
	Example	GETFILE DOG	00 WEV#(1)(1)	1			
GETPOS	Function	Stores the pos	sition data of Data2 (step number) in Data	11.			
	Additional	Data1	PX <variable number=""></variable>				
	Item	Data2	STEP# (<step number="">)</step>				
	Example	GETPOS PX	GETPOS PX000 STEP#(1)				
VAL	Function	Converts the real number, a	numeric value of the character string (ASC and stores the result in Data1. <data1> <data2></data2></data1>	CII) of Data2 into the			
	Additional Item	Data1	B <variable number="">, I <variable number="">, D <variable number="">, R <variable number=""></variable></variable></variable></variable>				
		Data2	Character string, S <variable number=""></variable>				
	Example	VAL B000 "12	3"				

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ASC	Function	Data2, and	Obtains the character code of the first letter of the character string (ASCII) of Data2, and stores the result in Data1. Format:ASC <data1><data2></data2></data1>			
	Additional Item	Data1	B <variable number="">, I <variable number="">, D <variable number=""></variable></variable></variable>			
		Data2	Character string, S <variable number=""></variable>			
	Example	ASC B000	"ABC"			
CHR\$	Function	the result in	character (ASCII) with the character code on Data1. R\$ <data1><data2></data2></data1>	of Data2, and stores		
	Additional	Data1	S <variable number=""></variable>			
	Item	Data2	Constant, B <variable number=""></variable>			
Exa	Example	CHR\$ S000	0 65	1		
MID\$ Function	Function	character s	character string (ASCII) of any length (Data tring (ASCII) of Data2, and stores the result 0\$ <data1><data2><data3><data4></data4></data3></data2></data1>			
	Additional	Data1	S <variable number=""></variable>			
	Item	Data2	Character string, S <variable number=""></variable>			
		Data3	Constant, B <variable number="">, I <variable number="">, D <variable number=""></variable></variable></variable>			
		Data4	Constant, B <variable number="">, I <variable number="">, D <variable number=""></variable></variable></variable>			
	Example	MID\$ S000	"123ABC456" 4 3	1		
LEN	Function	and stores	total number of bytes of the character strin the result in Data1. N <data1><data2></data2></data1>	g (ASCII) of Data2,		
	Additional Item	Data1	B <variable number="">, I <variable number="">, D <variable number=""></variable></variable></variable>			
		Data2	Character string, S <variable number=""></variable>			
	Example	LEN B000 '	'ABCDEF"			
CAT\$	Function	result in Da	he character string (ASCII) of Data2 and Da ta1. 「\$ <data1><data2><data3></data3></data2></data1>	ata3, and stores the		
	Additional	Data1	S <variable number=""></variable>			
	Item	Data2	Character string, S <variable number=""></variable>			
		Data3	Character string, S <variable number=""></variable>			
	Example	CAT\$ S000	"ABC" "DEF"			

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