The Americas YASKAWA Representative

- 24-hour Telephone Number: **(937) 847-3200**
  Use for urgent or emergency needs for technical support, service and/or replacement parts
- Routine Technical Inquiries: *techsupport@motoman.com*
  Allow up to 36 hours for response

YASKAWA

YRC1000micro
OPERATOR'S MANUAL

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

MOTOMAN INSTRUCTIONS

MOTOMAN-□□□ INSTRUCTIONS
YRC1000micro INSTRUCTIONS
YRC1000micro OPERATOR'S MANUAL
YRC1000micro MAINTENANCE MANUAL
YRC1000micro ALARM CODES (MAJOR ALARMS) (MINOR ALARMS)

Have the following information available when contacting the YASKAWA Representative:

- System
- Primary Application
- Software Version *(Located on Programming Pendant by selecting: {Main Menu} - {System Info} - {Version})*
- Warranty ID *(Located on Robot Controller)*
- Robot Serial Number *(Located on Manipulator data plate)*
- Robot Sales Order Number *(Located on Robot controller data plate)*

MANUAL NO. RE-CSO-A058 ◈9

Part Number: 181257-1CD
Revision: 9

DANGER

- This manual describes the various components and general operations of the YRC1000micro system. Read this manual carefully and be sure to understand its contents before handling the YRC1000micro. Any matter, including operation, usage, measures, and modifications, not described in this manual must be regarded as “prohibited” or “improper”.
- General information related to safety are described in “Chapter 1. Safety” of the YRC1000micro INSTRUCTIONS. To ensure correct and safe operation, carefully read “Chapter 1. Safety” of the YRC1000micro INSTRUCTIONS.

CAUTION

- In some drawings in this manual, protective covers or shields are removed to show details. Make sure that all the covers or shields are installed in place before operating this product.
- YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids the product warranty.

NOTICE

- 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. Be sure to tell the representative the manual number listed on the front cover.

Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the YRC1000micro.

In this manual, the Notes for Safe Operation are classified as “DANGER”, “WARNING”, “CAUTION”, or “NOTICE”.



Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. Safety Signs identified by the signal word DANGER should be used sparingly and only for those situations presenting the most serious hazards.



Indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury. Hazards identified by the signal word WARNING present a lesser degree of risk of injury or death than those identified by the signal word DANGER.



Indicates a hazardous situation, which if not avoided, could result in minor or moderate injury. It may also be used without the safety alert symbol as an alternative to “NOTICE”.



NOTICE is the preferred signal word to address practices not related to personal injury. The safety alert symbol should not be used with this signal word. As an alternative to “NOTICE”, the word “CAUTION” without the safety alert symbol may be used to indicate a message not related to personal injury.

Even items described as “CAUTION” may result in a serious accident in some situations.



To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as “DANGER”, “WARNING”, or “CAUTION”.

DANGER

- Before operating the manipulator, make sure the servo power is turned OFF by performing the following operations. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.
  - Press the emergency stop button YRC1000micro programming pendant.
  - Disconnect the safety plug of the safety fence. (when in play mode or in remote mode)

If operation of the manipulator cannot be stopped in an emergency, personal injury and/or equipment damage may result.

Fig. : Emergency Stop Button



- Before releasing the emergency stop, make sure to remove the obstacle or error that caused the emergency stop, if any, and then turn the servo power ON.

Failure to observe this instruction may cause unintended movement of the manipulator, which may result in personal injury.

Fig. : Release of Emergency Stop



- Observe the following precautions when performing a teaching operation within the manipulator's operating range:
  - Be sure to perform lockout by putting a lockout device on the safety fence when going into the area enclosed by the safety fence. In addition, the operator of the teaching operation must display a sign that indicates an operation is being performed so that no other person closes the safety fence.
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Always keep in mind emergency response measures against the manipulator’s unexpected movement toward a person.
  - Ensure a safe place to retreat in case of emergency.

Failure to observe this instruction may cause improper or unintended movement of the manipulator, which may result in personal injury.

- Confirm that no person is present in the manipulator's operating range and that the operator is in a safe location before:
  - Turning ON the YRC1000micro power
  - Moving the manipulator by using the programming pendant
  - Running the system in the check mode
  - Performing automatic operations

Personal injury may result if a person enters the manipulator's operating range during operation. Immediately press an emergency stop button whenever there is a problem. The emergency stop button is located on the upper right of the programming pendant.

- Read and understand the Explanation of the Warning Labels before operating the manipulator.

DANGER

- If you are not using the programming pendant, be sure to supply the emergency stop button on the equipment. Then before operating the manipulator, check to be sure that the servo power is turned OFF by pressing the emergency stop button.
  Connect the external emergency stop button to the 4-14 pin and 5-15 pin of the Safety connector (Safety).
- Upon shipment of the YRC1000micro, this signal is connected by a jumper cable in the dummy connector. To use the signal, make sure to supply a new connector, and then input it.

If the signal is input with the jumper cable connected, it does not function, which may result in personal injury or equipment damage.

WARNING

- Perform the following inspection procedures prior to conducting manipulator teaching. If there is any problem, immediately take necessary steps to solve it, such as maintenance and repair.
  - Check for a problem in manipulator movement.
  - Check for damage to insulation and sheathing of external wires.
- Return the programming pendant to a safe place after use.

If the programming pendant is left unattended on the manipulator, on a fixture, or on the floor, etc., the Enable Switch may be activated due to surface irregularities of where it is left, and the servo power may be turned ON. In addition, in case the operation of the manipulator starts, the manipulator or the tool may hit the programming pendant left unattended, which may result in personal injury and/or equipment damage.

Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product.

The MOTOMAN usually consists of the manipulator, the YRC1000micro controller, manipulator cables, the YRC1000micro programming pendant (optional), and the YRC1000micro programming pendant safety signal short circuit connector (optional).

In this manual, the equipment is designated as follows:

Equipment	Manual Designation
YRC1000micro controller	YRC1000micro
YRC1000micro programming pendant	Programming pendant (optional)
Cable between the manipulator and the controller	Manipulator cable
YRC1000micro programming pendant safety signal short circuit connector	Programming pendant safety signal short circuit connector (optional)

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

Equipment		Manual Designation
Programming Pendant	Character Keys /Symbol Keys	The keys which have characters or symbols printed on them are denoted with [ ]. e.g. [ENTER]
	Axis Keys /Numeric Keys	[Axis Key] and [Numeric Key] 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, e.g. [SHIFT]+[COORD].
	Mode Switch	Mode Switch can select three kinds of modes that are denoted as follows: REMOTE, PLAY or TEACH. (The switch names are denoted as symbols)
	Button	The three buttons on the upper side of the programming pendant are denoted as follows: START, HOLD, or EMERGENCY STOP. (The button names are denoted as symbols)
	Displays	The menu displayed in the programming pendant is denoted with { }. e.g. {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 [SELECT] is pressed, or that the item is directly selected by touching the screen.

Registered Trademark

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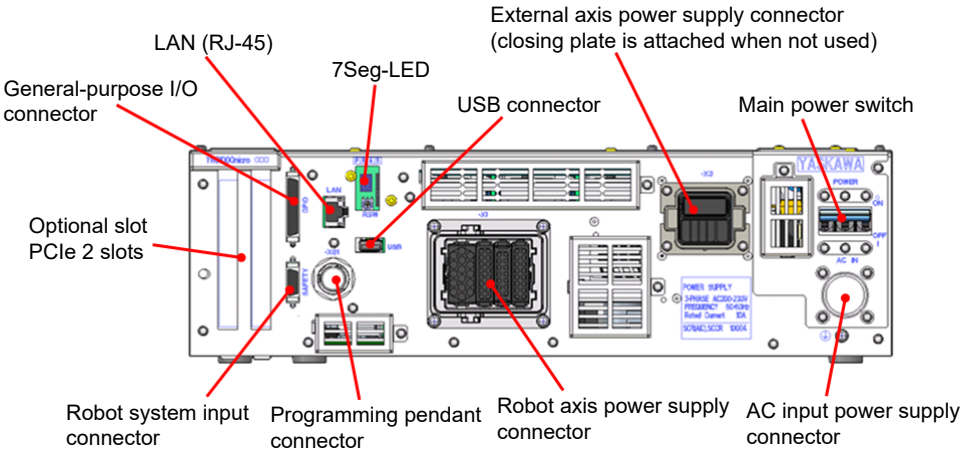
1 Introduction

1.1 YRC1000micro Overview

The main power switch is located in the upper right on the front panel of the YRC1000micro.

For information on setup, installation, and connection of the YRC1000micro system, refer to “YRC1000micro INSTRUCTIONS (RE-CTO-A222)”.

Fig. 1-1: YRC1000micro Front View



1.2 Programming Pendant

1.2.1 Programming Pendant Overview

The programming pendant is equipped with the keys and buttons used to perform manipulator teaching, job editing and playback, etc.

Fig. 1-2: Programming Pendant Overview



1.2.2 Key Description

1.2.2.1 Character Keys and Symbol Keys

The keys with characters or symbols printed on them are denoted with [ ].

For example, 

is denoted as [ENTER].

To each numeric key, functions other than numerical entry are allocated.

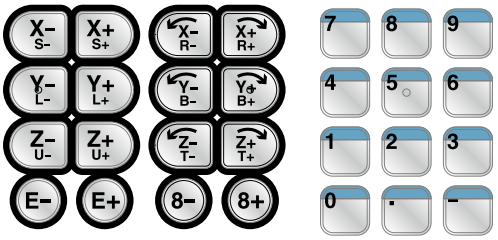
In the description of our instruction manuals, only the function explained there is denoted as the key.

For example, 

is denoted as [1] when the key is used to enter the numerical value 1, and denoted as [TIMER] when used to register the timer instruction.

1.2.2.2 Axis Keys and Numeric Keys

The keys shown below are collectively referred to as [Axis Keys] and [Numeric Keys].



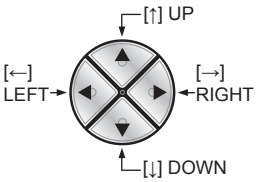
Axis Keys Numeric Keys

1.2.2.3 Keys Pressed Simultaneously

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

1.2.3 Programming Pendant Keys

[START] 	**Starts the manipulator motion in playback operation.** • The LED on this button lights up during the play operation. The LED also lights up when the playback operation is started by the START signal of system input. • The LED turns OFF when the playback operation is stopped by alarm occurrence, HOLD signal, or mode change.
[HOLD] 	**Temporarily stops the manipulator motion.** • This button is enabled in any mode. • The LED on this button lights up only while the button is being pressed. Although the LED turns OFF when the button is released, the manipulator stays stopped until a next START command is input. • The HOLD LED automatically lights up in the following cases to indicate that the system is in HOLD status. The start and axis operations are disabled while the LED lights up. 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 that occurred in working process. • While communication between the YRC1000micro and the programming pendant is disconnected, the manipulator does not stop its operation even if [HOLD] is pressed.
[EMERGENCY STOP] 	**Turns OFF the servo power.** • When the servo power is turned OFF, the “SERVO ON” LED on the programming pendant turns OFF. • An emergency stop message is shown on the display.
Mode Switch 	**Selects Play mode, Teach mode, or Remote mode.** PLAY: Play Mode The playback of a taught job can be performed. The START signal from an external device is disabled. TEACH: Teach Mode Axis can be operated and operation can be edited by using the programming pendant. The START signal from an external device is disabled. REMOTE: Remote Mode Operation by an external signal is enabled. During remote mode, [START] of the programming pendant is disabled. • While communication between the YRC1000micro and the programming pendant is disconnected, the mode of the YRC1000micro cannot be changed.

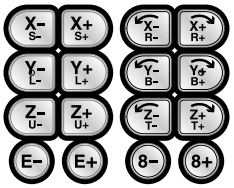
Enable Switch 	**Turns ON the servo power.** • When the Enable Switch is lightly squeezed while the "SERVO ON" LED is blinking and the Mode Switch is set to TEACH, the power turns ON. • When this switch is released or firmly squeezed while the power is turned ON, the power turns OFF.
[SELECT] 	**Works as described below.** • Selects a menu item in the main menu area and the menu area. • Makes the selected item ready to be set in the general-purpose display area. • Shows two or more messages in the human interface display area.
Cursor Key 	**Moves the cursor in the direction of the arrow.** • The size of the cursor and the range/place where the cursor can move vary depending on the window. • In the JOB CONTENT window, if the UP cursor is pressed when the cursor is on the first line, the cursor moves to the last line of the job. Conversely, if the cursor is on the last line of the job and the DOWN cursor 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] 	**Displays the main menu.** • When the main menu is shown, press this key to hide the main menu. [MAIN MENU] + UP Increases the brightness of the screen. [MAIN MENU] + DOWN Decreases the brightness of the screen.
[SIMPLE MENU] 	**Displays the simple menu.** • When the simple menu is shown, press this key to hide the simple menu. [SHIFT] + [SIMPLE MENU] Registers the layout displayed in the general-purpose area to the user defined menu. Press [SIMPLE MENU] for three seconds to display the pop-up menu window.

[SERVO ON READY] 	**Enables the servo power supply to be turned ON.** • If the servo power supply is shut OFF by the emergency stop or overrun signal, press this key to enable the servo power supply to be turned ON. • When this key is pressed, 1. in play mode, the servo power supply turns ON if the safeguarding is securely closed; 2. in teach mode, the “SERVO ON” LED blinks, and the servo power supply turns ON with the Enable Switch turned ON; 3. while the servo power is ON, the “SERVO ON” LED lights up.
[CANCEL] 	**Cancels the current status.** • Hides the sub menu in the main menu area and the menu area. • Cancels the current input data or input status in the general-purpose display area. • Cancels the list of messages in the human interface display area. • Cancels the current error. [SHIFT] + [CANCEL] When the job content is shown and the undo function is enabled, the assist menu is shown.
[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] 	**Selects the operation coordinate system when the manipulator is operated manually.** • The coordinate system can be selected from the five coordinate systems, i.e., joint, Cartesian, cylindrical, tool, and user. Each time this key is pressed, the coordinate system is switched in the following order: JOINT → CAR/CYL → TOOL → USER • The selected coordinate system is shown in the status display area. [SHIFT] + [COORD] The number of the coordinate system can be changed when the “TOOL” or “USER” coordinate system is selected.

[DIRECT OPEN] 	**Displays the content related to the current line.** • When the job content is displayed, move the cursor to an instruction and press this key to show its related content. Example: For a CALL instruction, the content of the called job is shown. For a work instruction, the content of the current condition file is shown. For an input/output instruction, the input/output status is shown. • The LED on this button lights up while the direct open is ON. While the LED lights up, press this button to return to the previous window.
[PAGE] 	**Displays the next page.** • The page can be switched only when the LED on this button lights up. [SHIFT] + [PAGE] Switches to the previous page.
[AREA] 	**Moves the cursor in the display in the following order: Menu Area → General-Purpose Display Area → Human Interface Display Area → Main Menu Area. If no item is displayed, the cursor does not move.** [SHIFT] + [AREA] Switches the language 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 together.** Can be used with [SIMPLE MENU], [PAGE], [DIRECT OPEN], [MULTI], [COORD], [AREA], [MOTION TYPE], the cursor, [Numeric Key], [ROBOT], [EX. AXIS], or [AUX] to access alternate functions. Refer to the description of each key for the alternate functions with [SHIFT].
[INTERLOCK] 	**Changes the functions of other keys by pressing together.** Can be used with [TEST START], [FWD], [Numeric Key] (Numeric key customize function), [ROBOT], or [AUX]. Refer to the description of each key for the alternate functions with [INTERLOCK].
[INFORM LIST] 	**Displays the list of instructions available for editing the job.**

[ROBOT] 	**Switches the robot axis to be operated.** • Press this key to enable the robot axis operation. • [ROBOT] is enabled for the system with one YRC1000micro and multiple manipulators or the system with one or more external axes. [SHIFT] + [ROBOT] The robot axis to be operated is switched to a robot axis which is not registered in the currently selected job. [INTERLOCK] + [ROBOT] Switches the application when multiple applications are set to one robot.
[EX. AXIS] 	**Switches the external axis to be operated.** • Press this key to enable the external axis (base axis or station axis) operation. • [EX.AXIS] is enabled for the system with one or more external axes. [SHIFT] + [EX. AXIS] The external axis to be operated is switched to an external axis which is not registered in the currently selected job.
[MOTION TYPE] 	**Selects the interpolation type for playback operation.** • The selected interpolation type is shown in the input buffer line in the display. • 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* In each interpolation mode, by pressing only [MOTION TYPE], the usable interpolation method is switched as in the above STANDARD mode. *: These modes are options.
[AUX] 	**Calls a function.** [INTERLOCK] + [AUX] Shows the confirmation dialog for enabling/disabling the touch panel.
[TEST START] 	**Press [TEST START] and [INTERLOCK] simultaneously to move the manipulator through the taught steps in a continuous motion for checking the path.** • The manipulator moves in the currently selected operation cycle: AUTO, 1 CYCLE, or STEP. • The manipulator moves at the taught speed. If the taught speed exceeds the maximum teaching speed, the operation proceeds at the maximum teaching speed. [INTERLOCK] + [TEST START] The manipulator moves through the taught steps in a continuous motion. Operation immediately stops when this key is released during the continuous motion.

[FWD] 	**Moves the manipulator through the taught steps only while this key is pressed.** • Only the move instruction is executed. • The manipulator moves at the selected manual speed. Before operating the manipulator, make sure that the selected manual speed is set as intended. [INTERLOCK] + [FWD] All instructions including the move instruction are executed. [REFP] + [FWD] The manipulator moves to the reference point indicated by the line with the cursor.
[BWD] 	**Moves the manipulator through the taught steps in the reverse direction only while this key is pressed.** • Only the move instruction is executed. • The manipulator moves at the selected manual speed. Before operating the manipulator, make sure that the selected manual speed is set as intended.
[DELETE] 	**Deletes the registered instruction.** • Deletion completes when [ENTER] is pressed while the LED on this key lights up.
[INSERT] 	**Inserts a new instruction.** • Insertion completes when [ENTER] is pressed while the LED on this key lights up.
[MODIFY] 	**Modifies the taught position data or instruction.** • Modification completes when [ENTER] is pressed while the LED on this key lights up.
[ENTER] 	**Completes the execution of each process for registration and edition of instructions, data, current position of the manipulator, etc.** • When [ENTER] is pressed, the instruction or data shown in the input buffer line moves to the cursor position to complete a registration, insertion, modification, etc.
[MANUAL SPEED] 	**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

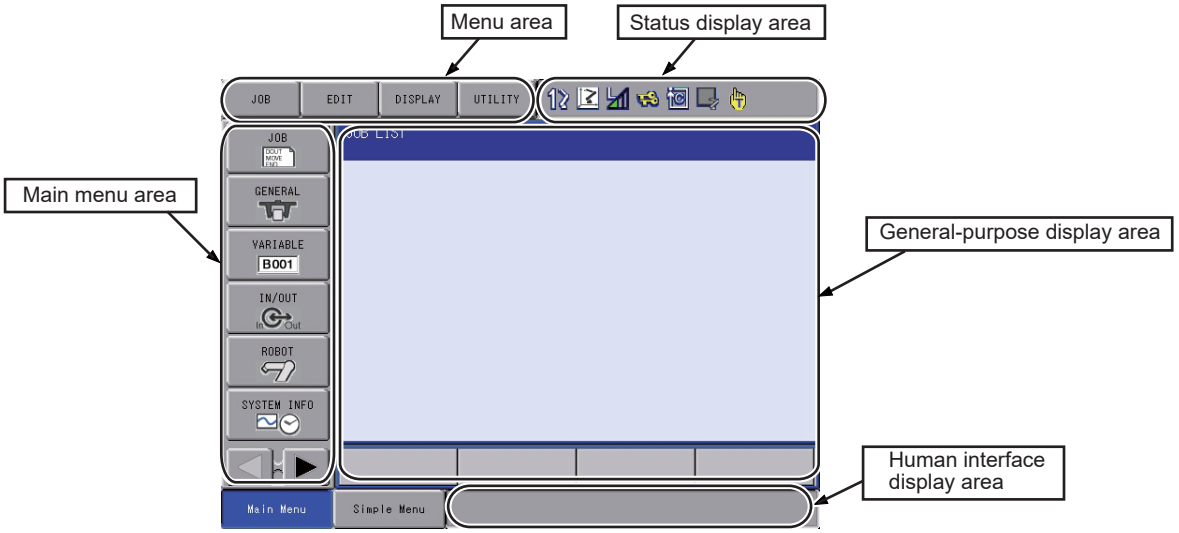
[HIGH SPEED] 	**Makes the manipulator move at high speed while this key and one of the axis keys are pressed simultaneously during manual operation. No need to change the setting of speed.** • The speed for [HIGH SPEED] is specified in advance.
[Axis Key] 	**Moves a specific axis of the manipulator.** • The manipulator operates only while the key is pressed. • By pressing two or more keys simultaneously, multiple axes can be operated at the same time. • The manipulator operates in the selected coordinate system at the selected manual speed. Before operating the axis, make sure that the selected coordinate system and the manual speed are set as intended. • A user-selected external axis can be allocated to [E-], [E+], [8-], or [8+]. For details, refer to *chapter 6.9 "Jog Key Allocation"* .
[Numeric Key] 	**Enters the number or symbol on the key when the prompt ">" appears on the input line.** • "." is the decimal point. "-" is a minus sign or hyphen. • [Numeric Keys] are also used as function keys. Refer to the explanation of each function for details.

1.2.4 Programming Pendant Display

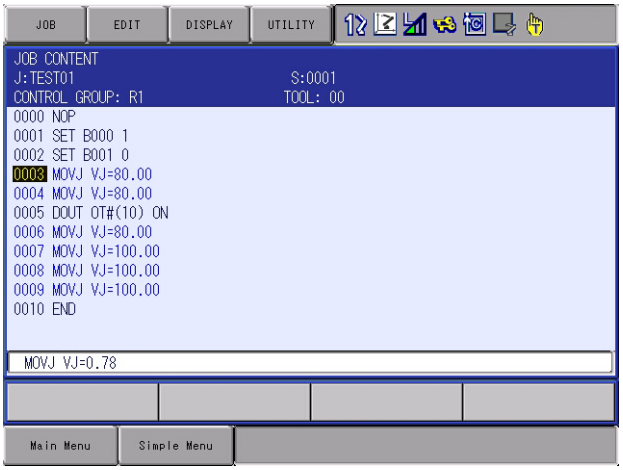
The programming pendant display is a 5.7 inch color display.
Alphanumeric characters can be used.

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.



1.2.4.2 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.

Displays also can be switched by scrolling the window, moving the cursor and switching pages.

Character strings can be copied or the window can be zoomed in/out by touch operation.

■ **Scrolling the window**

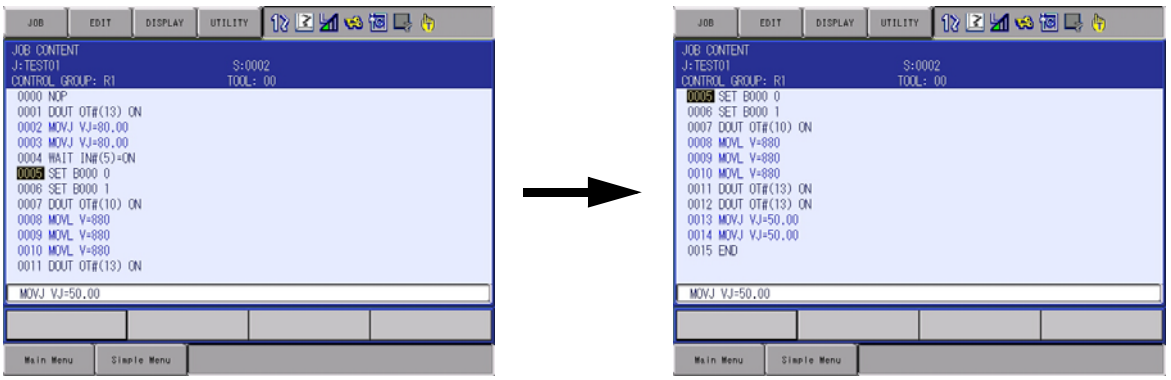
If the display content is oversized in the general-purpose display area, the display area can be resized by scrolling the window.

Follow the procedure below to scroll the window.

- Scrolling the window using the cursor:
  Refer to *chapter 1.2.3 "Programming Pendant Keys"* .
- Scrolling the window by touch operation:
  While touching the general-purpose display area, move it up and down or sideways, and release the touch.

  To enable or disable scrolling the window by touch operation, select {DISPLAY SETUP} - {TOUCH OPE. SETTING} and make the setting.

  <Example>
  Touch the job window and slide it upwards. (The window scrolls towards the lower part.)



■ **Moving the cursor**

The cursor are displayed on some windows. Follow the procedure below to move the cursor position.

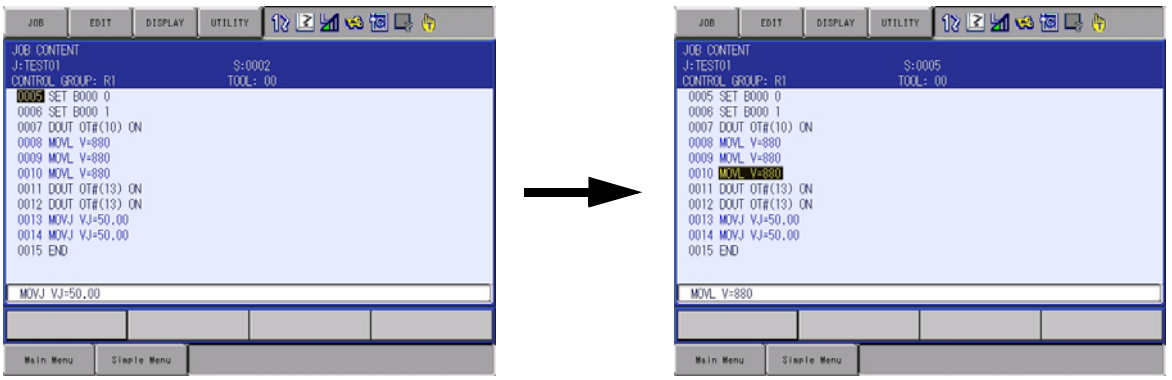
- Moving the cursor using the cursor:
  Refer to *chapter 1.2.3 “Programming Pendant Keys”* .
- Moving the cursor by touch operation:
  Touch the position available for cursor moving in the general-purpose display area, and release the touch.
  To enable or disable moving the cursor by touch operation, select {DISPLAY SETUP} - {TOUCH OPE. SETTING} and specify the setting.

To move the cursor by touch operation in the job window, select one of the following methods:

A. Pressing [INTERLOCK] + touch operation
B. Touch operation + confirmation dialog
C. Not use touch operation to move the cursor

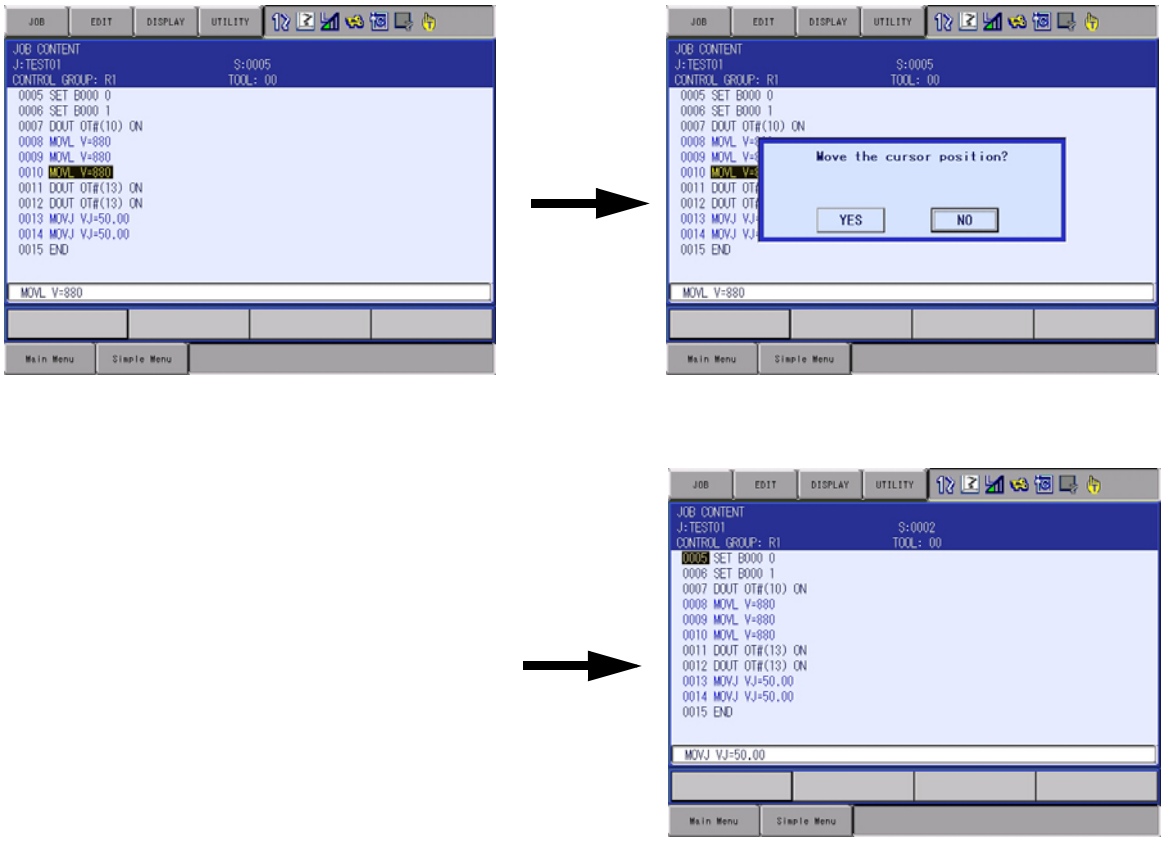
A. Method of “pressing [INTERLOCK] + touch operation”

1. Set pressing [INTERLOCK] as the method for moving the cursor by touch operation in the job window.
2. While pressing [INTERLOCK], touch a position in the job window where the cursor can move.



B. Method of “touch operation + confirmation dialog”

1. Set confirming by the dialog as the method for moving the cursor by touch operation in the job window.
2. Touch a position in the job window where the cursor can move.
3. Select “YES” in the confirmation dialog box “Move the cursor position?”.



■ **Page switching**

When the [PAGE] LED lights up, the pages can be switched.

Select one of the following methods to switch the pages.

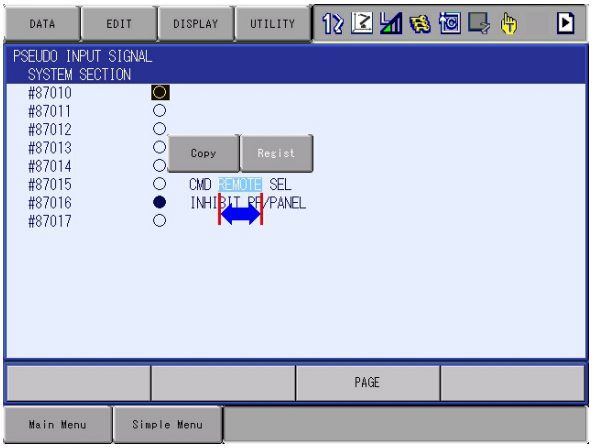
- Page switching by [PAGE]:
  Refer to *chapter 1.2.3 “Programming Pendant Keys”* .
- Displaying the next page by touch operation:
  While touching the general-purpose display area, move it to the left side and release it.
- Displaying the previous page by touch operation:
  While touching the general-purpose display area, move it to the right side and release it.
- To enable or disable page switching by touch operation, select {DISPLAY SETUP} - {TOUCH OPE. SETTING} and specify the setting.

■ Copy and paste of a character string

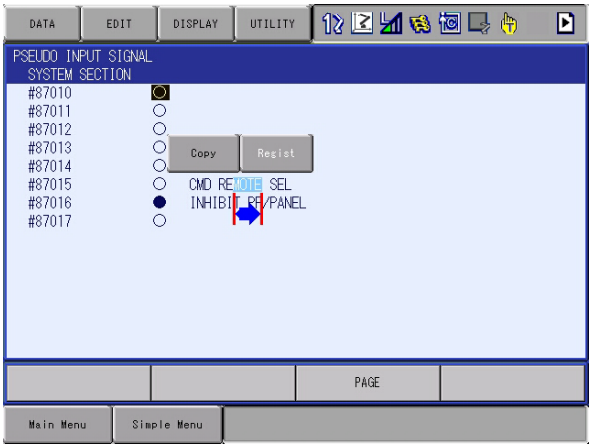
Character strings in the general-purpose display area can be copied by touch operation. The copied character string can be pasted on the “Result” of the character input keypad.

Copy a character string by the following procedure:

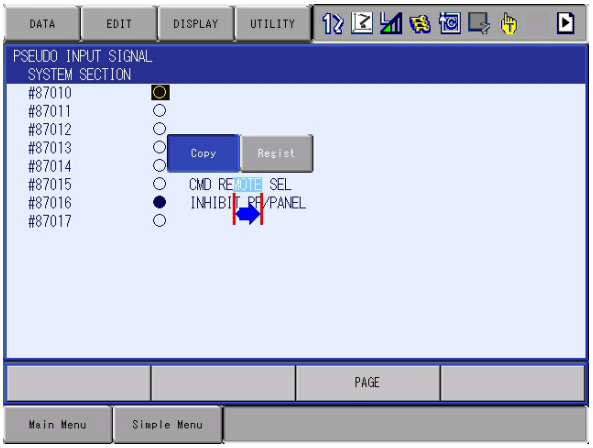
1. Touch and hold a character string in the general-purpose display area.
   – Selection menu appears.



2. To change the length of the character string to be copied, touch and slide the copy cursor.

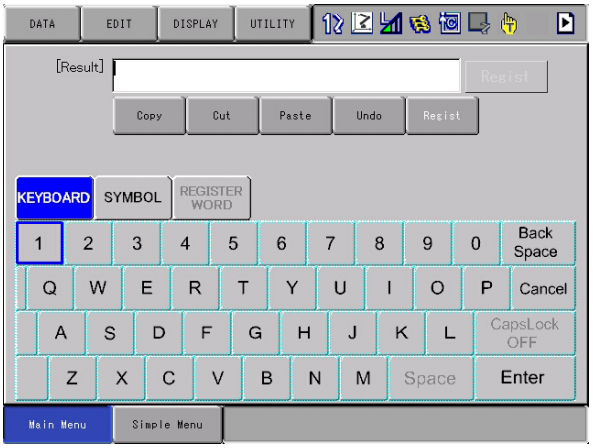


3. Select “Copy” in the selection menu.
   – The character string is copied.

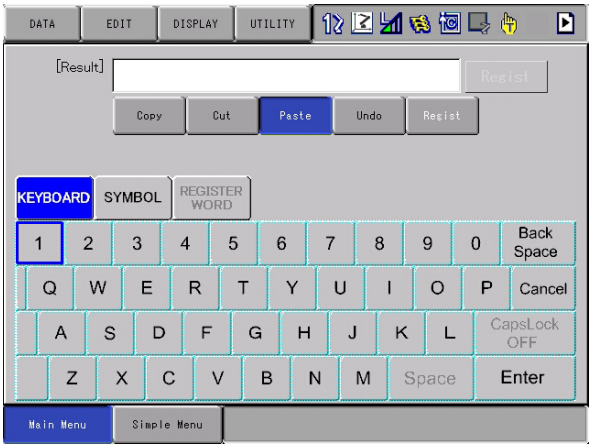


Paste a character string by the following procedure:

1. Touch and hold the “Result” of the character input keypad.
   – Selection menu appears.



2. Select “Paste” in the selection menu.
   – The copied character string is pasted.



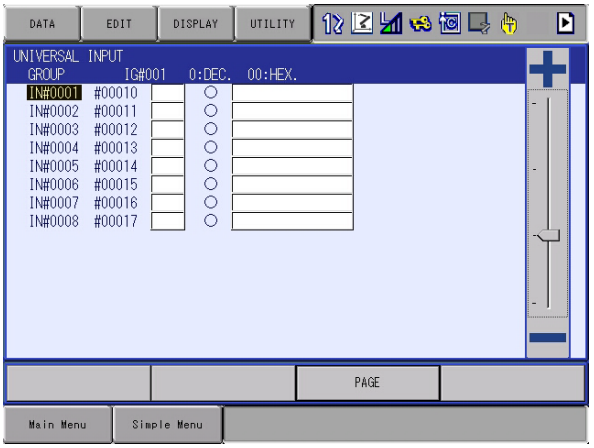
By using the character input keypad, cut or paste of the character string can be undone by “Undo”, and a character string within 8 characters can be registered by “Regist”.

To enable or disable copy and paste of a character string, select {DISPLAY SETUP} - {TOUCH OPE. SETTING} and specify the setting.

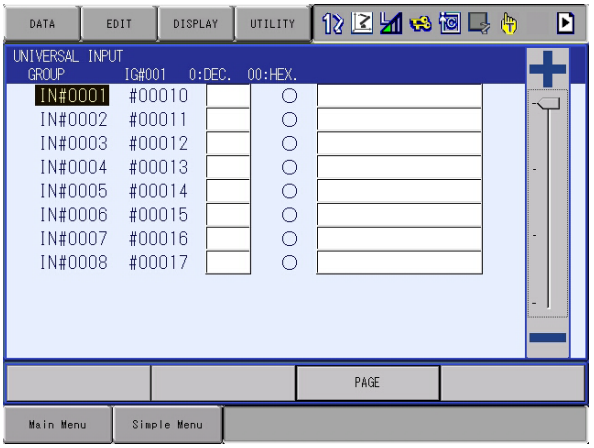
■ **Zooming in/out of the window**

To zoom in or out the general-purpose display area, touch and hold the title or unused space.

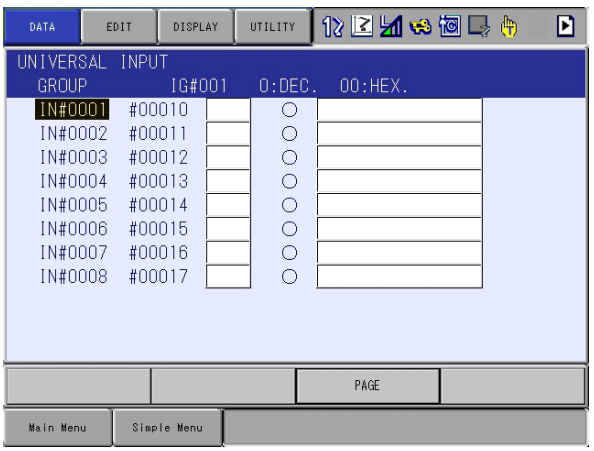
1. Touch and hold the title of the general-purpose display area.
   – Zoom in/out bar appears.



2. Touch and slide the cursor of the zoom in/out bar.
   – Only the main area of the general-purpose display area is zoomed in/out.



3. Touch anywhere outside the zoom in/out bar.
   – The zoom in/out bar is closed, and the entire general-purpose display area is zoomed in/out.



To enable or disable zooming in/out of the window, select {DISPLAY SETUP} - {TOUCH OPE. SETTING} and specify the setting.

■ **Operation buttons**

On some windows, an operation button appears.

To perform the operation allocated to the operation button, press [SELECT] or touch the operation button.

To move the cursor from the general-purpose display area to the operation button, press [AREA] + [↓].

To move the cursor from the operation button to the general-purpose display area, press [AREA] + [↑] or press [CANCEL].

In the operation button area, press [←] or [→] to move the cursor and press [SELECT] to perform the operation where the cursor is located.

EXECUTE : Continues operation of the contents displayed in the general-purpose display area.

CANCEL : Cancels the contents displayed in the general-purpose display area, and returns to the previous window.

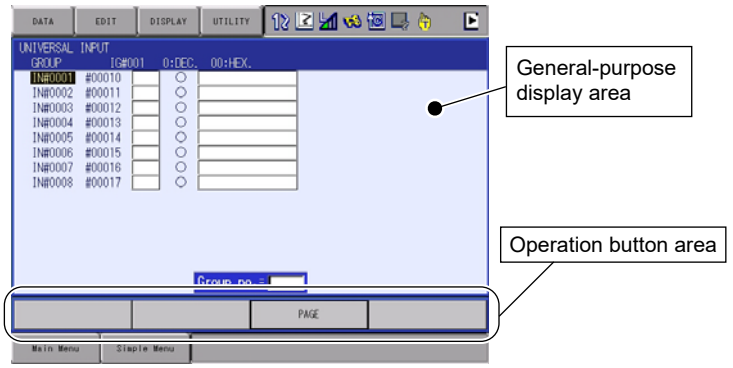
COMPLETE : Completes the setting operation displayed in the general-purpose display area.

STOP : Stops loading, saving, or verifying in the external memory device.

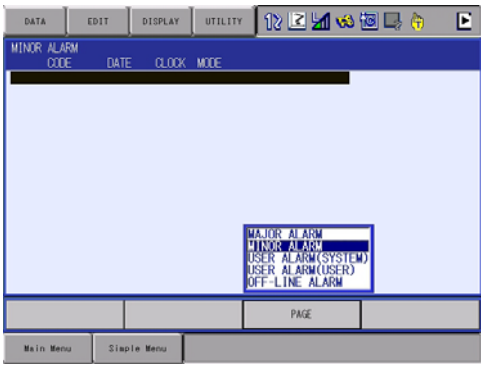
RELEASE : Releases the overrun and shock sensor function.

RESET : Resets an alarm. (Cannot reset major alarms.)

PAGE : On a switchable page, press {PAGE} and directly enter a desired page number, and then press [ENTER] to switch to the desired page.



On a window where a list appears, press [↓] or [↑] to select a desired item on the list, and press [ENTER] to show the desired item.



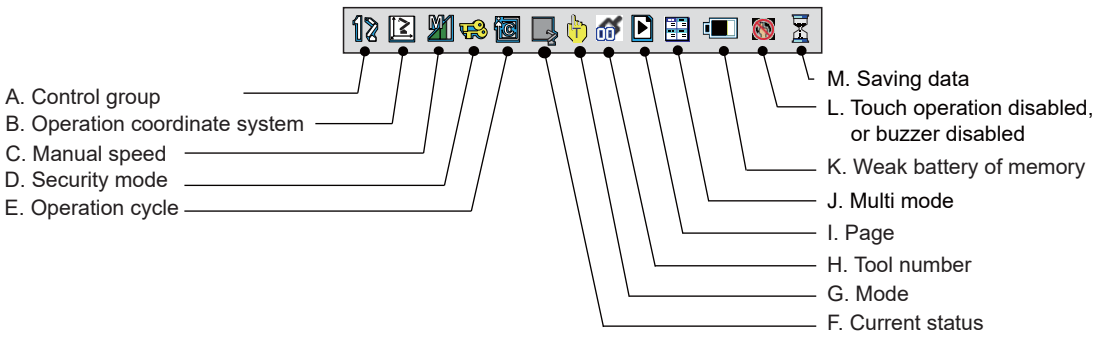
1.2.4.3 Main Menu Area

Menus and submenus are displayed in the main menu area. Press [MAIN MENU] or touch the main menu on the bottom left of the window to display the main menu.



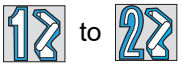
1.2.4.4 Status Display

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 when the robot system includes a station axis, two or more robot axes, etc.

 to : Robot Axes

 to  : Base Axes

 to  : Station Axes

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 axis operation. For details, refer to *chapter 2.2.0.5 "Select Manual Speed"* .

 : Inching

 : Low Speed

 : Medium Speed

 : High Speed

D. Security Mode

 : Operation Mode

 : Edit Mode

 : Management Mode

 : Safety Mode

 : One Time Manage Mode

E. Operation Cycle

Displays the present operation cycle.

 : Step

 : Cycle

 : Continuous

F. Current Status

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

 : Stop Status

 : Hold Status

 : Emergency Stop Status

 : Alarm Status

 : Operating Status

G. Mode

 : Teach mode

 : Play mode

H. Tool Number

From  to  : Displays the tool No. selected by the robot when the tool No. switching function is enabled. (S2C431=1)

I. Page

 : Displayed when the page can be switched.

J. Multi Mode

 : Displayed when the multi window mode is set.

K. Weak Battery of Memory

 : Displayed when the battery of memory is weak.

L. Touch Operation Disabled, or Buzzer Disabled

 : Displayed the touch panel operation is disabled.

 : Displayed when the battery of memory is weak and the touch operation is disabled.

 : Displayed when the pendant buzzer function is disabled.

 : Displayed when the battery of memory is weak and the pendant buzzer function is disabled.

The data of the disabling touch panel operation is displayed when the touch panel operation and the pendant buzzer function are disabled.

M. Saving Data

 : Displayed while saving the data.

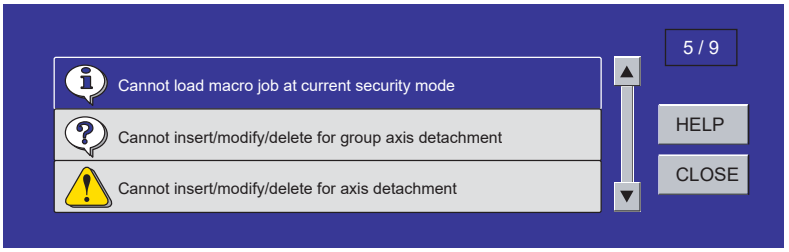
1.2.4.5 Human Interface Display Area

A message(s) is displayed in the human interface display area.



When there are two or more messages, 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].

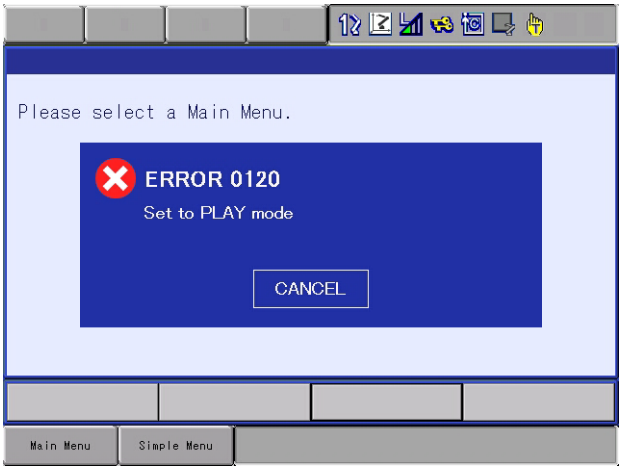
1.2.4.6 Menu Area

The menu area is used for edit or management of jobs and for execution of various utilities.



1.2.4.7 Error Dialog Box

If an error occurs, an error dialog box appears in the middle of the display.



While the error dialog box is on the display, no operation can be performed.

Press [CANCEL] or select {CANCEL} by manually touching the window in the error dialog box to continue operation.

To show the description of an error in the human interface display area, select {DISPLAY SETUP} - {TOUCH OPE. SETTING} and disable the error dialog box.

1.2.5 Screen Descriptions

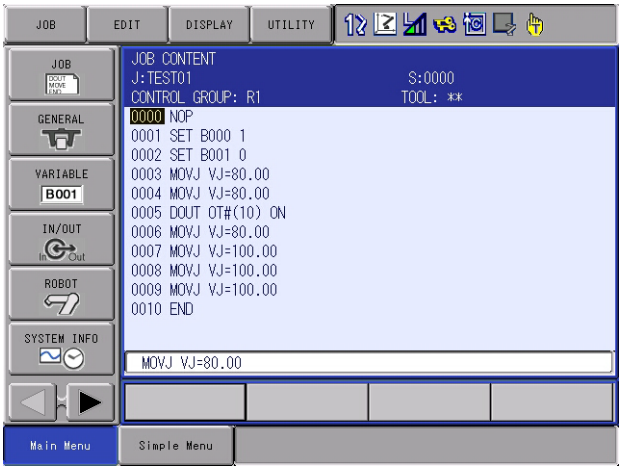
- The menu displayed in the programming pendant is denoted with { }.



The above menu items are denoted as {DATA}, {EDIT}, {DISPLAY}, and {UTILITY}.

- The window is shown in full view or in partial view as necessary.

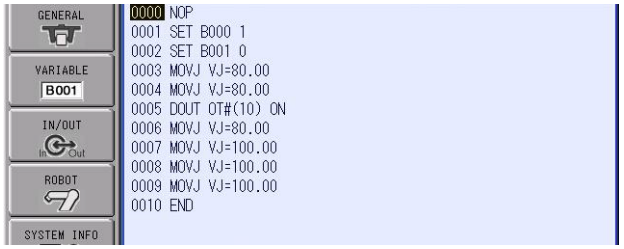
Full Window View



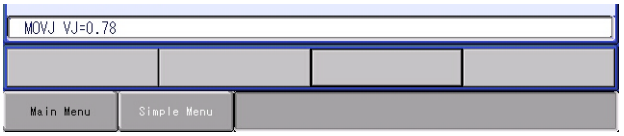
Upper Window View



Middle Window View



Lower Window View



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	**Key on the programming pendant**	**Description**
Cursor		Moves the cursor (focus).
[SELECT]		Selects a character.
[CANCEL]		Clears all the characters being typed. Press this key two times to close the software keypad.
[ENTER]		Enters the input characters.
Button Tab		Switches the keypads displayed on the programming pendant.
-		Closes the software keypad.
Numeric Key	 to 	Enters numbers.

1.2.6.3 Alphanumeric Input

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

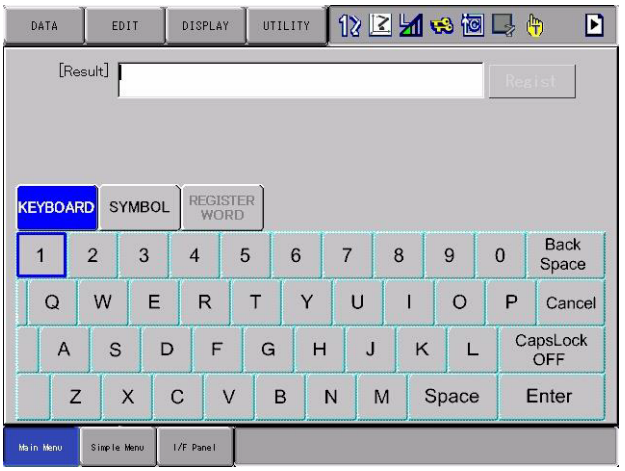
SUPPLE -MENT

Depending on the contents to be input, some characters may be restricted. If a registered word includes a restricted character, the word cannot be used.

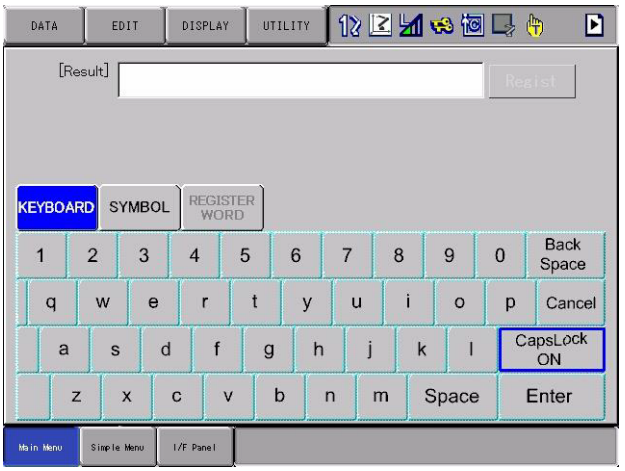
e.g., No lower-case character or decimal point can be used for a job name.

1. Press [PAGE] to display the alphanumeric input window.
2. Move the cursor to a desired character and press [SELECT] to enter the character.

For Numbers and Upper-Case Characters



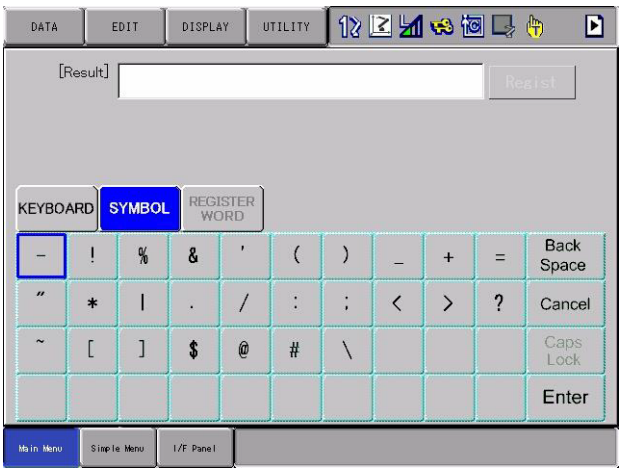
For Numbers and Lower-Case Characters



1.2.6.4 Symbol Input

1. Press [PAGE] to display the symbol input window.
2. Move the cursor to a desired symbol and press [SELECT] to enter the symbol.
   – Note that only some symbols are available for naming jobs.

For Symbols



SUPPLE -MENT

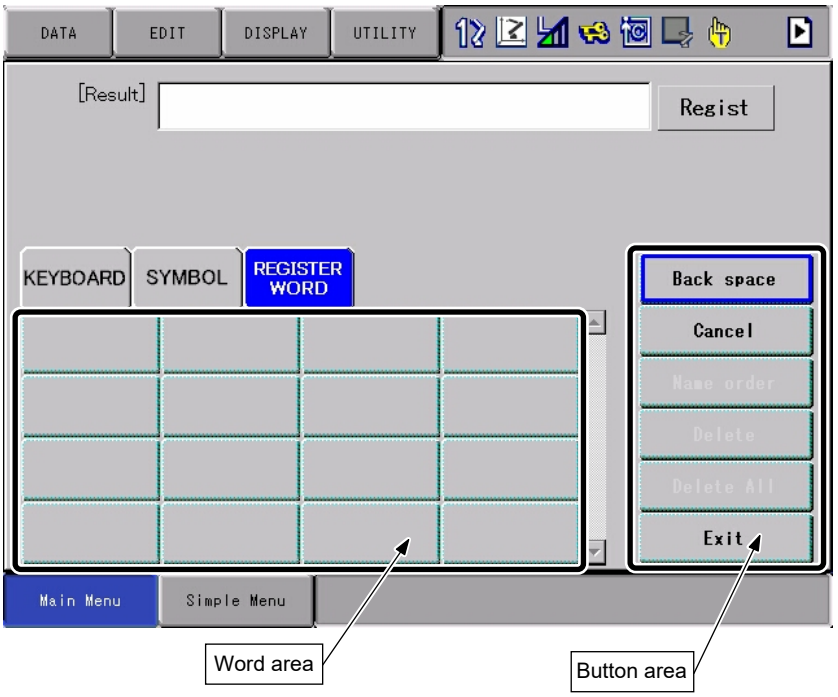
When the focus is in a text field of [Result], the cursor position can be moved by pressing [Shift]+[→] or [Shift]+[←].

1.2.6.5 Word Register Function

A word (character string) can be registered and used for character input. Each character string must be within 8 characters, and up to 32 character strings can be registered.

> SUPPLE -MENT
>
> Depending on the contents to be input, some characters may be restricted. If a registered word includes a restricted character, the word cannot be used.
>
> e.g., No lower-case character or decimal point can be used for a job name.

1. From the main menu, select {SETUP}, and then select {SET WORD}.
   - Word register window appears.
   - The registered words are displayed in the word area.
   - When no word is registered, {Name order}, {Delete}, and {Delete All} in the button area cannot be selected.



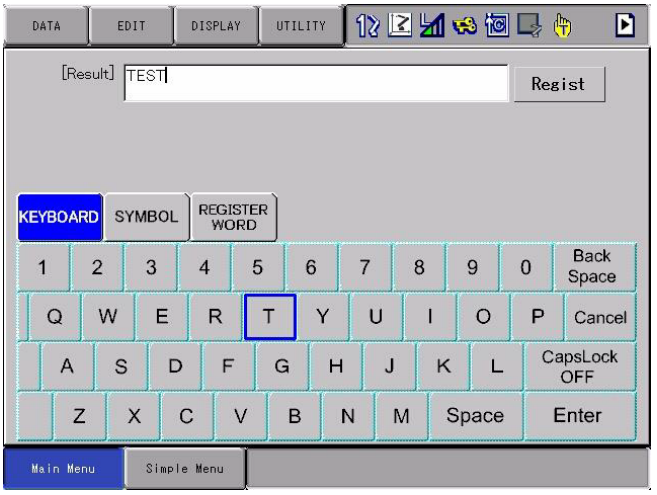
■ **Word Registration**

A word can be registered by selecting {Regist} in the word register window or in the keypad when the word registration function is enabled (S2C410=1).

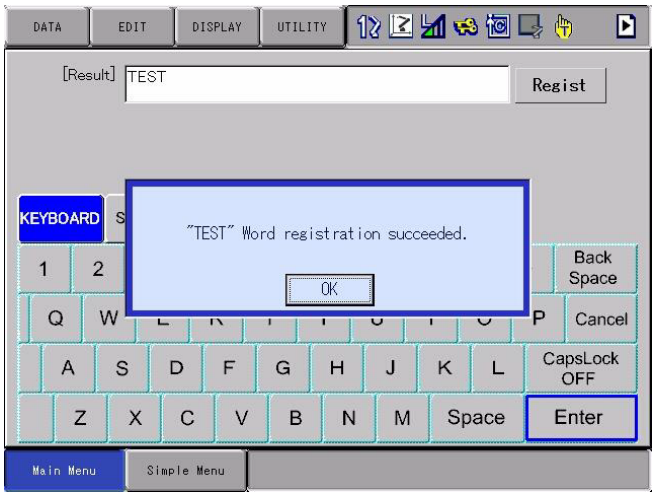
Up to 32 words (each word within 8 characters) can be registered.

<Example> Registration of the word “TEST”

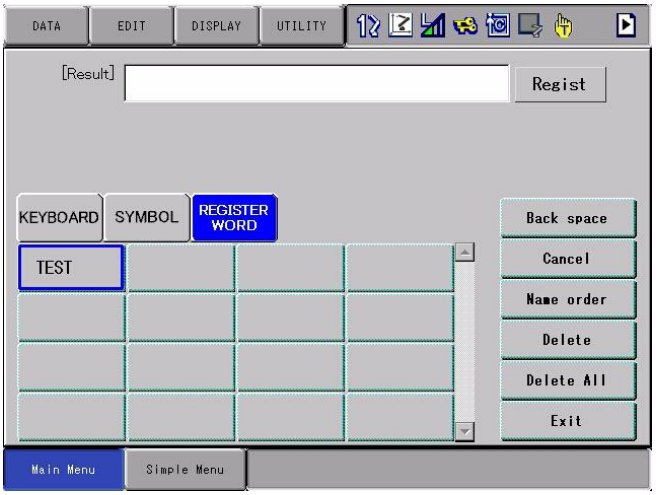
1. Select {KEYBORD}.



2. Enter “TEST” by using the keyboard, and select “Regist”.
   – The dialog box appears.



3. Select {REGISTER WORD}.
   – The word area appears.
   – Confirm that “TEST” is in the word area.



■ **Back Space**
Deletes the character located immediately before the cursor from the input character string.

1. Select {Back space} in the word register window.
   – The character immediately before the cursor is deleted from the character string.

■ **Cancel**
Cancels the input character string.

1. Select {Cancel} in the word register window.
   – When a character string is input, the input character string is canceled.
   – When no character string is input in the word register window, the window is closed.

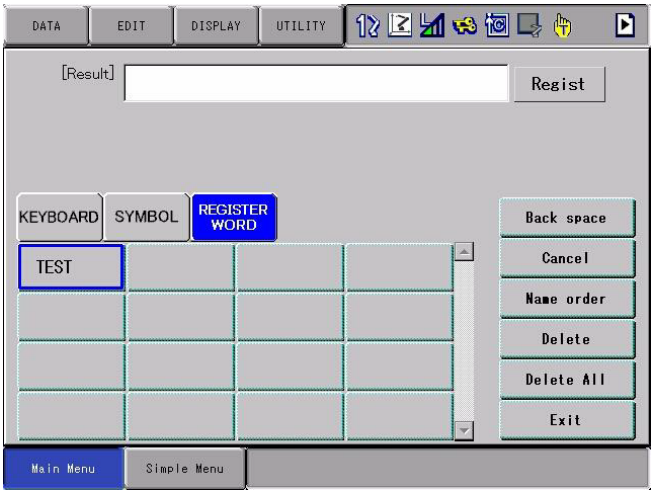
■ **Use of Registered Words**

<Example>

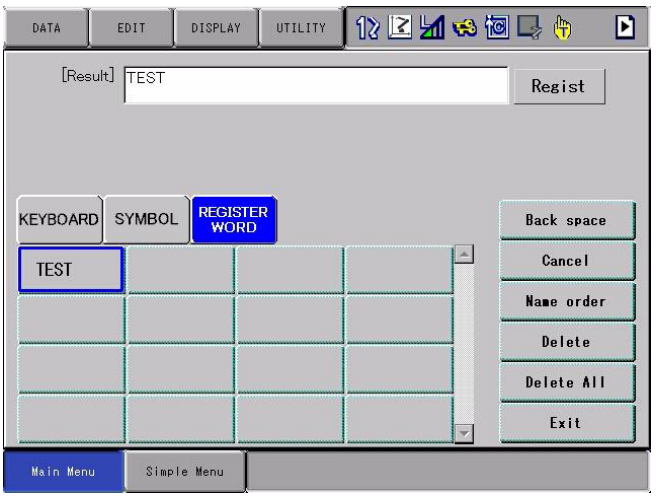
1. Select the {REGISTER WORD} tab where the word “TEST” is registered.
   – The word area is displayed.

SUPPLE -MENT

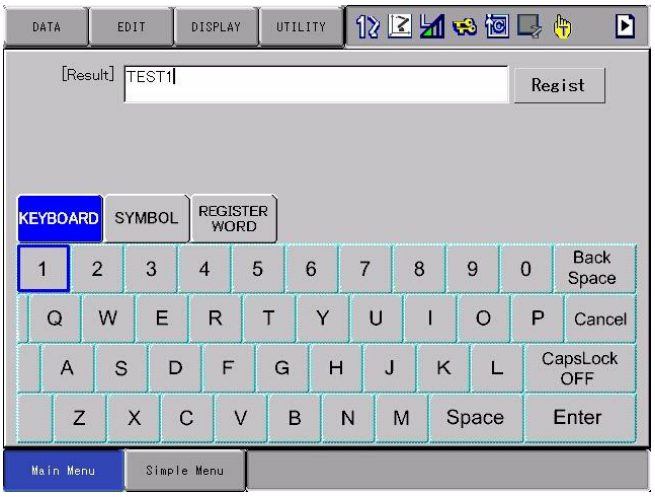
Depending on the contents to be input, some characters may be restricted. If a registered word includes a restricted character, the word cannot be used.



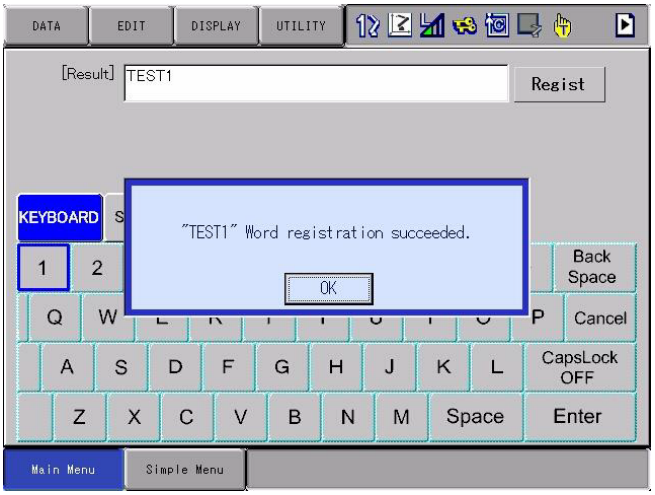
2. Select {TEST} in the word area.
   – The registered word “TEST” appears in the “Result” field.



3. Select {KEYBOARD}.
4. Move the focus to “1” by the programming pendant, and press [Select].
   – The “1” is entered after “TEST” in the “Result” field.



5. While “TEST1” is displayed in the “Result” field, select {Regist}.
   – The dialog box “‘TEST1’ Word registration succeeded.” appears, and the registration is completed.



■ **Changing Order of Registered Words**

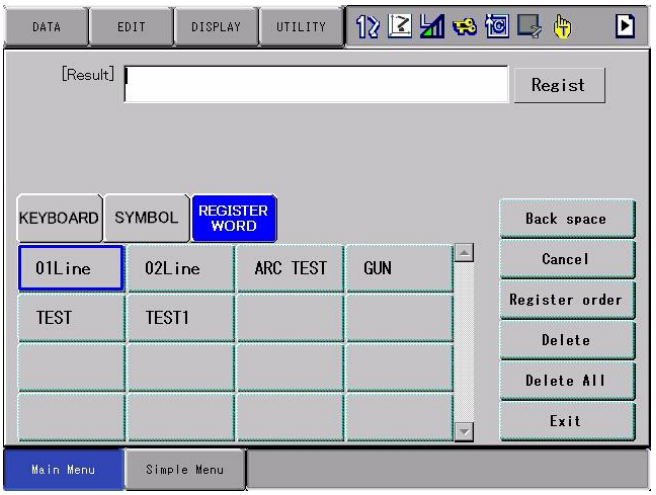
The order of registered words can be changed.

1. Listing the words in the order of name

   (1) Select {Name order} in the button area.

   – The words in the word area is shown in alphabetical order.

   – {Name Order} button changes to {Register order} button.

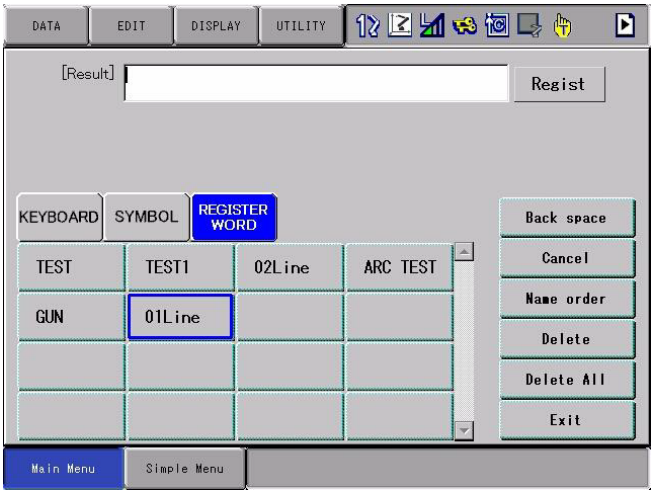


2. Listing the words in the order of registration

   (1) Select {Register order} in the button area.

   – Displayed by the register order of the words.

   – {Register order} button changes to {Name Order} button.



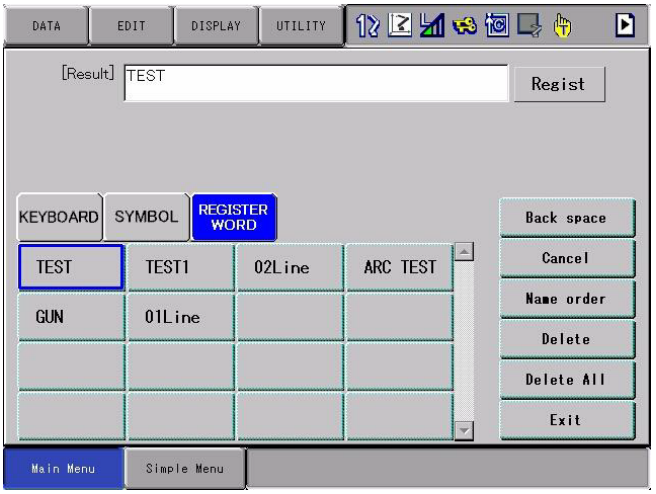
■ **Deleting a Registered Word**

A registered word can be deleted.

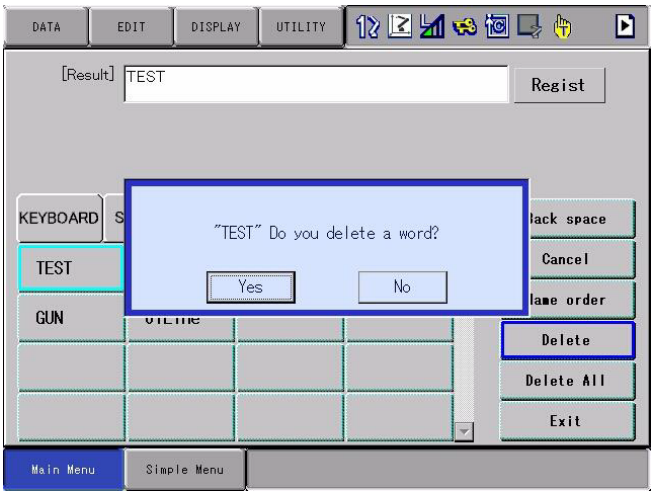
A registered word can be deleted in the word register window, or by using the keypad when word editing is enabled (S2C410=1).

Example: deleting a registered word “TEST”.

1. Select {REGISTER WORD} tab.
   – The word area appears.



2. Select {TEST} in the word area, and select {Delete} in the button area.
   – The dialog box ““TEST” Do you delete a word?” appears.



3. Select “Yes”.
   – “TEST” in the word area is deleted.

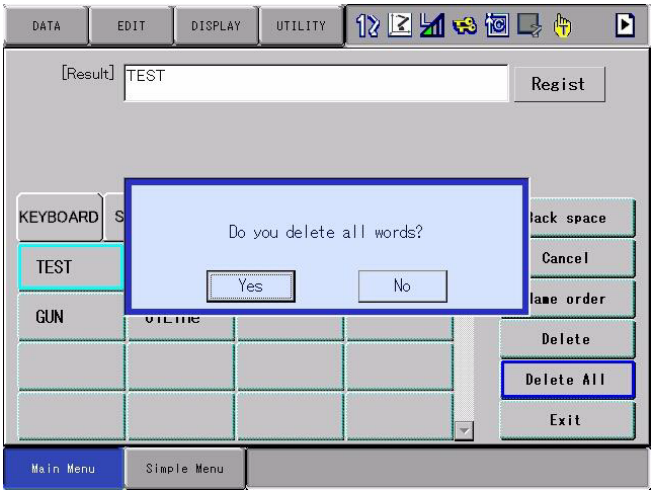
■ **Deleting All Registered Words**

All of the registered words can be deleted.

All of the registered words can be deleted in the word register window, or by using the keypad when word editing is enabled (S2C410=1).

• To delete all registered words

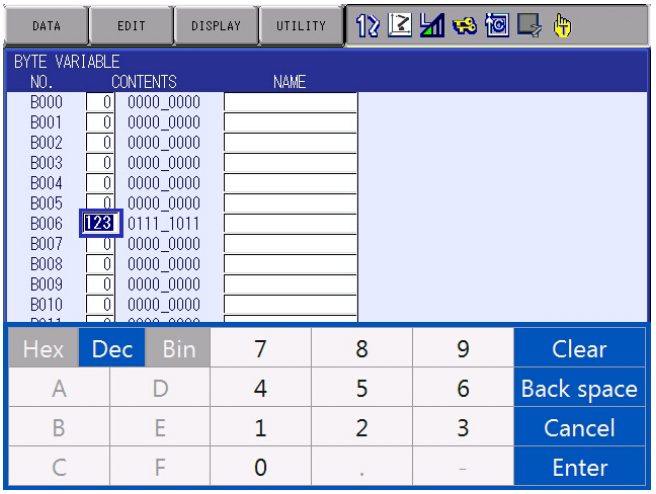
1. Select {Delete All} in the button area.
   – The dialog box “Do you delete all words?” appears.



2. Select “Yes”.
   – All of the registered words are deleted.

1.2.7 Numeric Value Input Operation

Move the cursor to the input data and press [SELECT]. The numeric value input area and the numeric value keypad are shown.
To enable or disable the numeric value keypad, select {DISPLAY SETUP}-{TOUCH OPE.SETTING} and specify the setting.



1.2.7.1 Operation for Numeric Value Input Area

Name of key	Key on the programming pendant	Description
Cursor		Moves the cursor (focus). The down cursor can delete one number.
[CANCEL]		Clears all the characters being typed. Press this key two times to close the numeric value input area.
[ENTER]		Enters the input numeric values.
Numeric keys	 to 	Inputs numbers. To input E as the real number, press [SHIFT] and [-(minus)] together.

1.2.7.2 Operation for Numeric Value Input Keypad

Keypad	Key on the programming pendant	Description
Clear	Clear	Clears all the characters being typed.
Back space	Back space	Deletes one number at the cursor position.
Cancel	Cancel	Clears all the characters being typed. Press this key two times to close the numeric value input area.
Enter	Enter	Enters the input numeric values.
Change of base number	Dec or Dec	Select the base number (Binary, decimal, hexadecimal). Modify the numeric value which is being input in the input area in accordance with the selected base number.
Numeric keys	0 to 9	Inputs numbers.
Numeric keys of hexadecimal	A to F	Inputs numbers for the hexadecimal input.

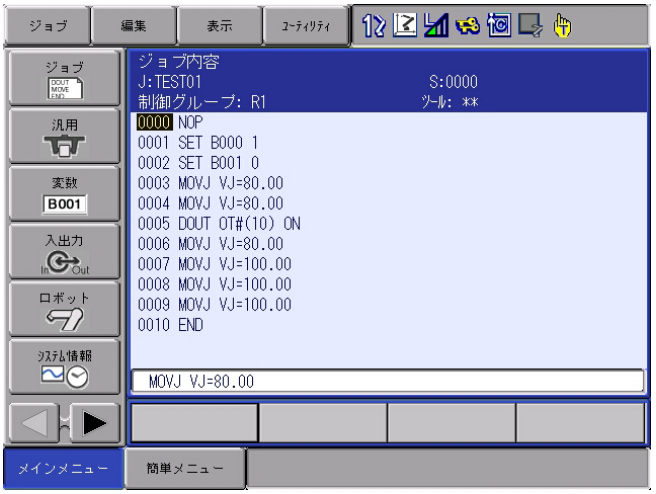
SUPPLE -MENT

Numeric values to be input are limited depending on the contents. For the numeric values which cannot be input, the color of numeric key becomes grey and the numbers cannot be selected.

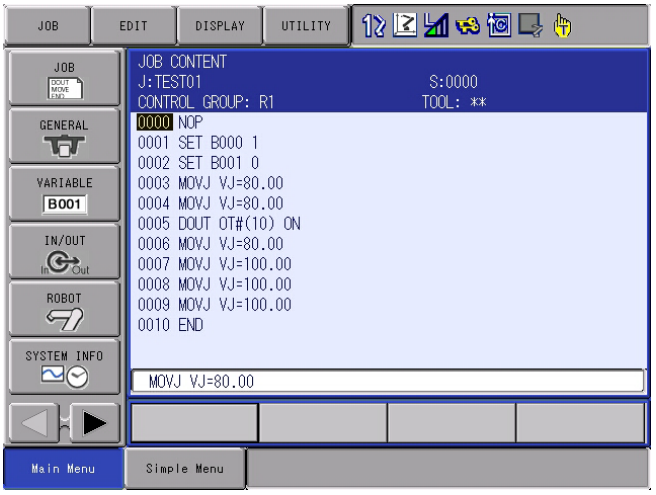
1.2.8 Bilingual Function (Optional)

When the bilingual function (optional) is enabled, two languages can be displayed alternately by ONE-TOUCH operation.

1. Press [SHIFT] + [AREA]



– English and Japanese are switched each time the [AREA] and the [SHIFT] are pressed simultaneously.



SUPPLE-MENT

The two languages cannot be displayed alternately in the following conditions:

- During character or number input operation, or when a confirmation dialog is on the window
- During axis operation, FWD/BWD operation, or test operation in teach mode

NOTE

Use alphanumeric characters (single byte) for items registered by users, such as job names and comments. Non-alphanumeric characters cannot be displayed correctly in languages other than Japanese and English.

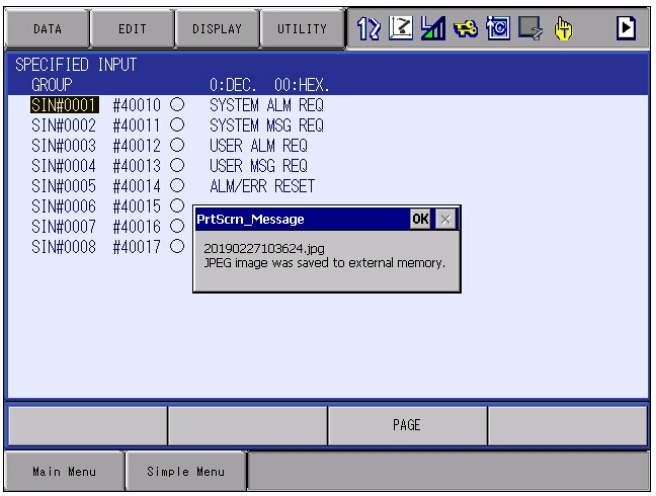
1.2.9 Screenshot Acquisition Function

The pendant display window can be saved to the external device as a JPG file.

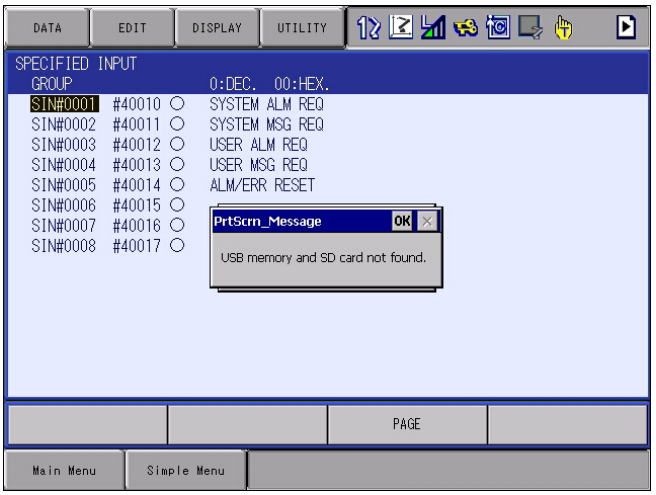
This function is available for YBS1.20-00 or later (pendant OS 1.04 or later).

1. Press [AUX] + [AREA].
   The JPG file is saved directly under the USB memory stick or the SD card which are installed in the programming pendant.

   – The completion dialog box appears after saving files.



   – The error dialog appears if the USB memory stick or the SD card is not installed in the programming pendant.



NOTE

Do not press [AUX] + [AREA] continuously.
If pressing them continuously, reloading the window of the programming pendant may be slow.

JPG files saved on the USB memory stick or the SD card are up to 999.
Even if pressing [AUX] + [AREA] after saving 999 files, the JPG file is not saved.

1.3 Mode

The following three modes are available for YRC1000micro.

- Teach Mode
- Play Mode
- Remote Mode

1.3.1 Teach Mode

In 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 play mode, the following can be done.

- Playback of a taught job

1.3.3 Remote Mode

In 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 remote mode, while [START] on the programming pendant becomes disabled.

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

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

Mode / Operation	Teach Mode	Play Mode	Remote Mode
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 teach mode, the following operations are disabled.

- Playback using [START]
- Playback from external input signals

1.4 Security Mode

1.4.1 Types of Security Modes

The following five types of security modes are available for YRC1000micro.

- 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.
- Safety Mode
  The operator who performs the safety management of the system can edit the files related to the safety function in addition to the operations enabled in the management mode. When the functional safety function (optional) is enabled, the security is changed to the safety mode in which files such as tool files can be edited. For the details of the safety mode, refer to “YRC1000micro OPTIONS INSTRUCTIONS FOR FUNCTIONAL SAFETY FUNCTION (HW1484544)”.
- One Time Manage Mode
  Maintenance operations in a higher security mode than the management mode can be performed. The one time security code provided by YASKAWA is required.
  Restriction of the loading of the batch data (CMOS.BIN)/parameter batch (ALL.PRM)/function definition parameter (FD.PRM) is released in addition to the operations enabled in the safety mode.

Any operation in the edit mode, the management mode, and the security mode requires a password.

In the edit mode and the management mode, the password must consist of 4 to 16 numbers or symbols.

In the safety mode, the password must consist of 9 to 16 numbers or symbols.

Table 1-1: Menu & Security Mode (Sheet 1 of 4)

Main Menu	Sub Menu	Allowed 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
	TRASH JOB LIST[3)]	Edit	Edit
	JOB EDIT (PLAY)	Edit	Edit
	PLAY EDIT JOB LIST	Edit	Edit
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	-
	FLAG	Operation	Edit
IN/OUT	EXTERNAL INPUT	Operation	Edit
	EXTERNAL OUTPUT	Operation	Edit
	GENERAL PURPOSE INPUT	Operation	Operation
	GENERAL PURPOSE OUTPUT	Operation	Operation
	SYSTEM INPUT	Operation	-
	SYSTEM OUTPUT	Operation	-
	RIN	Operation	-
	CPRIN	Operation	-
	REGISTER	Operation	Management
	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

Table 1-1: Menu & Security Mode (Sheet 2 of 4)

Main Menu	Sub Menu	Allowed Security Mode	
		DISPLAY	EDIT
IN/OUT	I/O MESSAGE	Management	Management
	TERMINAL	Operation	Edit
	I/O SIMULATION LIST	Management	Management
	SERVO ON FACTOR	Management	-
	SERVO OFF MONITOR	Operation	-
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	Edit
	USER COORDINATE	Edit	Edit
	HOME POSITION	Management	Management
	MANIPULATOR TYPE	Management	-
	ANALOG MONITOR	Management	Management
	OVERRUN&S-SENSOR[1)]	Operation	Operation
	LIMIT RELEASE[1)]	Edit	Edit
	ARM CONTROL[1)]	Management	Management
	SHIFT VALUE	Operation	-
	SOFTLIMIT SETTING	Management	Management
	SHOCK SENS LV.(CURRENT)	Operation	-
SYSTEM INFO	VERSION	Operation	-
	MONITORING TIME	Operation	Management
	ALARM HISTORY	Operation	Management
	I/O MSG HISTORY	Operation	Management
	USER DEFINITION MENU	Operation	Edit
	SECURITY	Operation	Operation
EX.MEMORY	LOAD	Edit	-
	SAVE	Operation	-
	VERIFY	Operation	-
	DELETE	Operation	-
	DEVICE	Operation	Operation
	FOLDER	Operation	Management
	INITIALIZE[1)]	Operation	-

Table 1-1: Menu & Security Mode (Sheet 3 of 4)

Main Menu	Sub Menu	Allowed Security Mode	
		DISPLAY	EDIT
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
	A5P	Management	Management
	A6P	Management	Management
	A7P	Management	Management
	A8P	Management	Management
	RS	Management	Management
	S1E	Management	Management
	S2E	Management	Management
	S3E	Management	Management
	S4E	Management	Management
	S5E	Management	Management
	S6E	Management	Management
	S7E	Management	Management
	S8E	Management	Management
SETUP	TEACHING COND.	Edit	Edit
	OPERATE COND.	Management	Management
	OPERATE ENABLE	Management	Management
	FUNCTION ENABLE	Management	Management
	JOG COND.	Management	Management
	PLAYBACK COND.	Management	Management
	FUNCTION COND.	Management	Management
	DISPLAYING COLOR COND.	Edit	Edit
	DATE/TIME	Management	Management
	GRP COMBINATION[2)]	Management	Management
	SET WORD	Edit	Edit
	RESERVE JOB NAME	Edit	Edit
	USER ID	Edit	Edit
	SET SPEED	Management	Management
	KEY ALLOCATION	Management	Management
	JOG KEY ALLOC.	Edit	Management
	RES. START (CNCT)	Management	Management
	AUTO BACK SET	Management	Management
	WRONG DATA LOG	Edit	Management
	ENERGY SAVING FUNCTION	Edit	Management
	ENCODER MAINTENANCE	Edit	Management

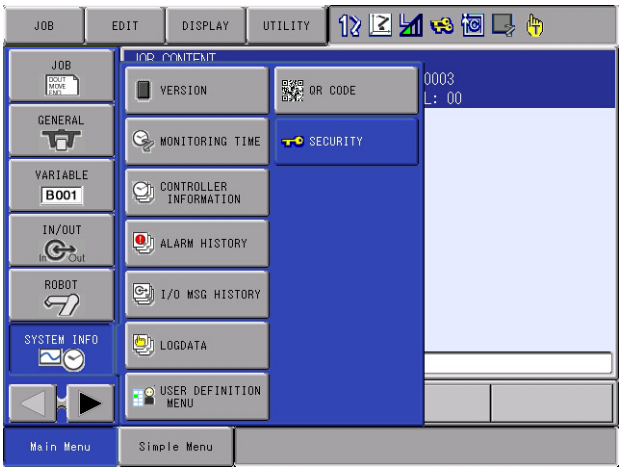
Table 1-1: Menu & Security Mode (Sheet 4 of 4)

Main Menu	Sub Menu	Allowed Security Mode	
		DISPLAY	EDIT
SAFETY FUNC	M-SAFETY SIGNAL ALLOC	Operation	Management
	TIMER DELAY SET	Operation	Management
	SAFETY LOGIC CIRCUIT	Operation	Management
PM	PM (REDUCER)	Operation	Management
	INSPECTION RECORD	Operation	Management
	OPERATING STATUS	Operation	Edit
	JOB MONITOR	Operation	Edit
	STEP DIAGNOSIS	Operation	Edit
	ROBOT MONITOR	Operation	Edit
DISPLAY SETUP	CHANGE FONT	Operation	Operation
	CHANGE BUTTON	Operation	Operation
	INITIALIZE LAYOUT	Operation	Operation
	CHANGE WINDOW PATTERN	Operation	Operation
	TOUCH OPE. SETTING	Operation	Operation
GENERAL	WEAVING	Operation	Edit
	GENERAL DIAG.	Operation	Edit
COMMON TO ALL APPLICATIONS	I/O VARIABLE CUSTOMIZE	Operation	Operation

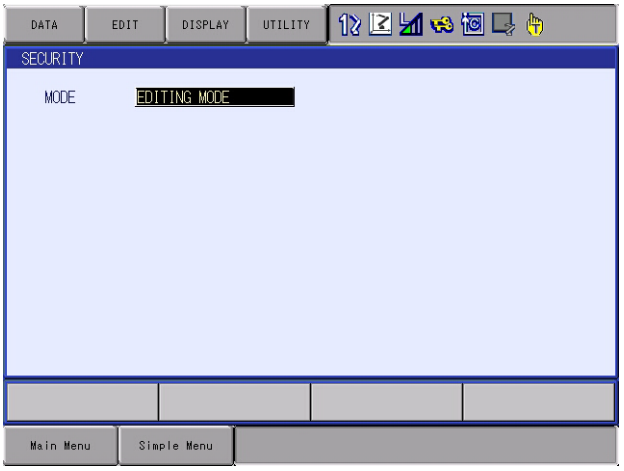
1 Displayed in teach mode only.
2 Displayed in play mode only.
3 Displayed when the job reconstruction function is valid.
*As for the menu and the security mode when the functional safety is valid, refer to “YRC1000micro OPTIONS INSTRUCTIONS FOR FUNCTIONAL SAFETY FUNCTION (HW1484544)” for more details.

1.4.2 Selecting Security Mode

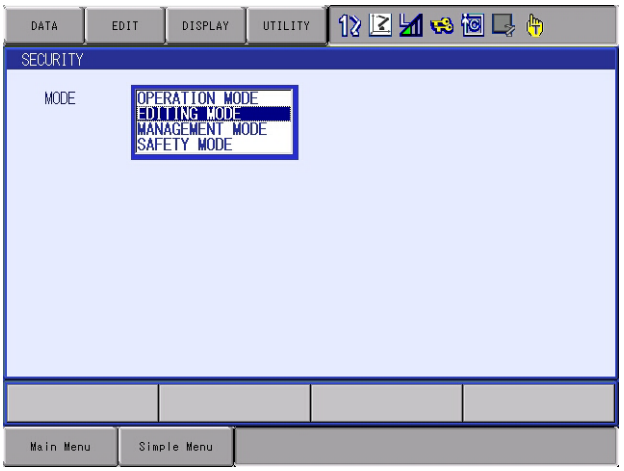
1. Select {SYSTEM INFO} under the main menu.
   – The sub menu appears.



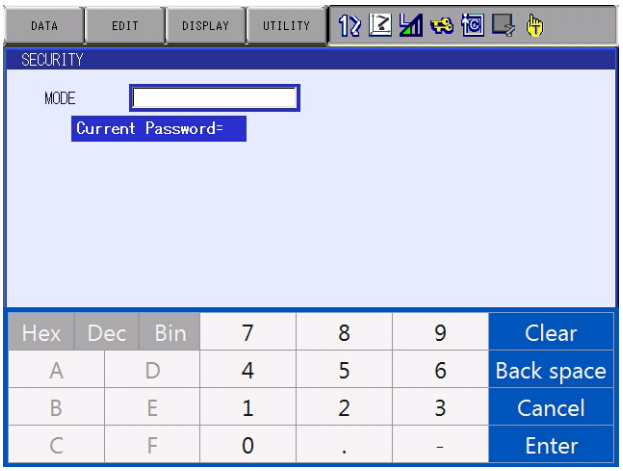
2. Select {SECURITY}.
   – The SECURITY window appears.



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



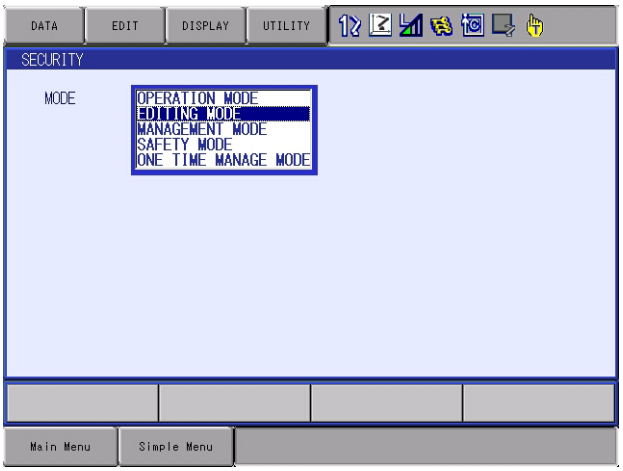
3. Select the desired security mode.
   – When the selected security mode is higher than the currently set mode, the Password input status window appears.



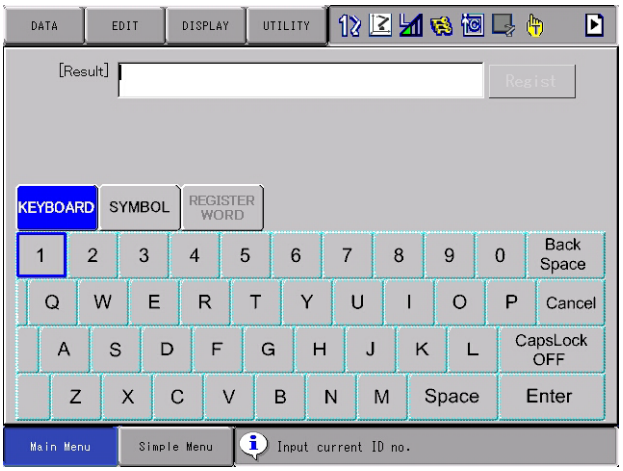
4. Input the password as required.
   – At the factory, the password number is preset as follows:
     Edit Mode : [0000000000000000]
     Management Mode : [9999999999999999]
     Safety Mode : [5555555555555555]
5. Press [ENTER].
   – The security mode is changed when the input password is correct.

Follow the procedures below when changing the security mode to the one time manage mode.

1. Change the security mode to the management mode.
   – Selection of the mode is available among “OPERATION MODE”, “EDITING MODE”, “MANAGEMENT MODE”, “SAFETY MODE”, and “ONE TIME MANAGE MODE” when the mode is changed to the management mode.



2. Select “ONE TIME MANAGE MODE”.
   – A key pad for character input is displayed. Input the one time security code provided by YASKAWA.
   – The security mode is changed to the one time manage mode when the input security code is correct.

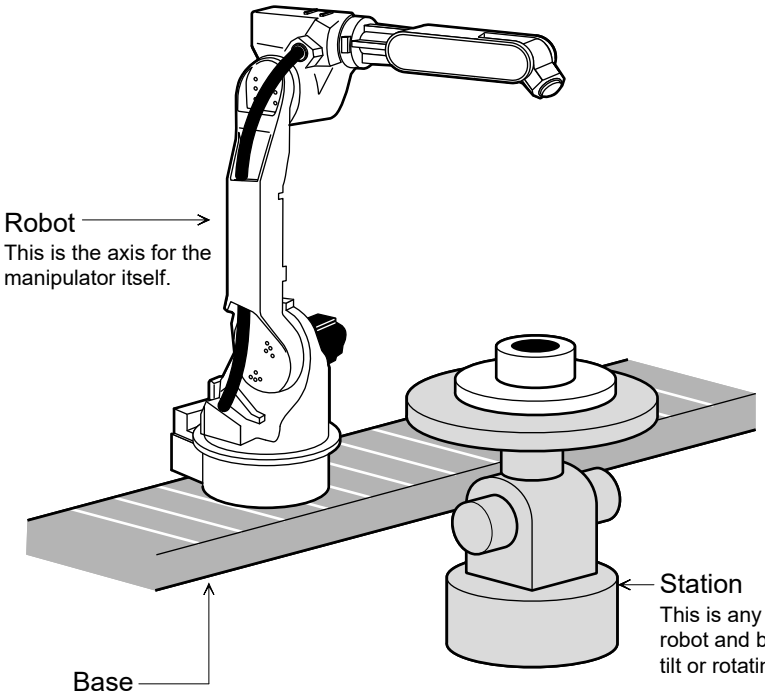


2 Manipulator Coordinate Systems and Operations

2.1 Control Groups and Coordinate Systems

2.1.1 Control Group

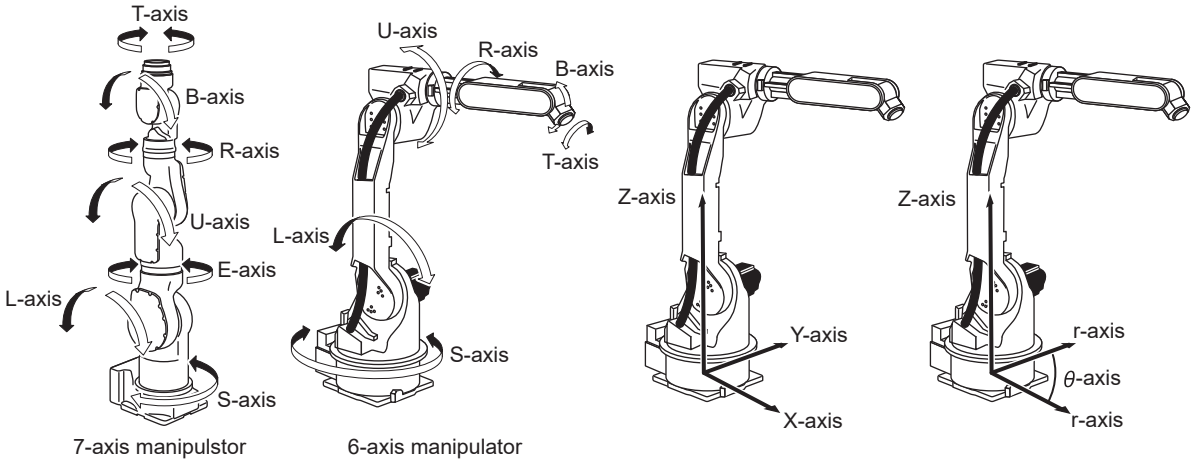
For the YRC1000micro, a group of axes to be controlled at a time is called “Control Group”, and the group is classified into three units: “ROBOT” as a manipulator itself, “BASE” that moves the manipulator in parallel, and “STATION” as jigs or tools other than “ROBOT” and “BASE”. BASE and STATION are also called external axes.

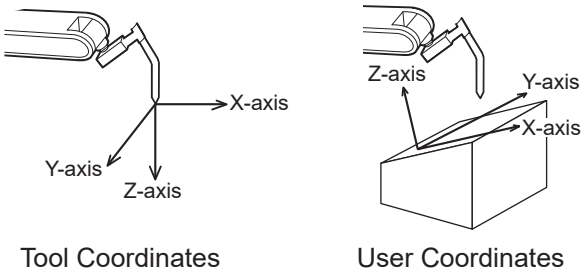


2.1.2 Types of Coordinate Systems

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.





2.2 General Operations

2.2.0.1 Check Safety

Before any operation of the YRC1000micro, read Section 1 “Safety” of “YRC1000micro 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 YRC1000micro 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].

Each time [COORD] 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.

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.

NOTE In operating the manipulator manually by the programming pendant, the maximum speeds of the center point and the flange are limited to 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".



2.2.0.6 Servo ON

Press [SERVO ON READY], and then SERVO ON LED starts blinking.

Squeeze the Enable Switch, and then SERVO ON LED lights up.

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"* .

2.2.0.8 HIGH SPEED

Press [HIGH SPEED] while pressing [Axis Key] to make the manipulator move faster than the usual speed.

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

2.3 Coordinate Systems and Axis Operation

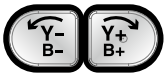
2.3.1 Joint Coordinates

When the manipulator is operating in the joint coordinates, each axis of the manipulator can be moved independently.

If the [Axis Key] of an axis not included in the manipulator is pressed, no axis operates.

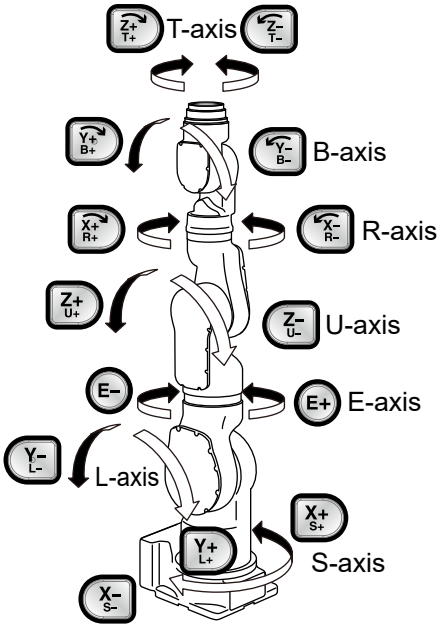
The motion of each axis is described in the table below.

Table 2-1: Axis Motion in Joint Coordinates

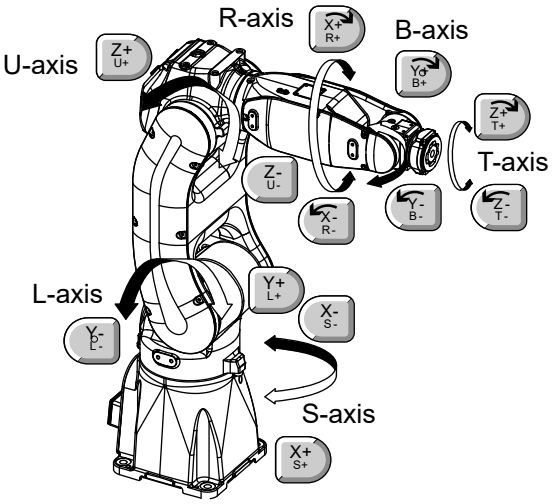
Axis Name		Axis Operation Key	Motion
Major Axes	S-axis		Main unit rotates right and left.
	L-axis		Lower arm moves forward and backward.
	U-axis		Upper are moves up and down.
Wrist Axes	R-axis		Wrist rolls right and left.
	B-axis		Wrist moves up and down.
	T-axis		Wrist turns right and left.
	E-axis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

Axis Operation in the Joint Coordinates

- When two or more [Axis Keys] are pressed at the same time, the manipulator performs a combined movement. However, if two different directional keys (such as [S -] + [S +]) for the same axis are pressed at the same time, the axis will not operate. (When [S -] + [S +] + [L +] are pressed, only the axis corresponding to [L +] will operate.)



7-Axis Manipulator



6-Axis Manipulator

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 Name		Axis Operation Key	Motion
Basic Axes	X-axis		Moves parallel to X-axis.
	Y-axis		Moves parallel to Y-axis.
	Z-axis		Moves parallel to Z-axis.
Wrist Axes		Motion about TCP is executed. See *chapter 2.3.7 "Motion about TCP"* .	

Axis Operation in the Cartesian Coordinates

- When two or more [Axis Keys] are pressed at the same time, the manipulator performs a combined movement. However, if two different directional keys (such as [X -] + [X +]) for the same axis are pressed at the same time, the axis will not operate. (When [X -] + [X +] + [Y +] are pressed, only the axis corresponding to [Y +] will operate.)

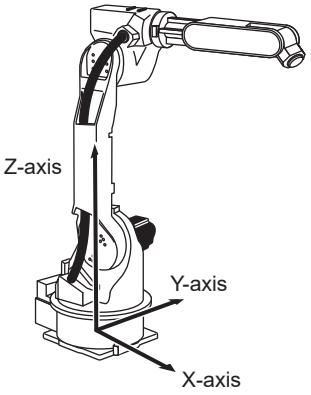


Fig. 2-1: Moves parallel to X- or Y-axis

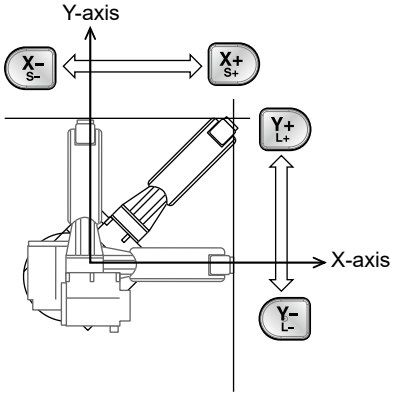
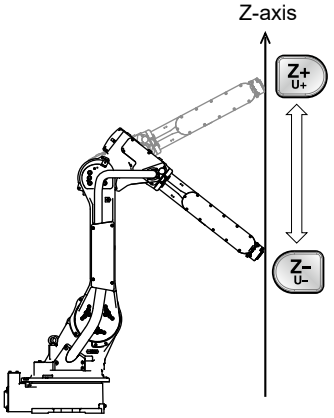


Fig. 2-2: Moves parallel to Z-axis



2.3.3 Cylindrical Coordinates

In the cylindrical coordinates, the manipulator operates in a rotational movement, a perpendicular movement, or a parallel movement with respect to the Z-axis.

The motion of each axis is described in the table below.

Table 2-3: Axis Motion in Cylindrical Coordinates

Axis Name		Axis Operation Key	Motion
Basic Axes	θ-axis		Main unit rotates with respect to Z-axis.
	r-axis		Moves perpendicular to Z-axis.
	Z-axis		Moves parallel to Z-axis.
Wrist Axes		Motion about TCP is executed. See *chapter 2.3.7 "Motion about TCP"* .	

Axis Operation in the Cylindrical Coordinates

- When two or more [Axis Keys] are pressed at the same time, the manipulator performs a combined movement. However, if two different directional keys (such as [Z -] + [Z +]) for the same axis are pressed at the same time, the axis will not operate. (When [Z -] + [Z +] + [Y +] are pressed, only the axis corresponding to [Y +] will operate.)

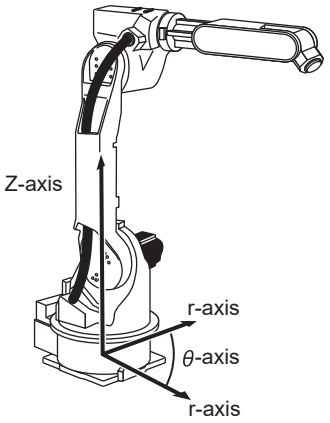


Fig. 2-3: Moves parallel to θ-axis

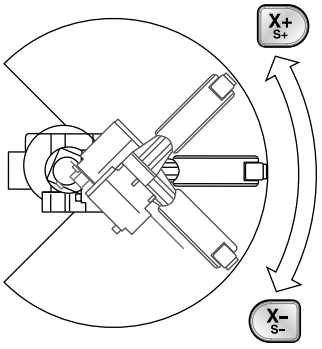
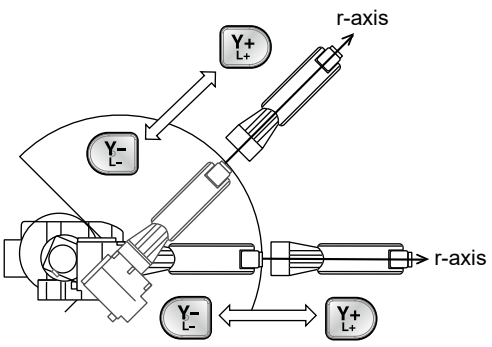


Fig. 2-4: Moves parallel to r-axis



2.3.4 Tool Coordinates

In the tool coordinates, the manipulator moves parallel to the X-, Y-, and Z-axes defined with respect to the tip of the tool.

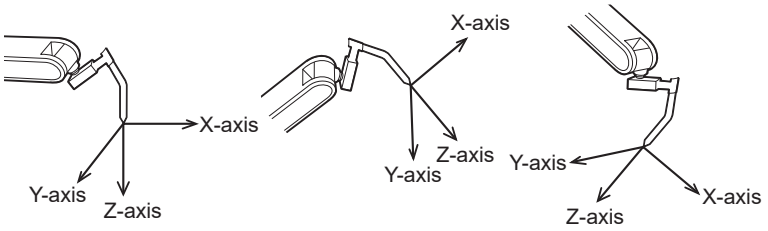
The motion of each axis is described in the table below.

Table 2-4: Axis Motion in Tool Coordinates

Axis Name		Axis Operation Key	Motion
Basic Axes	X-axis		Moves parallel to X-axis.
	Y-axis		Moves parallel to Y-axis.
	Z-axis		Moves parallel to Z-axis.
Wrist Axes		Motion about TCP is executed. See *chapter 2.3.7 "Motion about TCP"* .	

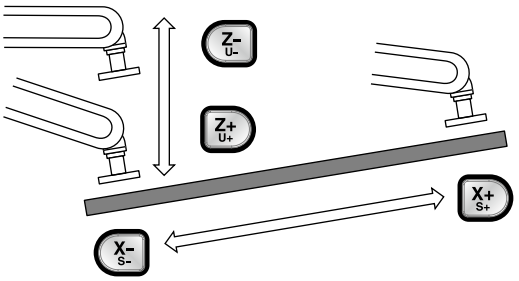
Axis Operation in the Tool Coordinates

- When two or more [Axis Keys] are pressed at the same time, the manipulator performs a combined movement. However, if two different directional keys (such as [X -] + [X +]) for the same axis are pressed at the same time, the axis will not operate. (When [X -] + [X +] + [Y +] are pressed, only the axis corresponding to [Y +] will 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.



SUPPLE -MENT

To use the tool coordinates, the tool file must be registered in advance. For further details, refer to “YRC1000micro INSTRUCTIONS (RE-CTO-A222) 8.3 Tool Data Setting”.

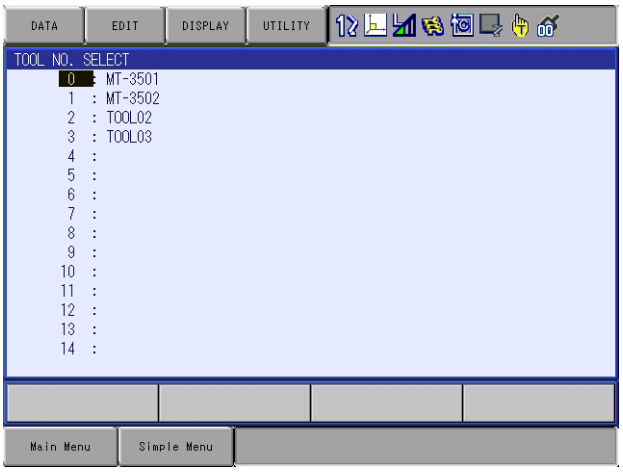
2.3.4.1 Selecting Tool

Tool numbers are allocated to tools when two or more tools are used in the system. Select the desired tool number to switch the tool.

SUPPLE -MENT

To switch the tools, settings for using two or more tools must be made in advance.
To use two or more tools for one manipulator, set the parameter as follows:
S2C431: TOOL NO. SWITCHING
1: Tool files can be switched
0: Cannot be switched

1. Press [COORD] and select the tool coordinates .
   – Each time [COORD] is pressed, the coordinate system switches in the following order:
   Joint → Cartesian (Cylindrical) → Tool → User
   Confirm the selected coordinate system in the status display area.
2. Press [SHIFT] + [COORD].
   – The TOOL NO. SELECT window appears.



3. Move the cursor to the tool to use.
   – As an example, the TOOL NO. SELECT window above indicates that the tool number 0 (MT-3501) is selected.
4. Press [SHIFT] + [COORD].
   – The window goes back to the previous window.

2.3.5 User Coordinates

In the user coordinates, the manipulator moves parallel to each axis of the coordinates predetermined by the user. The user must preset the X-, Y-, and Z-axes with desired slopes at a desired position within the manipulator's motion range. Up to 63 types of the user coordinates can be registered, and each has a user coordinates number and is called a user coordinates file.

The motion of each axis is described in the table below.

Table 2-5: Axis Motion in User Coordinates

Axis Name		Axis Operation Key	Motion
Basic Axes	X-axis		Moves parallel to X-axis.
	Y-axis		Moves parallel to Y-axis.
	Z-axis		Moves parallel to Z-axis.
Wrist Axes		Motion about TCP is executed. See *chapter 2.3.7 "Motion about TCP"* .	

Axis Operation in the User Coordinates

- When two or more [Axis Keys] are pressed at the same time, the manipulator performs a combined movement. However, if two different directional keys (such as [X -] + [X +]) for the same axis are pressed at the same time, the axis will not operate. (When [X -] + [X +] + [Y +] are pressed, only the axis corresponding to [Y +] will operate.)

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

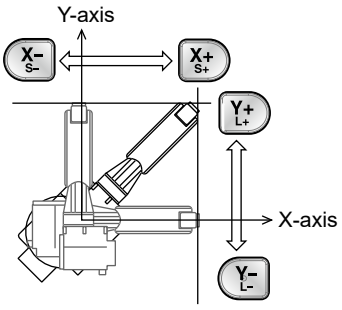
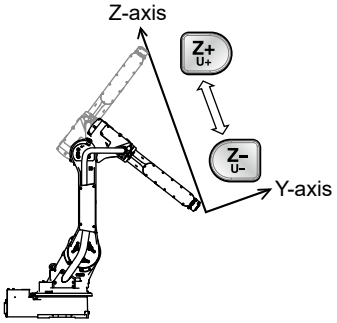
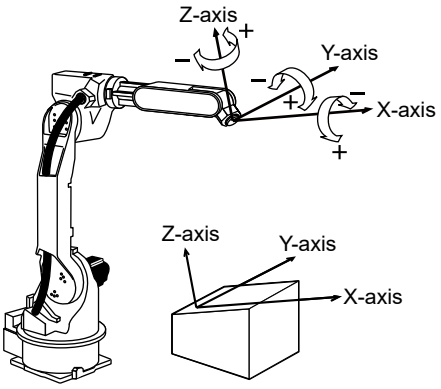


Fig. 2-6: Moves parallel to Z-axis

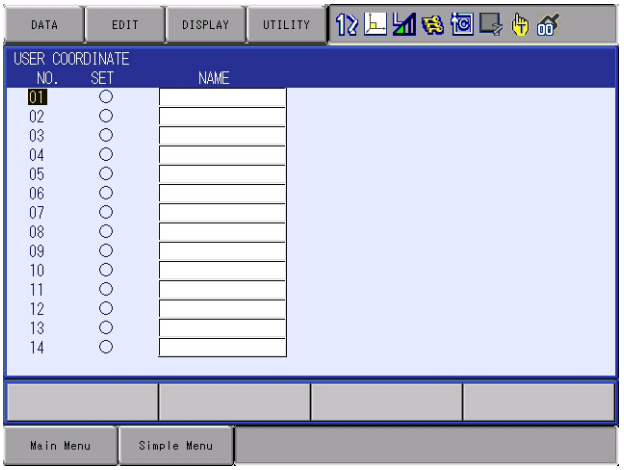




2.3.5.1 Selecting User Coordinates

In the system using two or more user coordinates, select the desired user coordinates for the task from the registered user coordinates.

1. Press [COORD], and select the user coordinates .
   – Each time [COORD] is pressed, the coordinate system switches in the following order:
   Joint → Cartesian (Cylindrical) → Tool → User
   Confirm the selected coordinate system in the status display area.
2. Press [SHIFT] + [COORD].
   – The USER COORDINATE window appears.



SUPPLE -MENT

For more information on registration of the user coordinates, refer to “YRC1000micro INSTRUCTIONS (RE-CTO-A222) 8.8 User Coordinate Setting”.

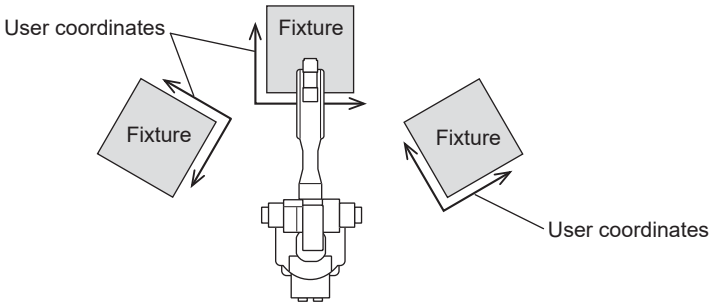
3. Select the number of the desired user coordinates.

2.3.5.2 Usage of User Coordinates

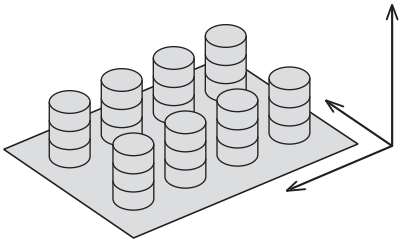
The user coordinates make teaching operations easier.

<Examples>

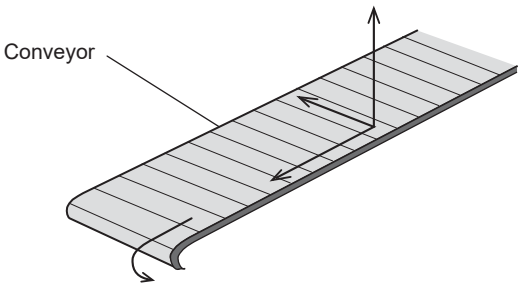
- When two or more fixtures are used,
  manual operation is simplified by setting the user coordinates for each fixture.



- When performing arranging or stacking operations,
  the incremental value for parallel shift is easily set by setting the 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		The 1st axis moves.
	2nd axis		The 2nd axis moves.
	3rd axis		The 3rd axis moves.

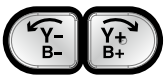
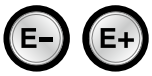
2.3.7 Motion about TCP

In the motion about TCP (Tool Center Point), the manipulator’s posture can be changed without changing the position of the tool’s tip (TCP).

The motion about TCP is available in the coordinates 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
Wrist Axes		Only the tool’s posture changes with the TCP fixed. The tool’s posture changes around the axes of the specified coordinates.
		
		
E-axis		* 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.)

SUPPLE -MENT

Axis Operation in the Motion about TCP

- When two or more [Axis Keys] are pressed at the same time, the manipulator performs a combined movement. However, if two different directional keys (such as [X -] + [X +]) for the same axis are pressed at the same time, the axis will not operate. (When [X -] + [X +] + [Y +] are pressed, only the axis corresponding to [Y +] will operate.)

Re is an element to indicate the posture of the manipulator with seven axes and does not change by the specified coordinates.

The definition of Re is shown below.

SUPPLE -MENT

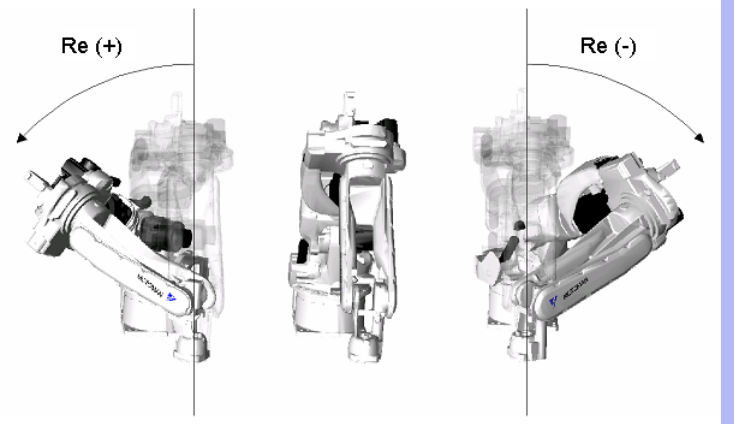
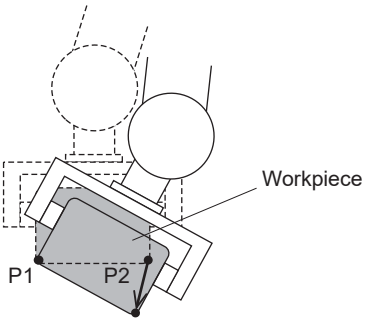
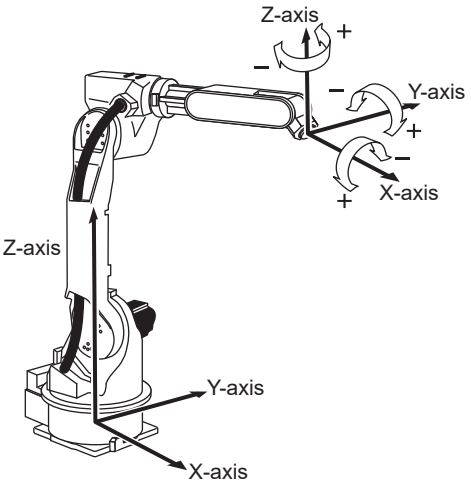


Fig. 2-7: When Using a Gripper

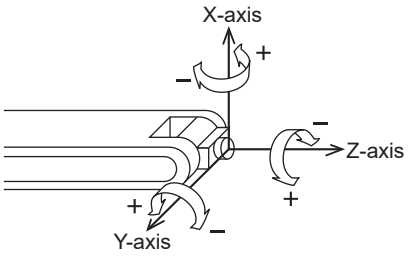


Turning of each wrist axis differs in each coordinate system.

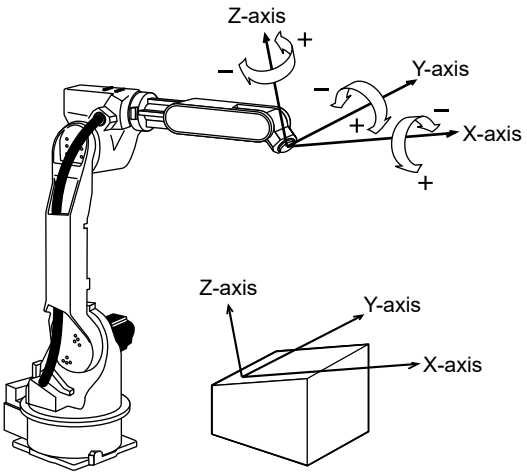
- In the Cartesian or cylindrical coordinates, wrist axis rotations are based on the X-, Y-, and Z-axes of the manipulator.



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



- In the user coordinates, wrist axis rotations are based on the X-, Y-, and Z-axes of the user coordinates.



2.3.7.1 Modification of TCP

The tool tip position (TCP) is the target point of axis operations and is registered in a tool file as the distance from the flange face.

Modification of TCP is performed as an axis operation that involves selecting a tool from the list of registered tools (Refer to *chapter 2.3.4.1 "Selecting Tool"*), and then manipulating the axes while changing the TCP.

Modification of TCP is available in the coordinates except the joint coordinates.

The axis operation after the modification of TCP is the same as that of the motion about TCP.

<Example 1> TCP Modification with Two or More 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 only follows Tool 1 and is not controlled by the axis operation.

(3) When Tool 2 is selected to perform an axis operation, P2 (Tool 2's TCP) is the target point of the axis operation.
Tool 1 only follows Tool 2.

Fig. 2-8: Selecting Tool 1 and operating axes with respect to P1 as TCP

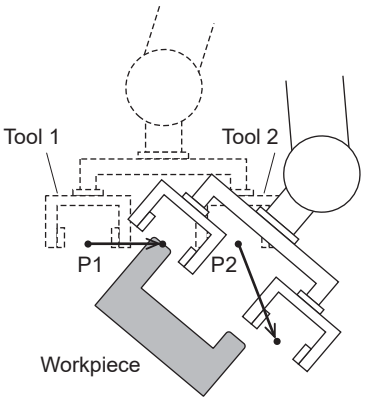
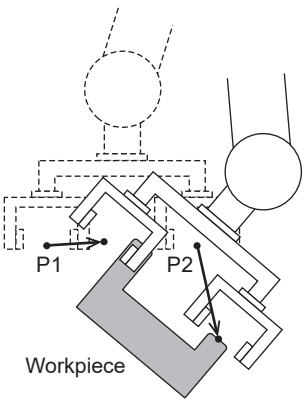


Fig. 2-9: Selecting Tool 2 and operating axes with respect to P2 as TCP



<Example 2> TCP Modification with One Tool

(1) Set the two corners of the workpiece which the tool is holding as TCP P1 and P2.

(2) By selecting two TCPs alternately, the workpiece moves as shown below.

Fig. 2-10: Selecting P1 to perform motion about TCP

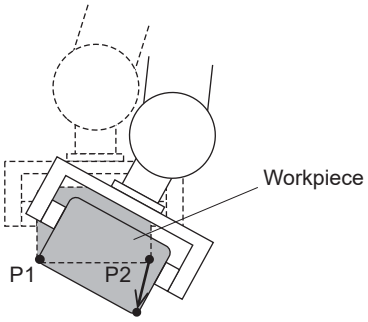
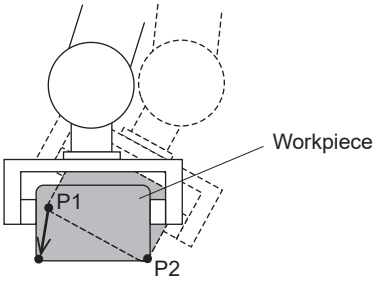


Fig. 2-11: Selecting P2 and perform motion about TCP



SUPPLE -MENT For registration of the tool file, refer to “YRC1000micro INSTRUCTIONS (RE-CTO-A222) 8.3 Tool Data Setting”

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

Before operating the manipulator, perform the following to ensure that the emergency stop button on the programming pendant is functioning properly.

1. Press [EMERGENCY STOP].
   – Press the emergency stop button on the programming pendant.
2. Confirm that the servo power is turned OFF.
   – The SERVO ON LED on the programming pendant lights while the servo power is turned ON.
   – When the emergency stop button is pressed and the servo power is turned OFF, the SERVO ON LED turns OFF.
3. Press [SERVO ON READY] of the programming pendant.
   – After confirming that the emergency stop button is functioning properly, press [SERVO ON READY]. The servo power becomes ready to be turned ON.
   – The servo power can be turned ON while the SERVO ON LED 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 teach mode and the machines cannot be played back using either [START] or external input.

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>

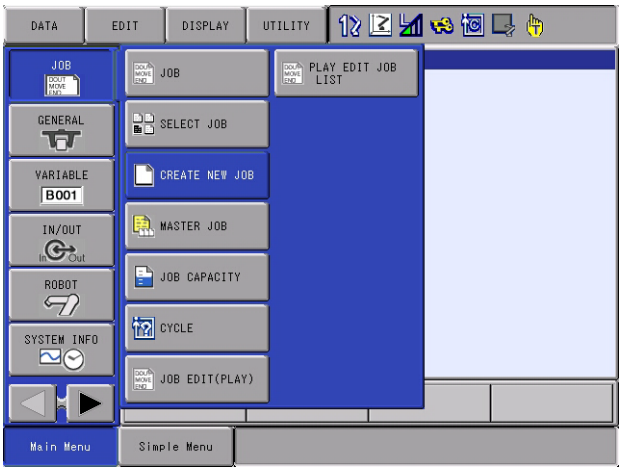
0	0	1					

J	O	B	-	1			

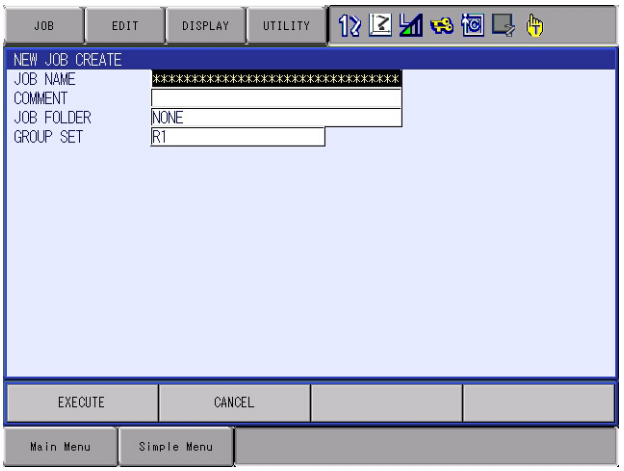
W	O	R	K	-	A		

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.



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"* .
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"* .
2. Press [ENTER].

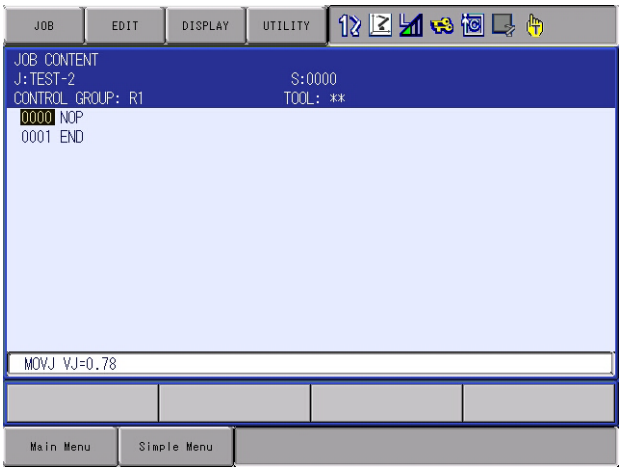
3.1.3.4 Registering Control Groups

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.

3.1.3.5 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.



SUPPLE-MENT

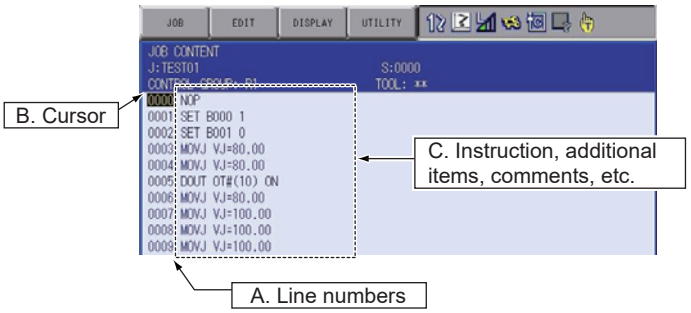
Up to 10000 instructions can be registered per JOB. (Including NOP and END, line 0 to 9999)

Note that the number of registrable instructions is restricted if the JOB capacity is not sufficient or if the structured program language function is used.

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:



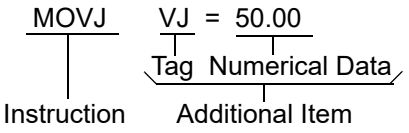
A. Line Numbers

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.

3.2.2 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.

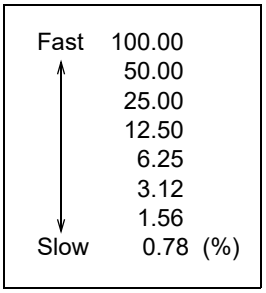
When [MOTION TYPE] is pressed, the move instruction on the input buffer line changes.

<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.

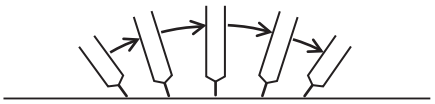
1. Move the cursor to the play speed.
2. Set the play speed by pressing [SHIFT] + the cursor.
   – The joint speed value increases or decreases.





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. 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.
   – The play speed value increases or decreases.



Fast	1500.0
↑	750.0
	375.0
	187.0
	93.0
	46.0
↓	23.0
Slow	11 (mm/s)

Fast	9000
↑	4500
	2250
	1122
	558
	276
↓	138
Slow	66 (cm/min)

VMAX speed

This is the play speed which is specified as the rate with respect to the maximum speed of each axes. This tag can be added to MOVL (linear interpolation). For example, if VMAX=100 is set, the linear interpolation motion is performed at the TCP speed without exceeding the maximum speed of each axes. If VMAX=50 is set, the motion is performed at the half speed of TCP speed when VMAX=100 is set.

NOTE

Notes for VMAX speed

If VMAX speed is specified, TCP speed may not be stable since the speed of each axes is controlled not to exceed the maximum speed during operation.
Thus, VMAX speed must be used in the case where the motion with the stable speed is not required for the operation. Also, VMAX speed is not changed by operation for speed modification, TRT and PAM function.

3.2.2.3 Circular Interpolation

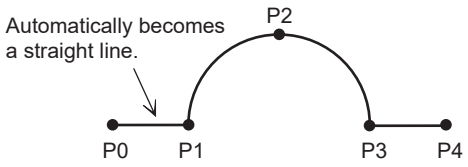
The manipulator moves in an arc that passes through three points. When circular interpolation is used for teaching a robot axis, the move instruction is MOVC.

■ **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

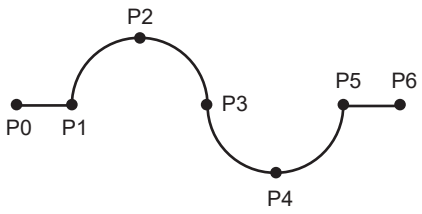


Point	Interpolation Type	Instruction
P0	Joint or Linear	MOVJ MOVL
P1 P2 P3	Circular	MOVC
P4	Joint or Linear	MOVJ MOVL

■ **Continuous Circular Arcs**

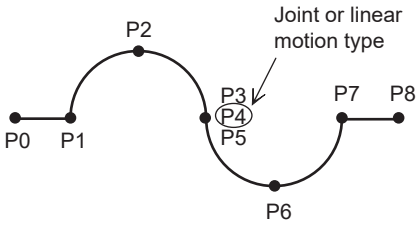
When two or more successive circular movements with different curvatures are required, the movements can be continuously performed by adding an “FPT” tag to the step whose curvature is needed to be changed.

Fig. 3-1: Interpolation Type for Continuous Circular Arcs



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

If not adding an “FPT” tag, the successive circular movements must be separated from each other, thus add a joint or linear interpolation step (P4) at a connecting point of the preceding movement and the following movement. However, when the steps at the same connecting point are taught, the movements cannot be continuously performed.



Point	Interpolation Type	Instruction
P0	Joint or Linear	MOVJ MOVL
P1 P2 P3	Circular	MOVC
P4	Joint or Linear	MOVJ MOVL
P5 P6 P7	Circular	MOVC
P8	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.

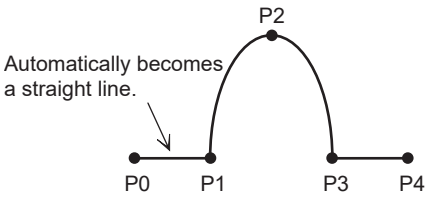
3.2.2.4 Spline Interpolation

Using the spline interpolation makes it easier to perform teaching for workpieces with irregular shapes. 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 3-2: Interpolation Type for Single Spline Curve

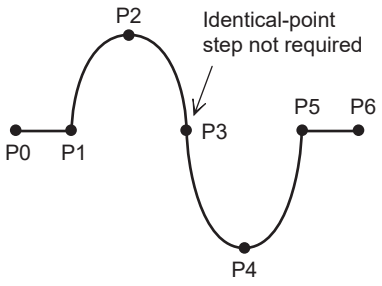


Point	Interpolation Type	Instruction
P0	Joint or Linear	MOVJ MOVL
P1 P2 P3	Spline	MOVS
P4	Joint or Linear	MOVJ MOVL

■ **Continuous Spline Curves**

The manipulator moves through a path created by combining parabolic curves. This differs from the circular interpolation in that steps at an identical point or an FPT tag is not required at the connecting point between two spline curves.

Table 3-3: 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.

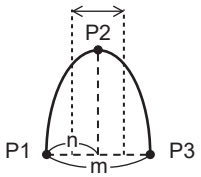


<Play Speed>

- 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.

NOTE

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.



3.2.3 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. 3-2 "Registering Move Instructions"* or they can be done by inserting steps between already registered steps, as shown in the right figure *fig. 3-3 "Inserting Move Instructions"*

This paragraph explains the teaching of *fig. 3-2 "Registering Move Instructions"* , the operations involved in registering new steps.

Fig. 3-2: Registering Move Instructions

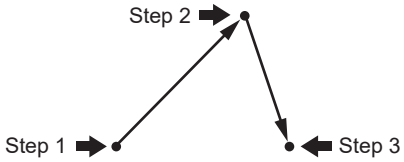
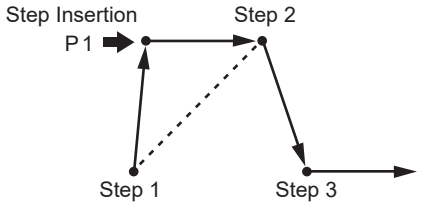


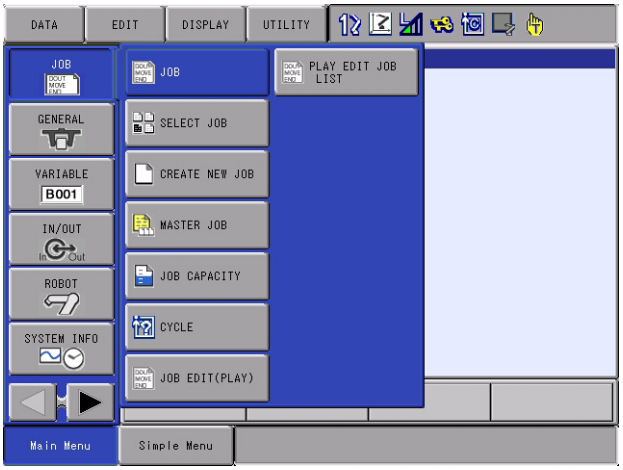
Fig. 3-3: Inserting Move Instructions



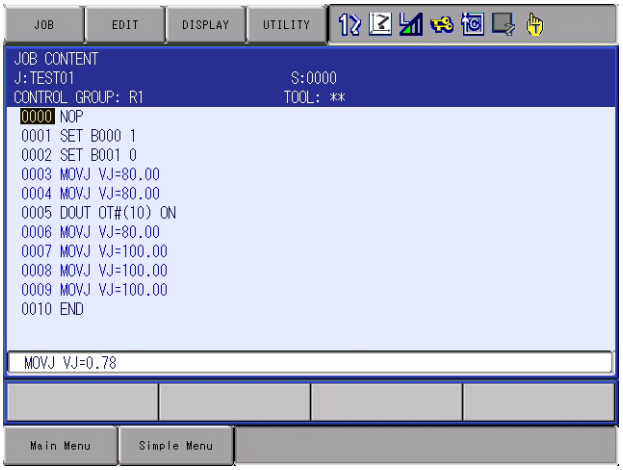
Teaching of *fig. 3-3 "Inserting Move Instructions"* is called "Inserting move instruction", to distinguish it from the method shown in *fig. 3-2 "Registering Move Instructions"* . For more details on this operation, see *chapter 3.4.2 "Inserting Move Instructions"* . The basic operations for registration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

■ **Setting the Position Data**

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



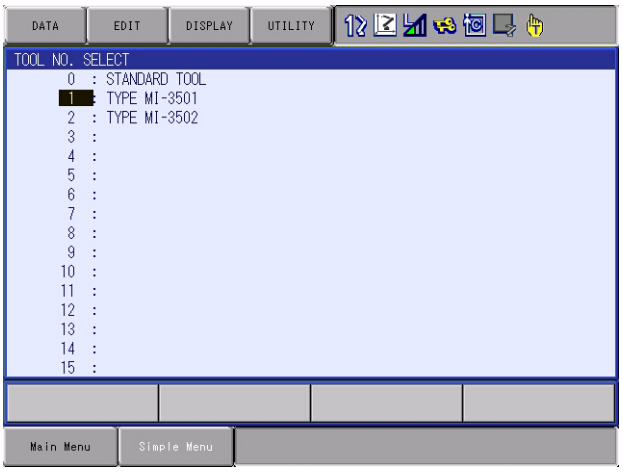
2. Select {JOB}.
   – The contents of the currently-selected job is displayed.



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 [Axis Key].
   – Use [Axis Key] to move the manipulator to the desired position.

■ 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. Move the cursor to the desired tool number.
   – The currently-selected tool number by the cursor is displayed.
3. Press [SHIFT] + [COORD].
   – The JOB CONTENT window appears.

> SUPPLE-MENT
>
> 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”* 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.

■ 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.



4. Press [SHIFT] + the cursor [↑] or [↓] simultaneously.
   – The joint speed moves up and down.



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.)

SUPPLE-MENT

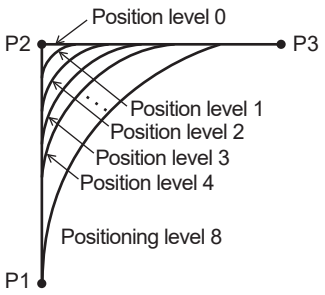
To make the setting so that the play speed tag is not displayed as a default, select {EDIT} from the menu and then select “ENABLE SPEED TAG” to delete “∗”.

SUPPLE-MENT

- 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 LVL 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.

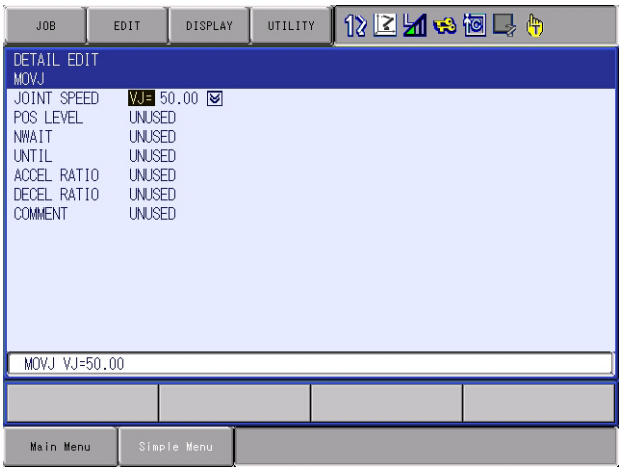
The relationship between path and accuracy for position levels is as follows.



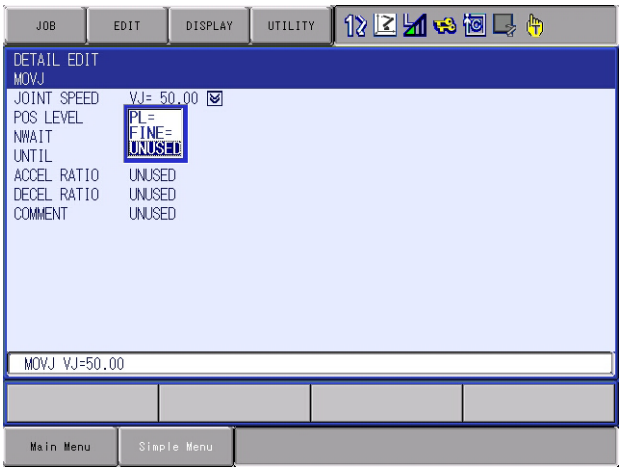
Position Levels	Accuracy
0	Teaching position
1 to 8	Fine | Rough

■ Setting the Position Level

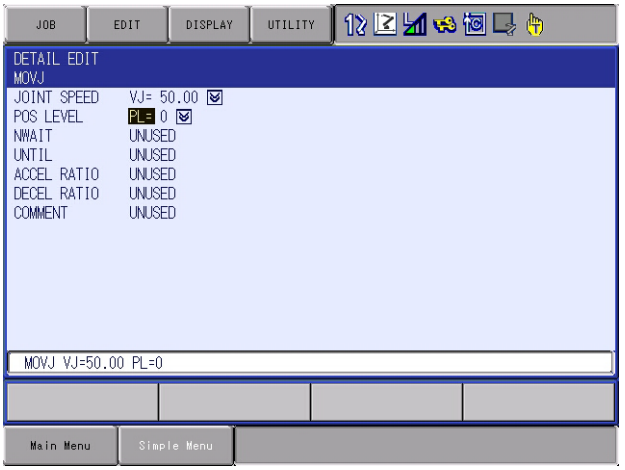
1. Select move instruction.
   – The DETAIL EDIT window appears.



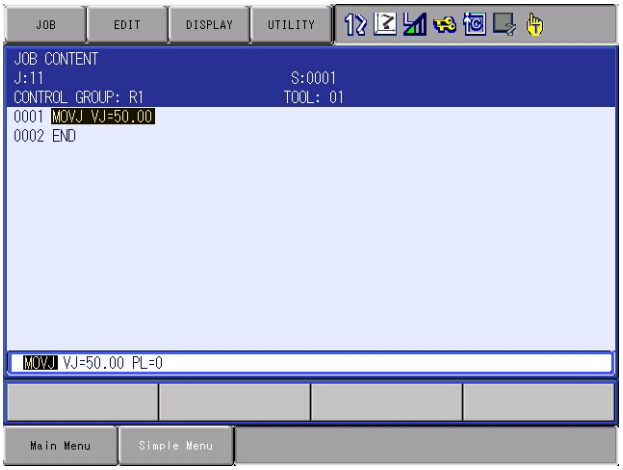
2. Select the position level “UNUSED”.
   – The selection dialog box appears.



3. Select “PL”.
   – The position level is displayed. The position initial value is 1.

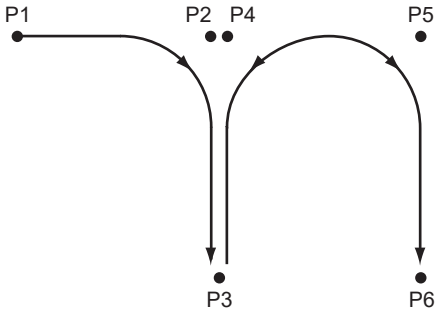


4. Press [ENTER].
   – To change the position level, select the level in the input buffer line, type the value using [Numeric Key], and press [ENTER]. The position level's move instruction is registered.



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:

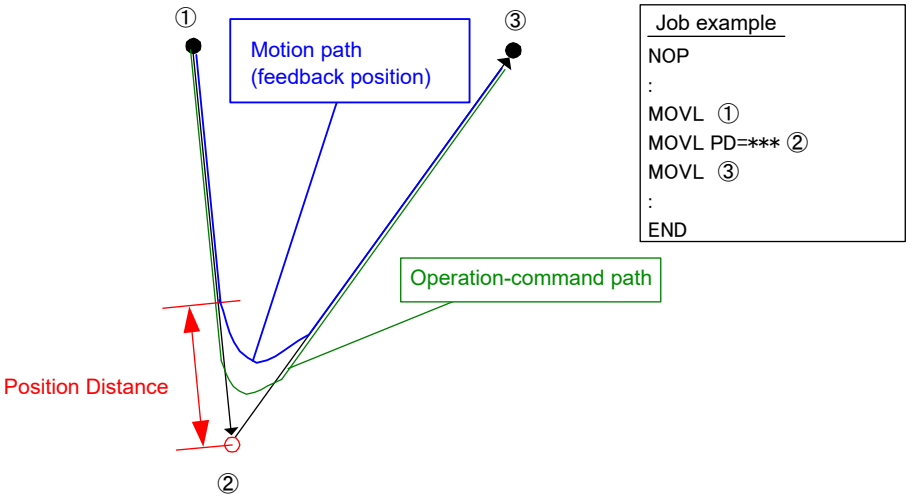
MOVL V=138 PL=3

Positioning point P3 and P6:

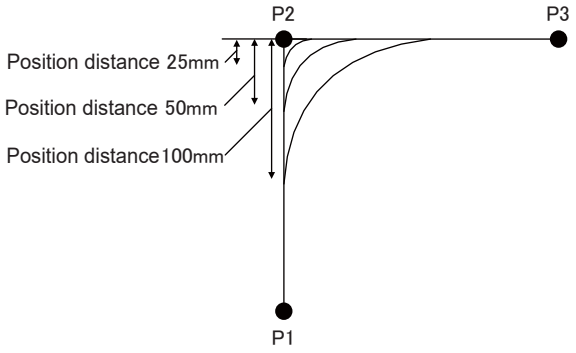
MOVL V=138 PL=0

Position Distance (PD): The position distance can be added to the instruction MOVL (linear interpolation). When the position distance is specified, the manipulator (at the feedback position) starts inward-turning operation from the specified point.
By adding this tag, a specific distance can be used to adjust how close the manipulator moves to the taught position.

The relation among the position distance, the operation-command path, and the manipulator's motion path (feedback position) is shown in the following figure. The manipulator can perform inward-turning operation from the specified point.

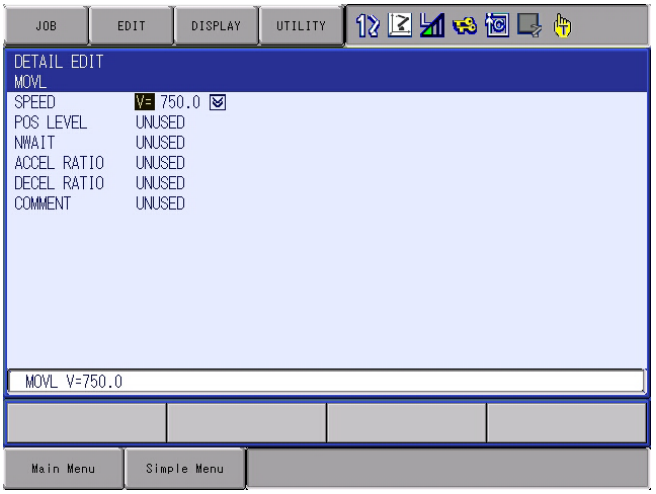


The relation between the manipulator's path and the teaching position when the position distance is specified is shown below.

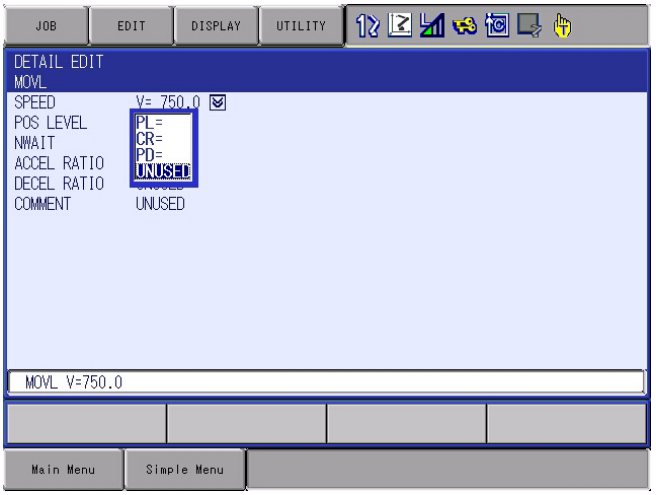


■ Setting the Position Distance

1. Select the MOVL instruction.
   – The DETAIL EDIT window appears.

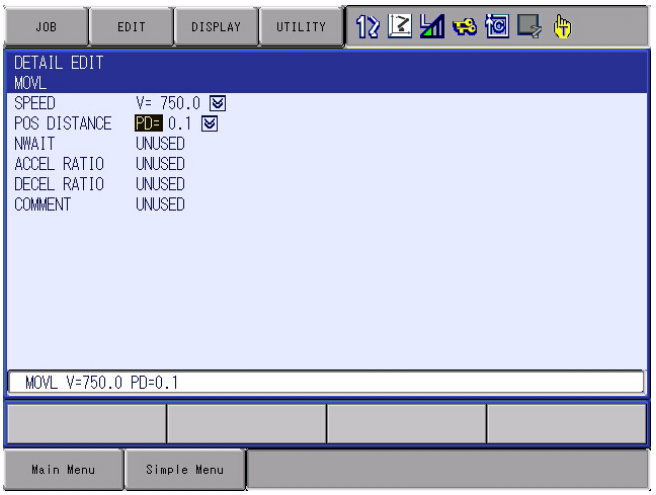


2. Select the position level “UNUSED”.
   – The selection dialog box appears.



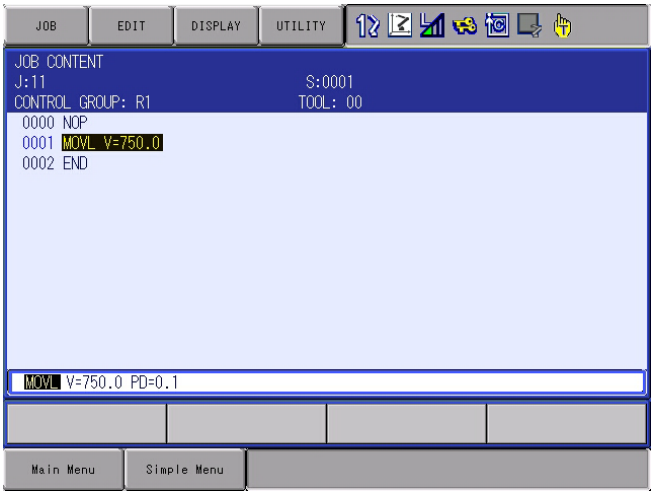
3. Select “PD”.

– The position distance is displayed. The position initial value is 0.1 mm.



4. Press [ENTER].

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



5. Press [ENTER].

NOTE

If a large value is specified for the position distance in a short-distance step, the accuracy of the position distance may be deteriorated.
The manipulator starts its inward-turning operation in the latter half of the step's distance.

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 [Axis 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 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] LED lights.
   When registering before the END instruction, pressing [INSERT] is not needed.
9. Press [ENTER].
   – The REFP instruction is registered.



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. The timer unit of adjustment is 0.01 seconds.



   – If [Numeric Keys] are used for inputting the timer value, press [SELECT] when the cursor is on the timer value. The data input line appears. Input the value and press [ENTER].

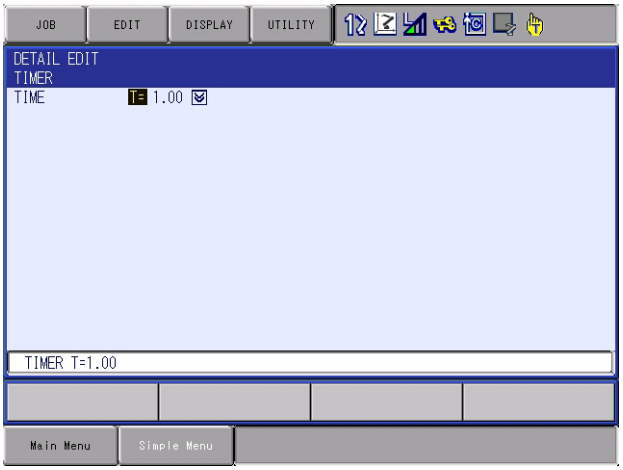


6. Press [INSERT].
   – The [INSERT] LED lights.
   – When registering before the END instruction, pressing [INSERT] is not needed.
7. Press [ENTER].
   – The TIMER instruction is registered.

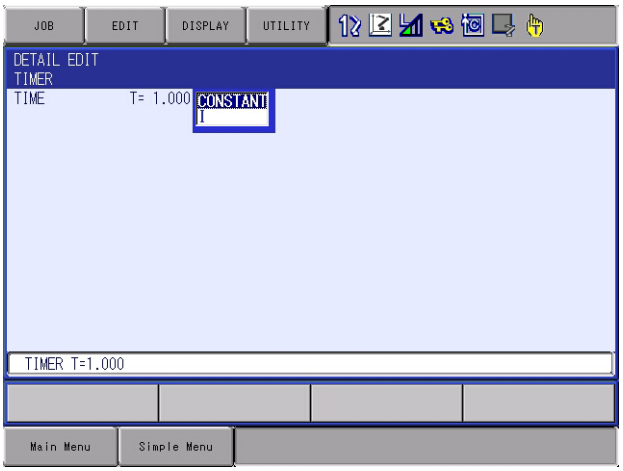


■ **Changing Timer Value**

1. Press [TIMER].
2. Press [SELECT].
   – The DETAIL EDIT window for the TIMER instruction appears.

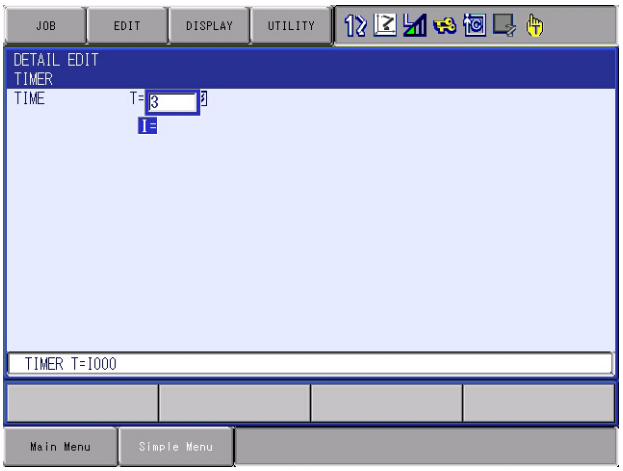


3. Input the timer value on the instruction DETAIL EDIT window.
   (1) When ⊻ is selected, the items available to be changed are displayed in the dialog box.



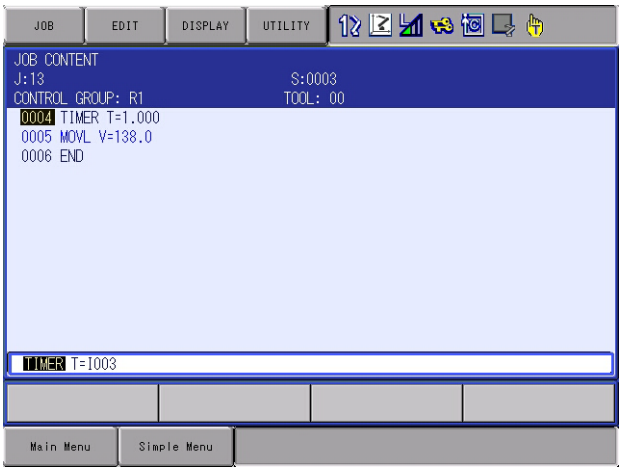
(2) Select the particular item to be changed.

– 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.



5. Press [ENTER].

– The TIMER instruction is registered.

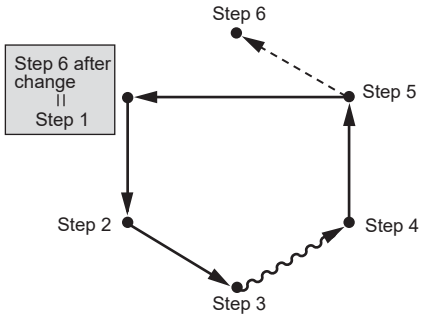


3.2.4 Overlapping the First and Last Steps

Why is overlapping the first and last step necessary?

Assume that the job shown below is to be repeated. The manipulator moves from the last step (Step 6) to the first step (Step 1). If Step 6 and Step 1 are the same position, the manipulator moves directly Step 5 to Step 1, thereby improving work efficiency.

SUPPLE -MENT



The position of step 6 is changed to overlap with step 1.

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 LED 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.

3.3 Checking Steps

3.3.1 FWD/BWD 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.
[INTERLOCK] + [FWD]: All instructions are executed alternately.

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

NOTE For safety, set manual speed at  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.

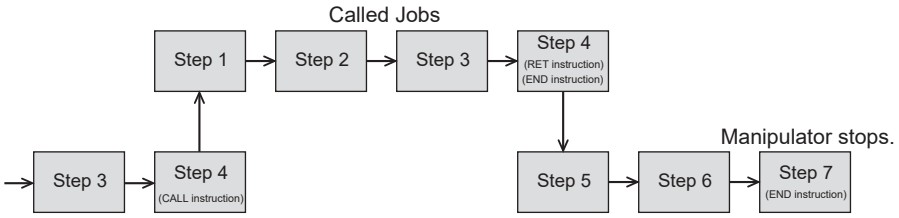
With using parameters, the movement at [FWD] operation can be set.

SUPPLE -MENT Refer to *chapter 8.3.0.4 "S2C198: EXECUTION UNITS AT "FORWARD" OPERATION"* and *chapter 8.3.0.5 "S2C199: INSTRUCTION (EXCEPT FOR MOVE) EXECUTION AT "FORWARD" OPERATION"* .

3.3.1.1 Precautions When Using FWD/BWD Operations

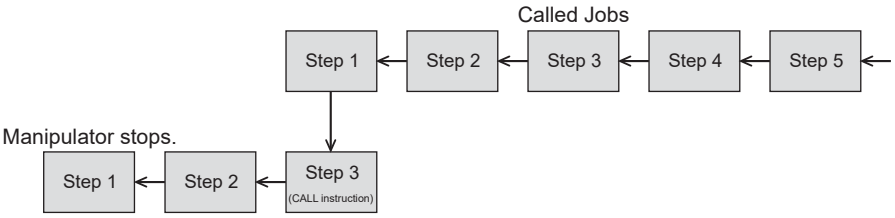
■ **FWD Movements**

- 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.



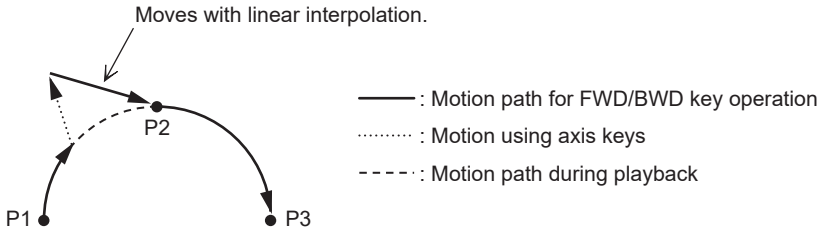
■ **BWD Movements**

- 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.



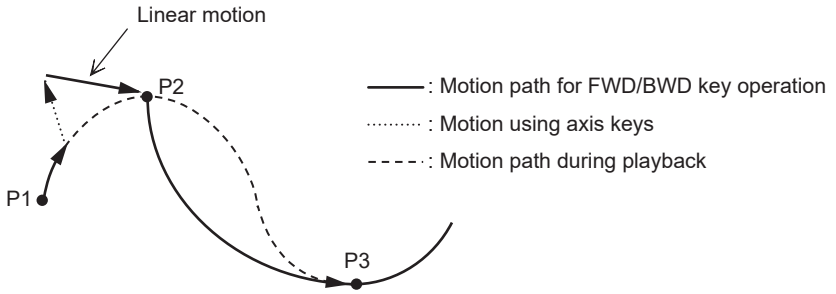
■ **Circular Movements with [FWD/BWD] Operations**

- 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.

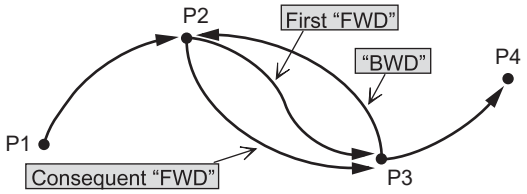


■ **Spline Curve Movements with FWD/BWD Operations**

- 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.



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".



NOTE

- 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.

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.

3.3.1.4 Test Operations

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

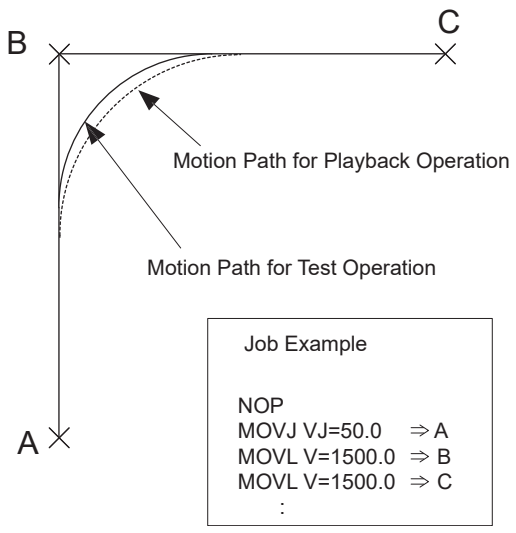
Test operation differs in the following ways from actual playback in play mode.

NOTE

- Operation speeds greater than the maximum teaching speed are reduced to the maximum teaching speed.
- Work instructions such as TOOLON are 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



NOTE

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.

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.

NOTE Always check safety conditions before pressing [INTERLOCK] + [TEST START] to start the manipulator in motion.

3.3.1.5 Machine Lock Operation

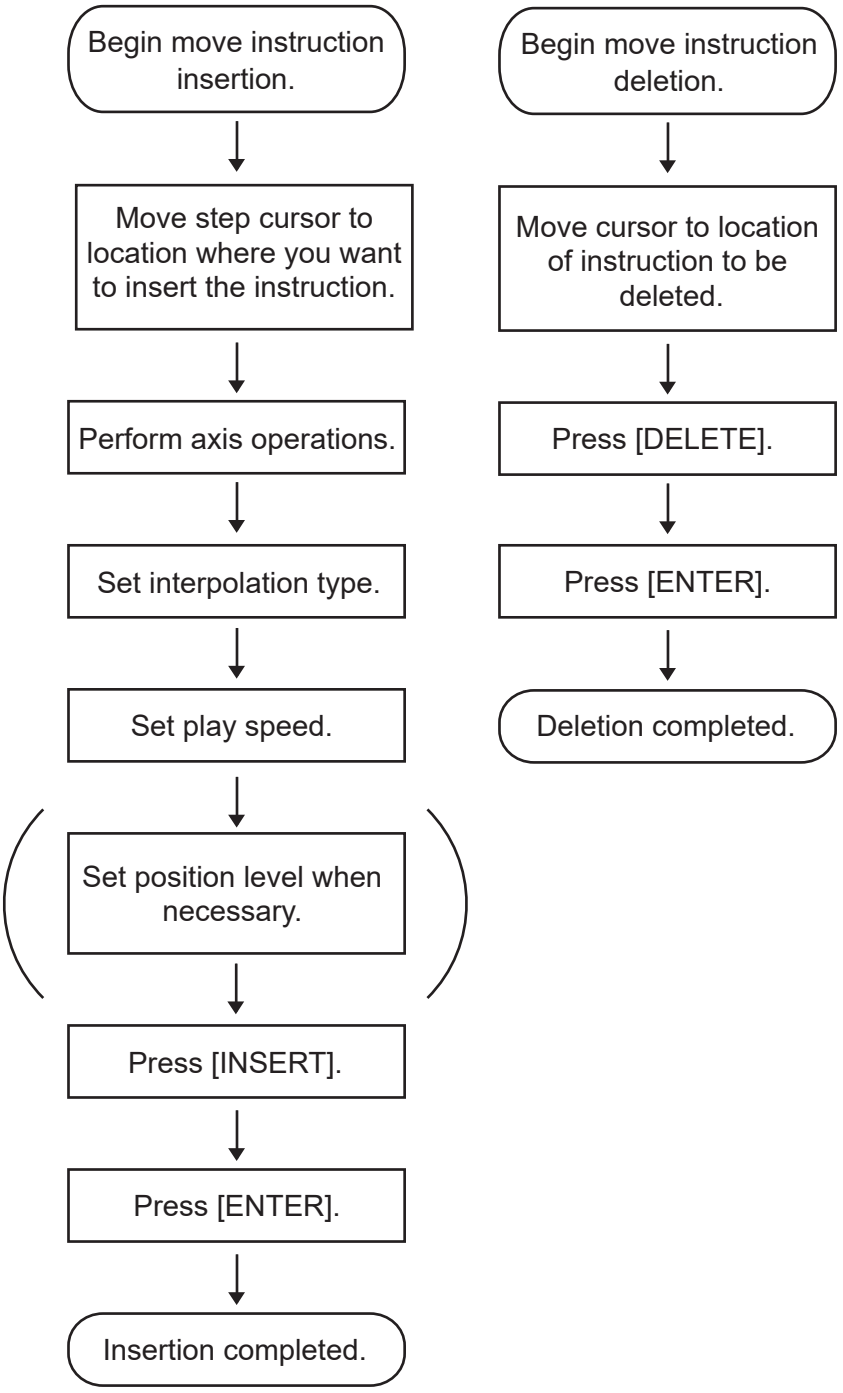
When “MACHINE LOCK” is enabled, the [FWD] / [BWD] operation or the test operation can be performed to check the status of input and output without moving the manipulator.

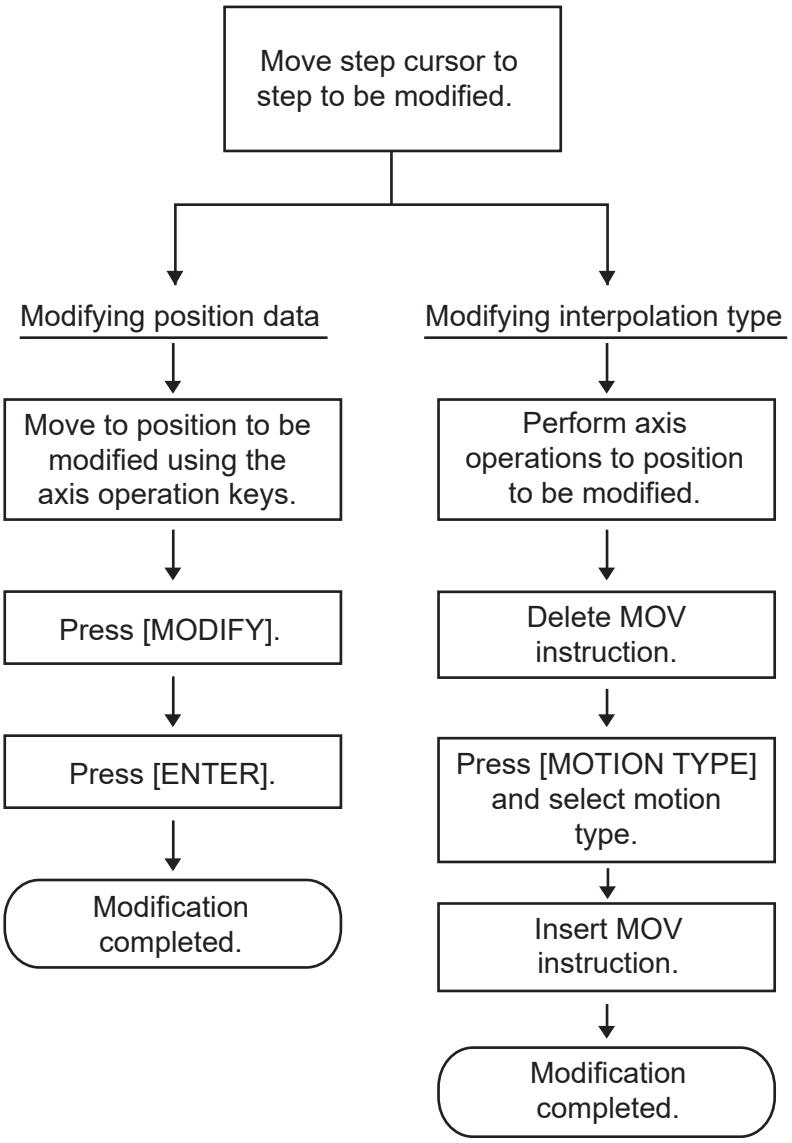
1. Press [AREA].
2. Select {UTILITY}.
3. Select {SETUP SPECIAL RUN}.
   – The SPECIAL TEACH window appears.
4. Select “MACHINE LOCK”.
   – Press [SELECT] to switch “VALID” and “INVALID”.

NOTE

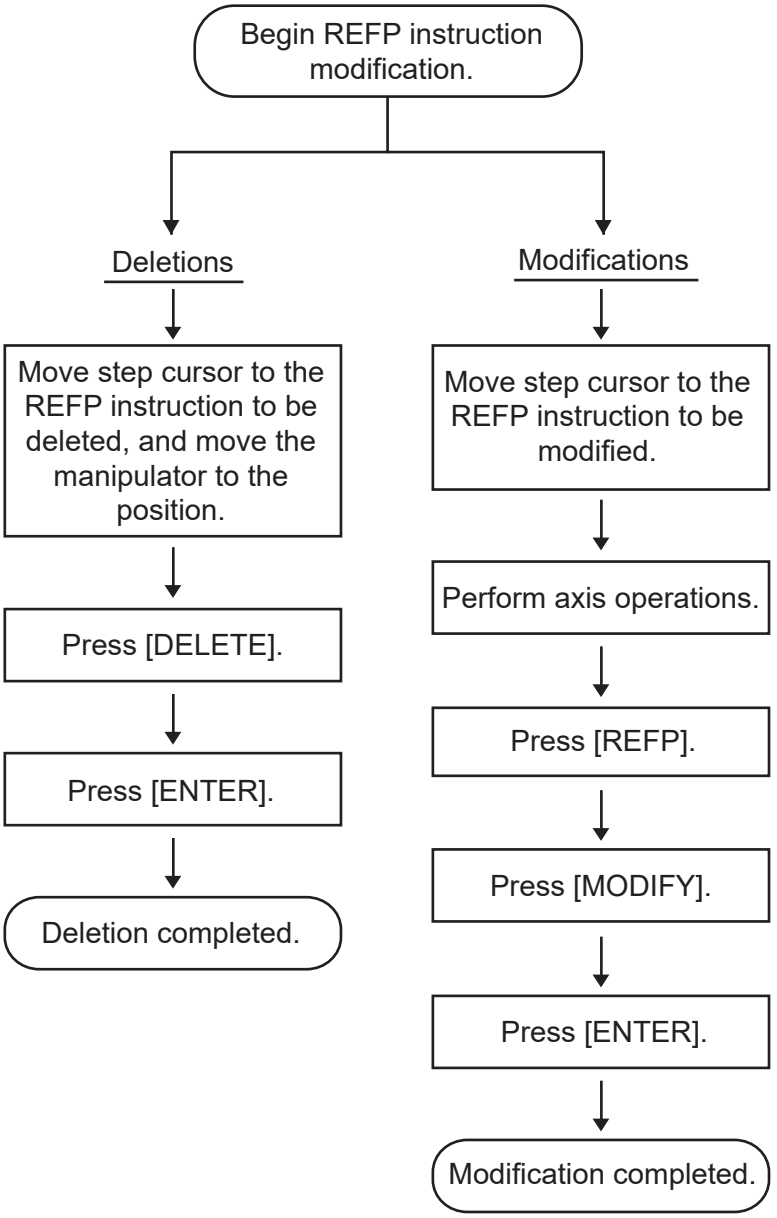
- The setting of “MACHINE LOCK” is maintained even after the mode is switched: If the machine lock is set to “VALID” in teach mode, it is still “VALID” after switching to play mode.
  The same applies when the mode is switched from play mode to teach mode.
- Note that the machine lock becomes “INVALID” if the following operation is performed.
  - Execution of “CANCEL ALL SELECT” in the SPECIAL PLAY window.
  - Turning off the main power.

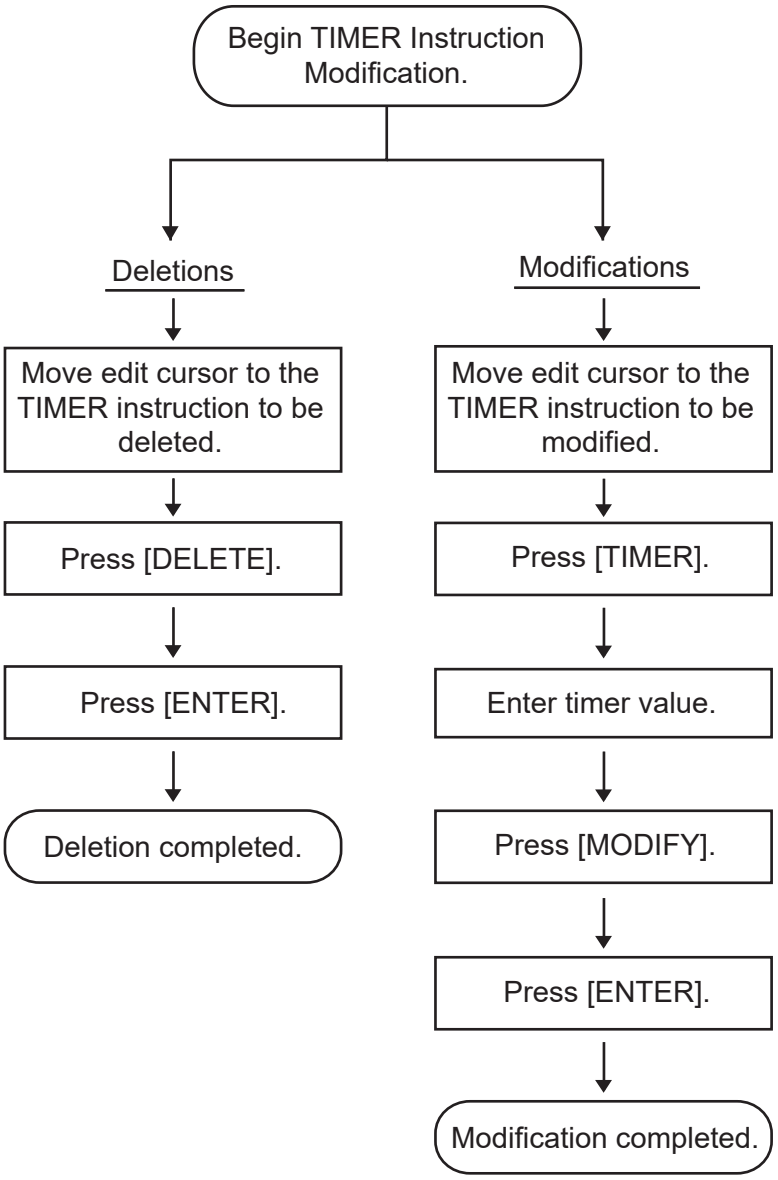
3.4 Modifying Steps





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


Begin REFP instruction modification.
Deletions
Move step cursor to the REFP instruction to be deleted, and move the manipulator to the position.
Press [DELETE].
Press [ENTER].
Deletion completed.
Modifications
Move step cursor to the REFP instruction to be modified.
Perform axis operations.
Press [REFP].
Press [MODIFY].
Press [ENTER].
Modification completed.


Begin TIMER Instruction Modification.
Deletions
Move edit cursor to the TIMER instruction to be deleted.
Press [DELETE].
Press [ENTER].
Deletion completed.
Modifications
Move edit cursor to the TIMER instruction to be modified.
Press [TIMER].
Enter timer value.
Press [MODIFY].
Press [ENTER].
Modification completed.

3.4.1 Displaying the JOB CONTENT Window for Editing

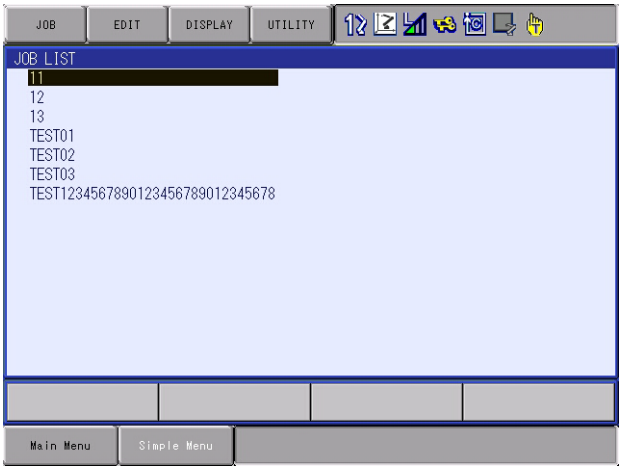
3.4.1.1 Job Currently Called-Up

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

3.4.1.2 Calling Up Other Jobs

NOTE In any other than teach mode, set the mode switch to “TEACH”.

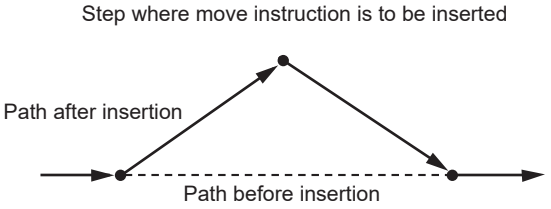
1. Select {JOB} under the main menu.
2. Select {SELECT JOB}.
   – The JOB LIST window appears.



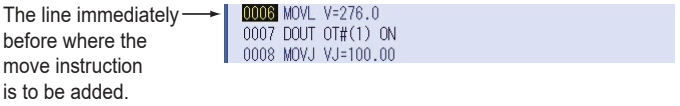
3. Select the job name to be called.

3.4.2 Inserting Move Instructions

NOTE Move instructions cannot be inserted when the servo power is OFF.



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



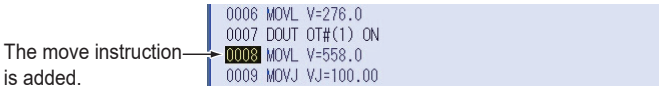
2. Press [Axis Key].
   – Turn ON the servo power and press [Axis Key] to move the manipulator to the position to be inserted.

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

3. Press [INSERT].
   – The key LED will light.

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

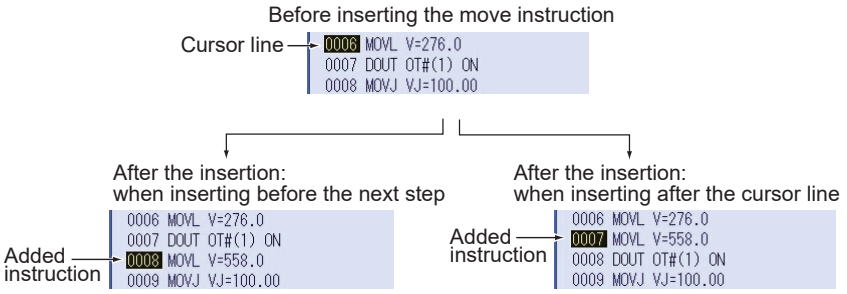
4. Press [ENTER].
   – The move instruction is inserted after the cursor line.



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 TEACHING CONDITION window.

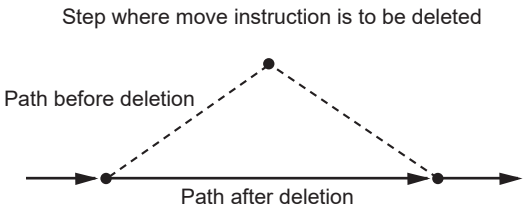


NOTE

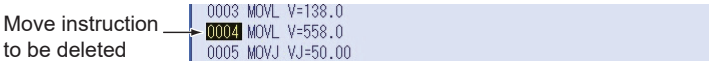
Positions where the move instructions are inserted.

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.

3.4.3 Deleting Move Instructions



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



NOTE

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 LED will blink.
3. Press [ENTER].
   – The step indicated by cursor line is deleted.



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 [Axis Key].
   – Turn ON the servo power and press [Axis Key] to move the manipulator to the desired position.
3. Press [MODIFY].
   – The key LED 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 LED 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.

3.4.5 Undo Operation

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

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

NOTE

- 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 after editing the move instruction.
- The undo operation works only for the last five edited instructions only.

1. Press [SHIFT] + [CANCEL].
   – The assist menu appears.



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

SUPPLE -MENT

UNDO and REDO can be performed also by selecting the pull-down menu {EDIT} → {UNDO}, and {EDIT} → {REDO}.

3.4.6 Modifying Reference Point Instructions

3.4.6.1 Deleting Reference Point Instructions

NOTE

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 LED will blink.
3. Press [ENTER].
   – The reference point instruction at the cursor line is deleted.

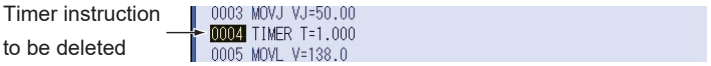
3.4.6.2 Modifying Reference Point Instructions

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

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 LED 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 [SELECT].
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 to set the data.
   – To use [Numeric Keys] to input data, move the cursor to the input buffer line timer value and press [SELECT].

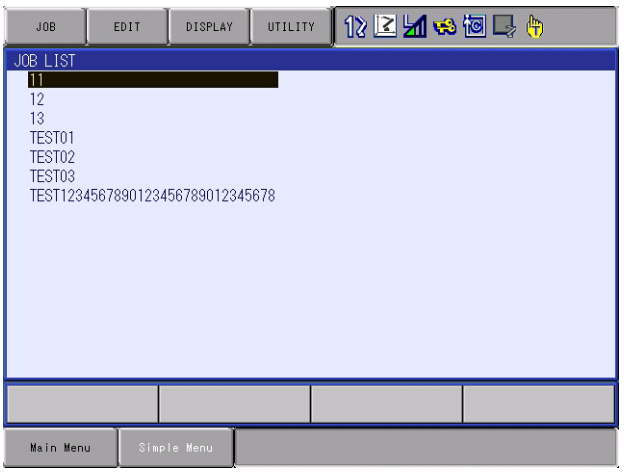


4. Change the timer value.
5. Press [MODIFY].
6. Press [ENTER].
   – This key LED will light.

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.

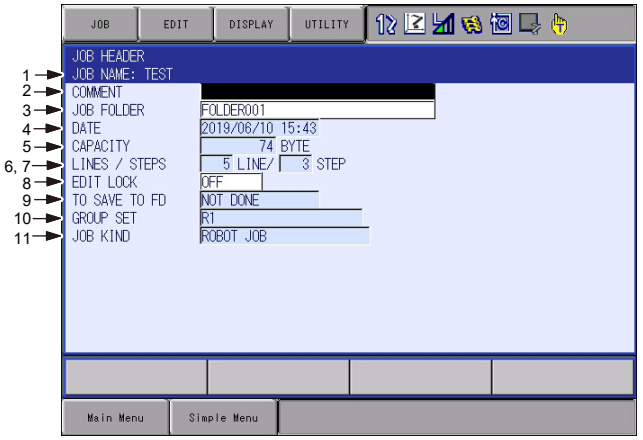
3.5.2 Windows Related to Job

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.

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.



1. JOB NAME

Displays the name of the current job.

2. COMMENT

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

3. JOB FOLDER

The JOB name which is set to this job is displayed.

This can be edited in this window.

4. DATE

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

5. CAPACITY

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

6. LINES

Displays the total number of instructions registered in this job.

7. STEPS

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

8. EDIT LOCK

Displays whether the Edit Lock setting for this job is “ON” or “OFF”. When the security mode is set to the management mode or higher, this can be edited in this window.

9. 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.

10. GROUP SET[1)]

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

11. JOB KIND[1)]

Displays the kind of this job.

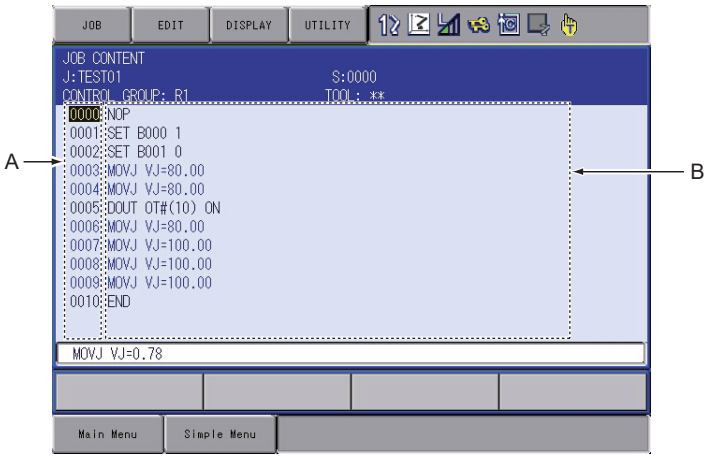
> SUPPLE -MENT
>
> To return to the JOB CONTENT window from the JOB HEADER window, select {DISPLAY} from the menu and then select {JOB CONTENT}.

3.5.4 JOB CONTENT Window

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 the line numbers, the step numbers and the tool numbers which are registered in the each step.

B. Instruction Area

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

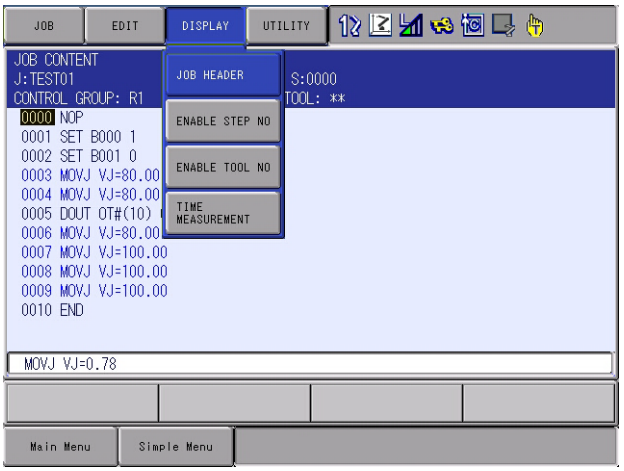
1 This item is displayed when a specific optional function is enabled.

3.5.4.1 Switching the Address Area

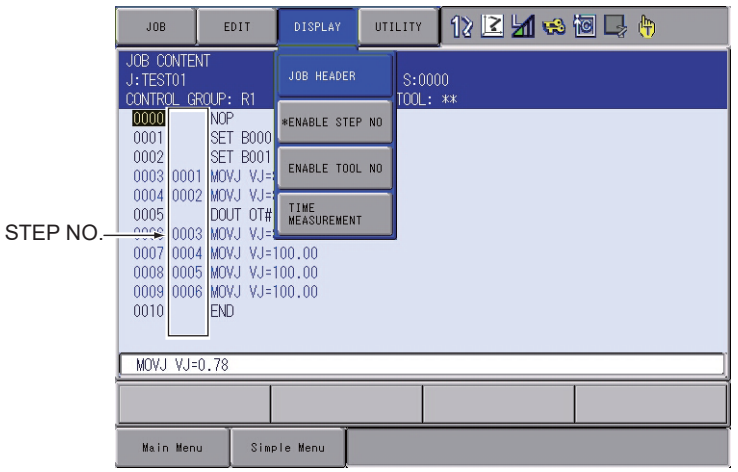
Able to switch a state of the display (to hide or show) of the following numbers in the address area.

- Step numbers
- Tool numbers in the each step

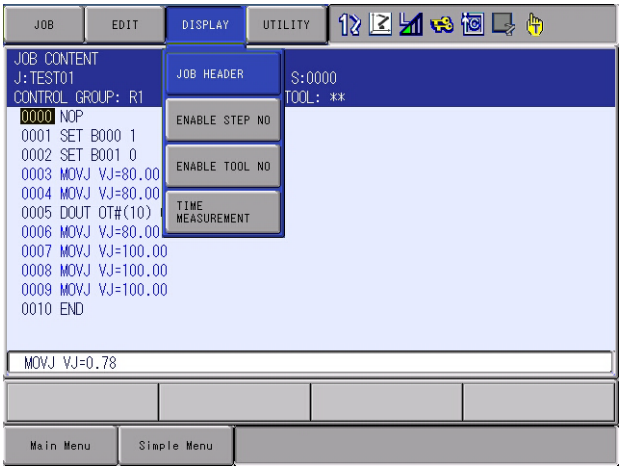
1. Select the {JOB} under the main menu.
2. Select {JOB CONTENT}.
   – Job content appears.
3. Select {DISPLAY} in the menu area.
   – A pull down menu appears.



4. Select {ENABLE STEP NO}.
   – Step numbers appear in the address area.
   – In the pull down menu, {ENABLE STEP NO} changes to {＊ENABLE STEP NO}.

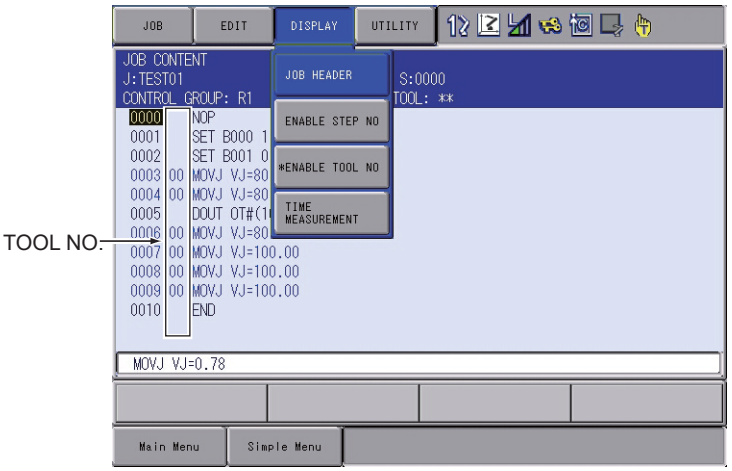


5. Select {＊ENABLE STEP NO}.
   – Step numbers in the address area disappear.
   – In the pull down menu, {＊ENABLE STEP NO} changes to {ENABLE STEP NO}.

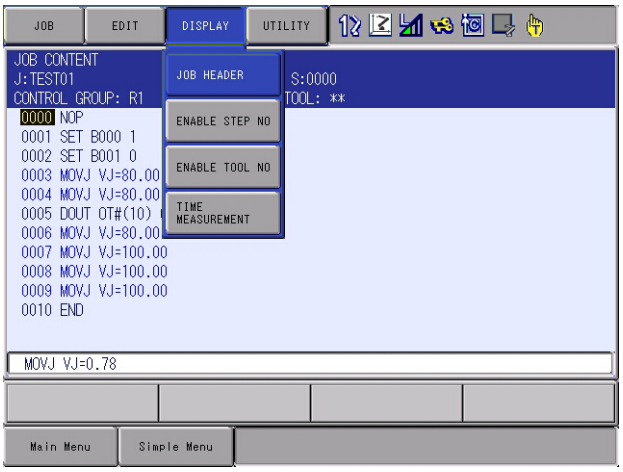


6. Select {ENABLE TOOL NO}.
   – Tool numbers appear in the address area.
   – In the pull down menu, {ENABLE TOOL NO} changes to {＊ENABLE TOOL NO}.

   Tool numbers only appear in the line during the move instruction and also appear under teach mode.

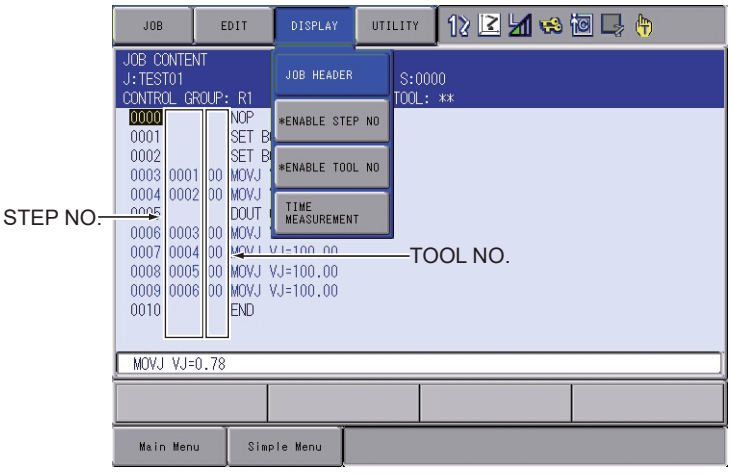


7. Select {＊ENABLE TOOL NO}.
   – Step numbers in the address area disappear.
   – In the pull down menu, {＊ENABLE TOOL NO} changes to {ENABLE TOOL NO}.

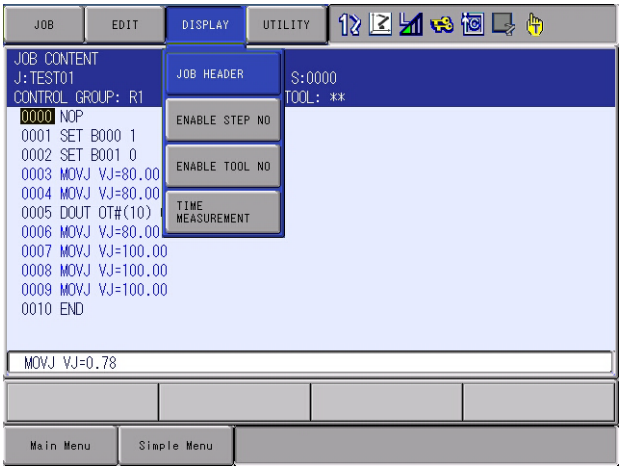


8. Select both {ENABLE STEP NO} and {ENABLE TOOL NO}.
   – The both step numbers and tool numbers appear in the address area.
   – In the pull down menu, {ENABLE STEP NO} changes to {＊ENABLE STEP NO}.
   – In the pull down menu, {ENABLE TOOL NO} changes to {＊ENABLE TOOL NO}.

   Tool numbers only appear in the line during the move instruction and also appear under teach mode.

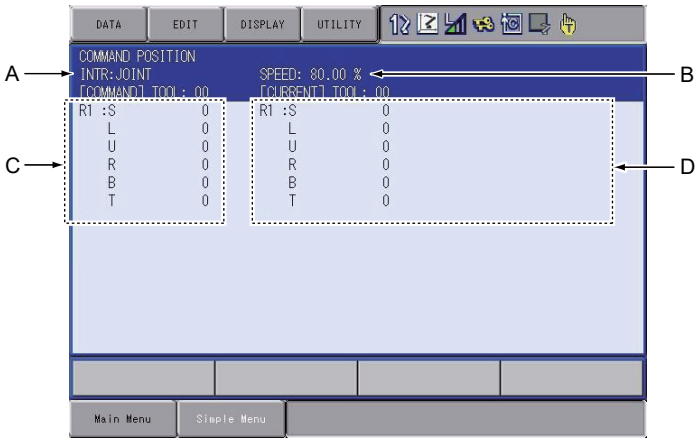


9. Select both {＊ENABLE STEP NO} and {＊ENABLE TOOL NO}.
   – The both step numbers and tool numbers disappear in the address area.
   – In the pull down menu, {＊ENABLE STEP NO} changes to {ENABLE STEP NO}.
   – In the pull down menu, {＊ENABLE TOOL NO} changes to {ENABLE TOOL NO}.



3.5.5 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.

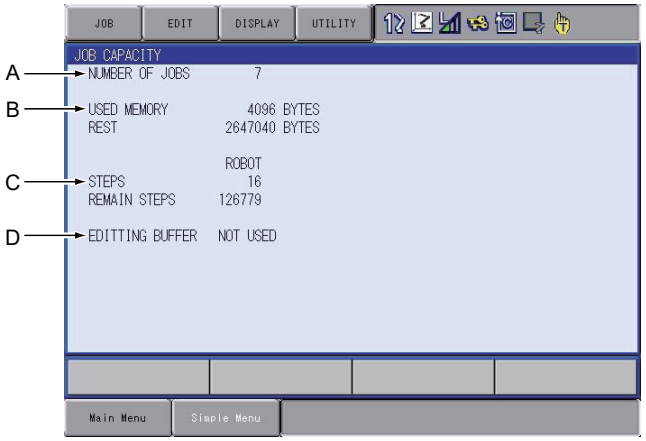
B. Speed
Displays the play speed.

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.

3.5.6 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 YRC1000micro.

B. USED MEMORY

Displays the total amount of memory used in the YRC1000micro.

C. STEPS

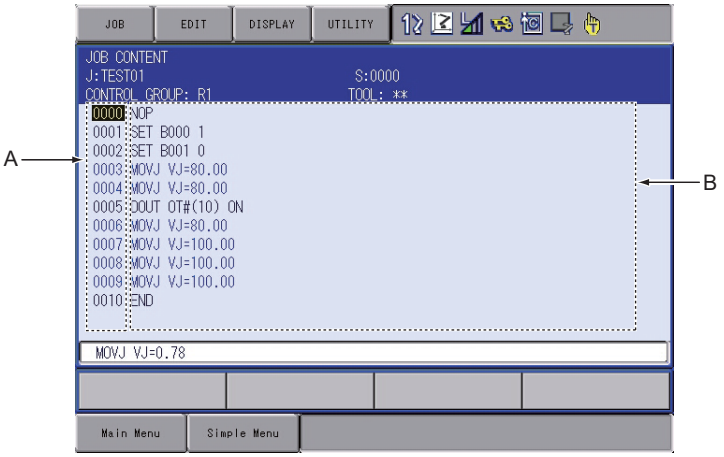
Displays the total number of used steps.

D. EDITING BUFFER

Displays editing buffer use.

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.

3.6.1 Instruction Group

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

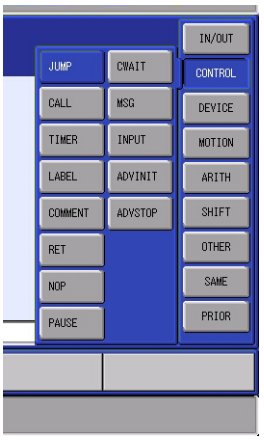
Display	Instruction Group	Content	Example
IN/OUT	I/O Instruction	Controls input and output	DOUT, WAIT
CONTROL	Control Instruction	Controls processing and each work	JUMP, TIMER
MOTION	Move Instructions	Moves the manipulator	MOVJ, REFP
DEVICE	Work Instructions	Operates press tending, cutting, and other applications	WVON, TOOLON
ARITH	Operating Instructions	Performs arithmetic calculation	ADD, SET
SHIFT	Shift Instructions	Shifts the teaching point	SFTON, SFTOF
SENS (Optional)	Sensor Instructions (Optional)	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.

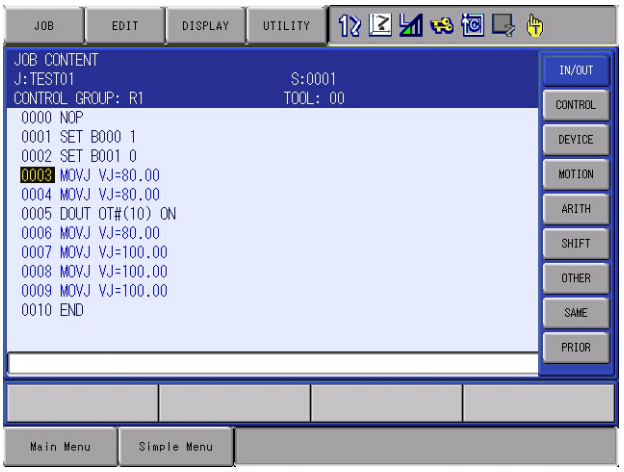


3.6.2 Inserting Instructions

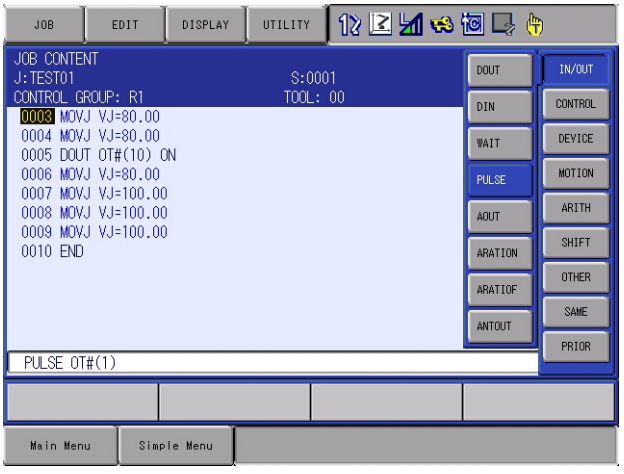
1. Move the cursor to the address area in the JOB CONTENT window.
   – Move the cursor to the line immediately before where the instruction is to be inserted, in teach mode.



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.

<When Additional Items are to be edited>

• Changing numeric data

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



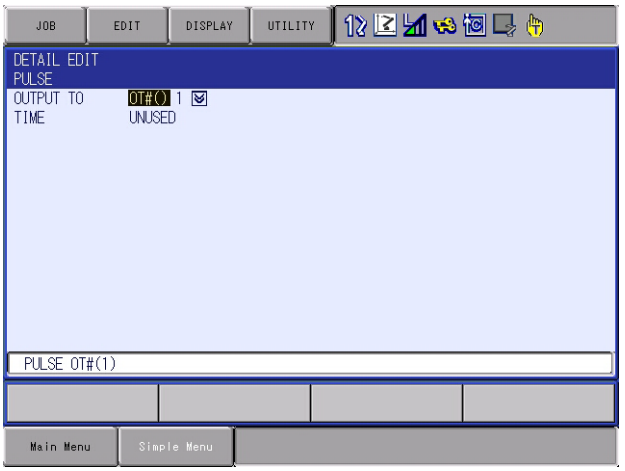
(2) To directly input the value using [Numeric Keys], press [SELECT] to display the input buffer line.



(3) Type the value and press [ENTER]. The value on the input buffer line is changed.

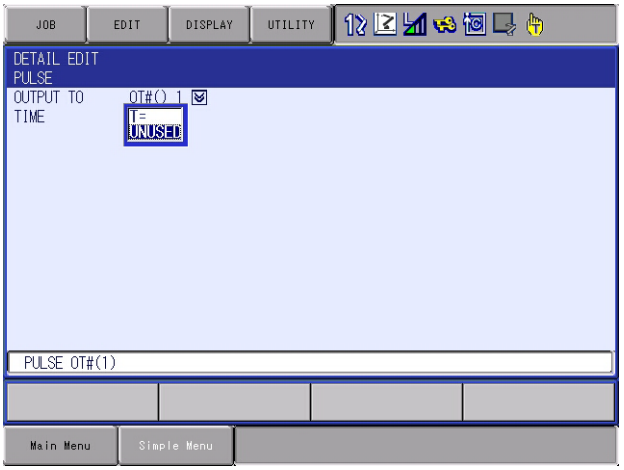
• Adding, modifying, or deleting an additional item

(1) 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.



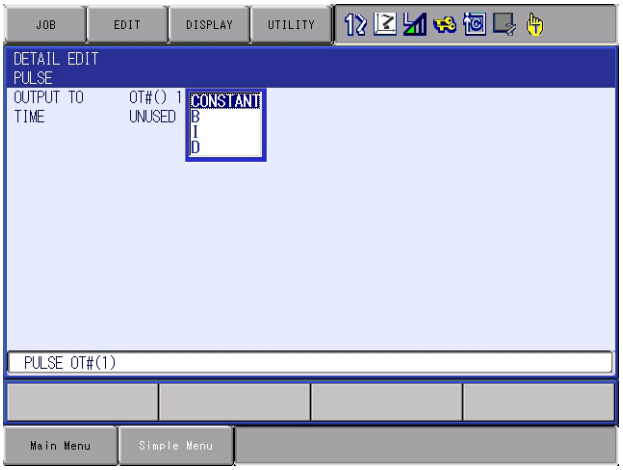
– To add an item, move the cursor to “UNUSED” and press [SELECT]. The selection dialog box appears.

(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”.



• 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.

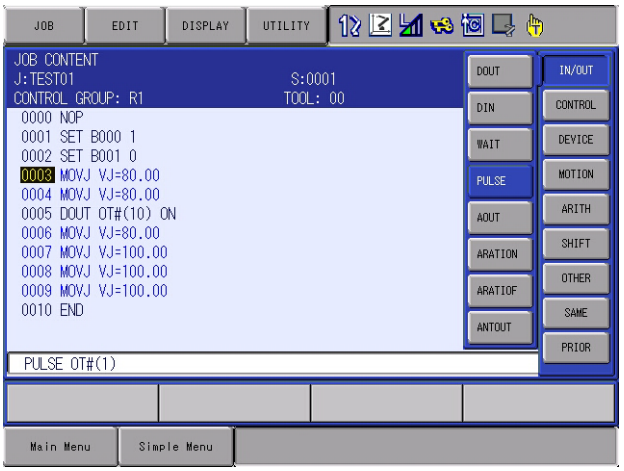


(2) After additional items have been added, modified or deleted as required, press [ENTER].

– 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.



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 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.

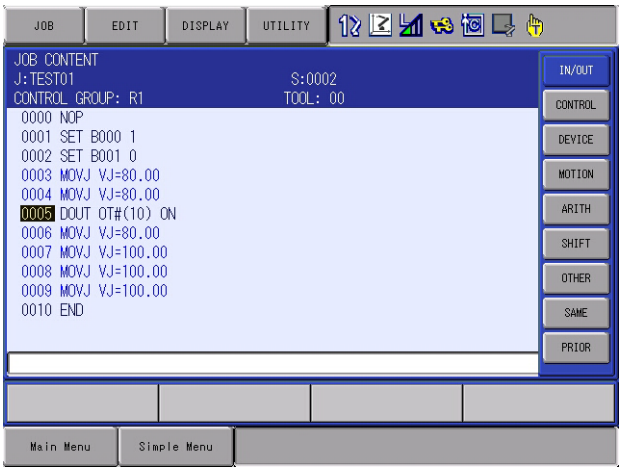


3.6.4 Modifying Instructions

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



5. 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.



4. Move the cursor to the instruction to be modified and press [SELECT].

5. Change the data of additional items or variables as required.

<Editing Additional Items>

• Changing numeric data

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



– To directly input the value using [Numeric Keys], press [SELECT] to display the input buffer line for the numeric values.

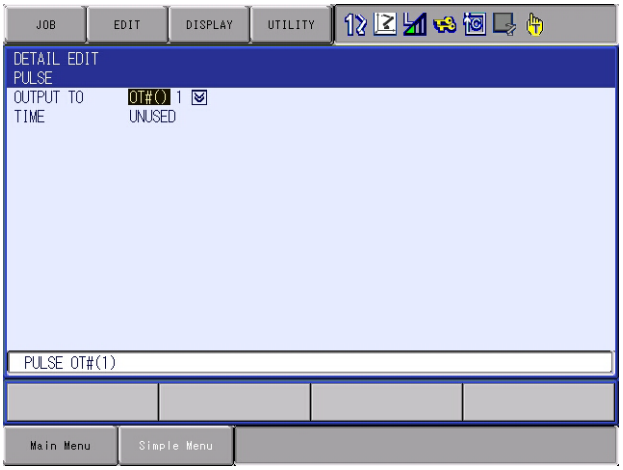


(2) Type the value and press [ENTER]. The value on the input buffer line is changed.

• Adding, modifying, or deleting an item

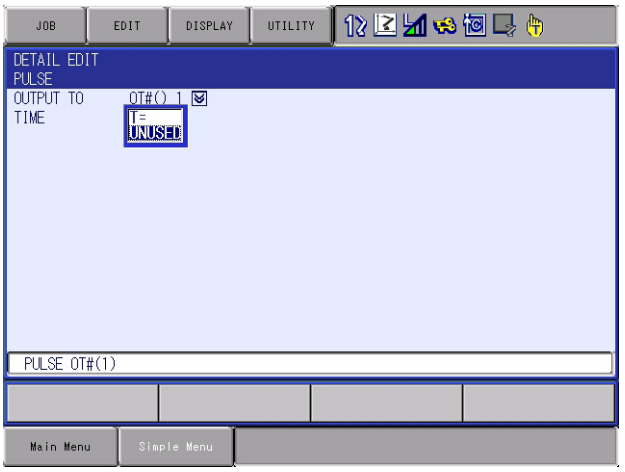
(1) To add, modify or delete an additional item, move the cursor to the instruction on the input buffer line and press [SELECT].

– The DETAIL EDIT window appears.



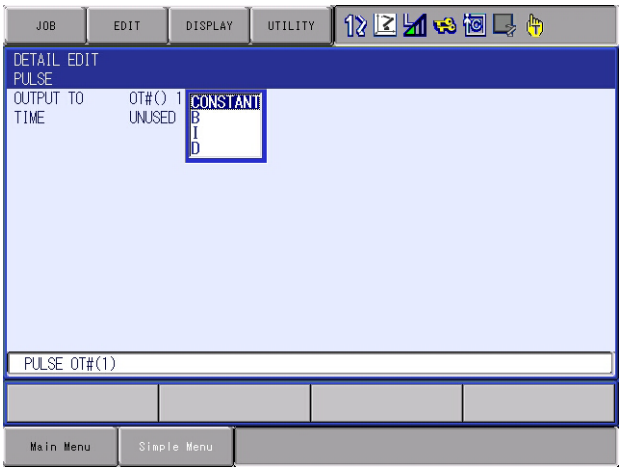
(2) To add an item, move the cursor to “UNUSED” and press [SELECT]. The selection dialog box appears.

(3) 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”.



• 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].
   – The instruction is modified to the instruction displayed in the input buffer line.



3.6.5 Modifying Additional Numeric Data

1. Move the cursor to the instruction area in the JOB CONTENT window.
   – Move the cursor to the instruction area if it is in the address area.
   – Press [SELECT] to change the mode to line editing mode.
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 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.



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.
   – Move the cursor to the instruction area if it is in the address area
   – Press [SELECT] to change the mode to line editing mode.



3. Select the instruction.
   – Move the cursor to a instruction, the press [SELECT] to display DETAIL EDIT window.



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.



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.
   – Move the cursor to [SELECT] and press, then DETAIL EDIT window appears.



4. Select the additional item to be inserted on DETAIL EDIT window.
   – The selection dialog box appears.



5. Select inserting additional item.
   – The item to be added appears.



   – 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].



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



3.6.8 Deleting Additional Items

NOTE 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.
   – Move the cursor to the instruction area when it is in the address area.
   – Press [SELECT] to change the mode to line editing mode.



3. Select the instruction.
   – Move the cursor to the instruction and press [SELECT], then DETAIL EDIT window appears.



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



5. Select “UNUSED”.
   – “UNUSED” is displayed ton the DETAIL EDIT window.



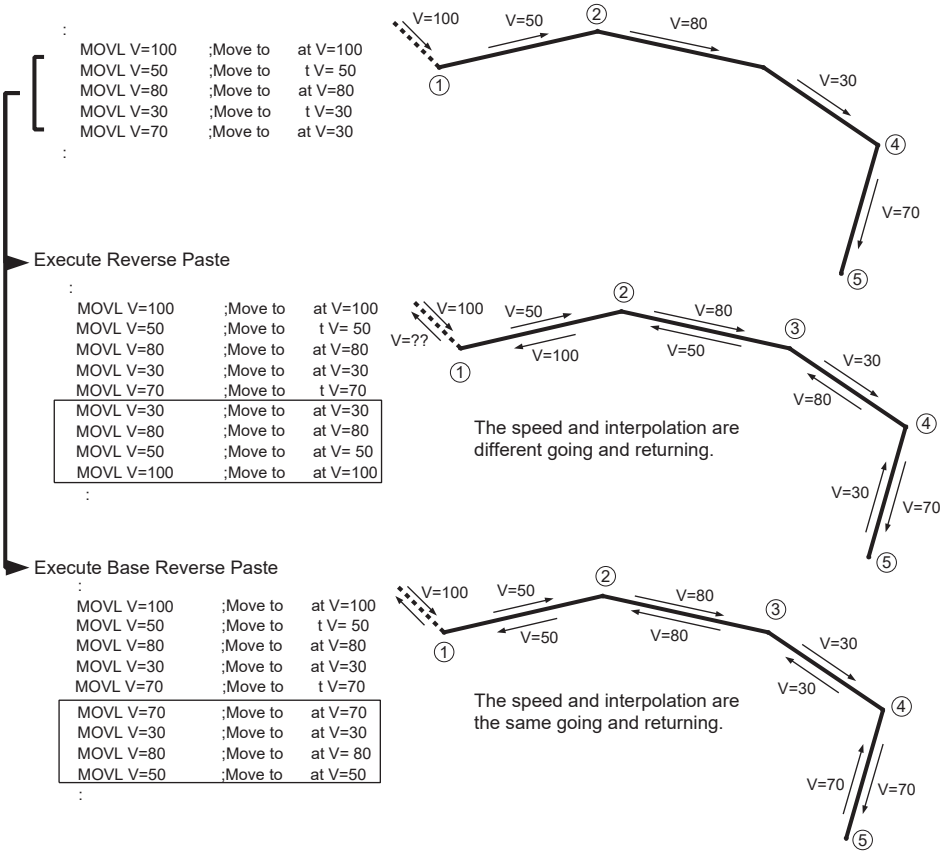
6. Press [ENTER].
   – The DETAIL EDIT window closes, and the JOB CONTENT window appears.
7. Press [ENTER].
   – Contents of the input buffer line are registered on the cursor line of the instruction area.

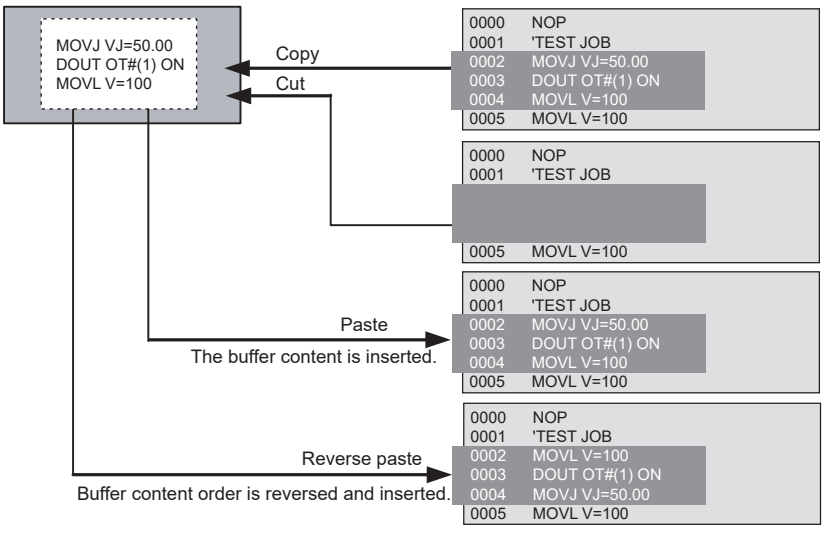


3.7 Editing Jobs

The following five operations are to edit jobs.

Copy	: Copies a specified range to the buffer.
Cut	: Deletes a specified range from a job, and copies it to a buffer.
Paste	: Inserts a content of the buffer into a job.
Reverse Paste	: Reverses the order of the contents of the buffer, and inserts them into a job.
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.

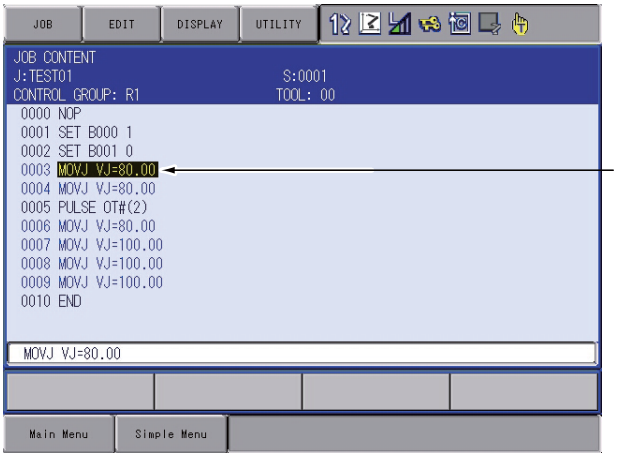




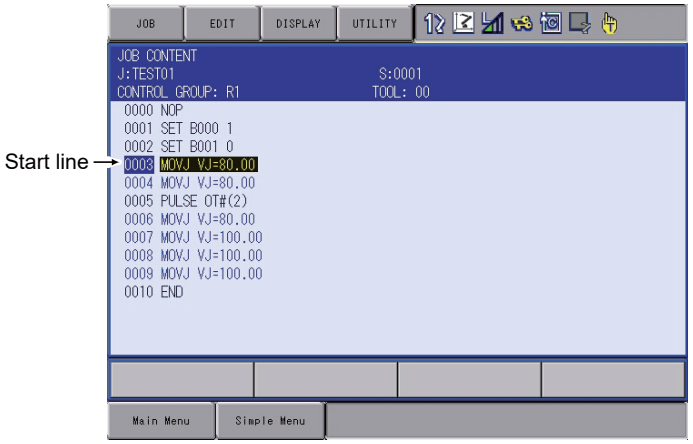
3.7.1 Selecting the Range

After setting the range, copying and deleting can be performed.

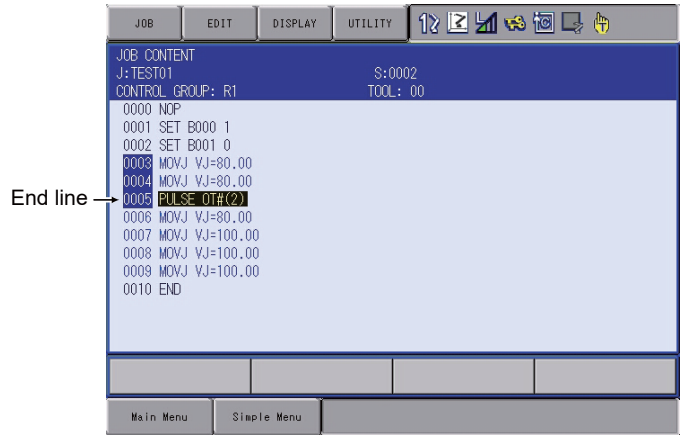
1. Move the cursor to the instruction area in the JOB CONTENT window.



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



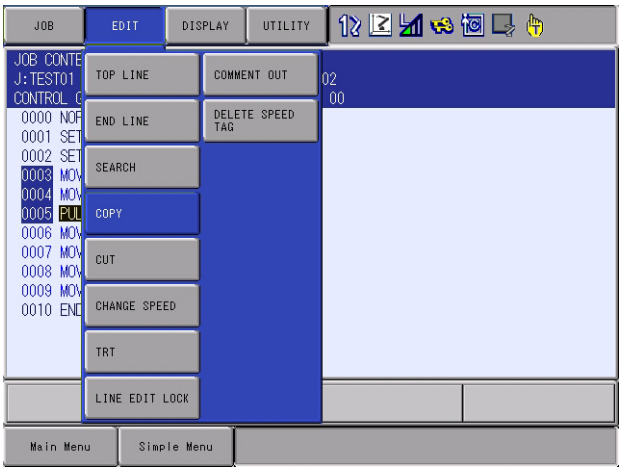
3. Move the cursor to the end line.
   – The range is varied by moving the cursor. Up to the line specified by the cursor is the range.



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.

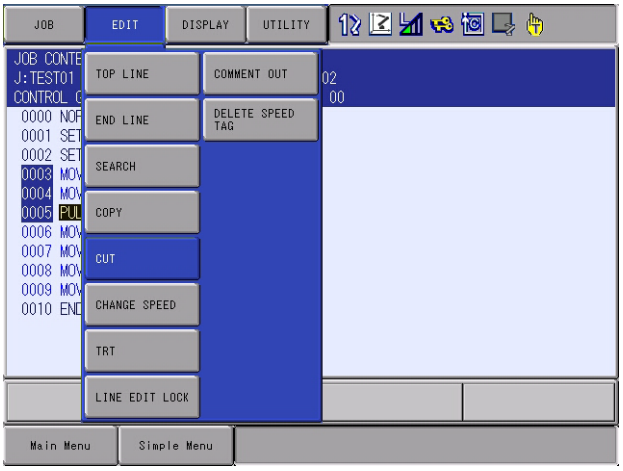


2. Select {COPY}.
   – The specified range is copied to the buffer.

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.



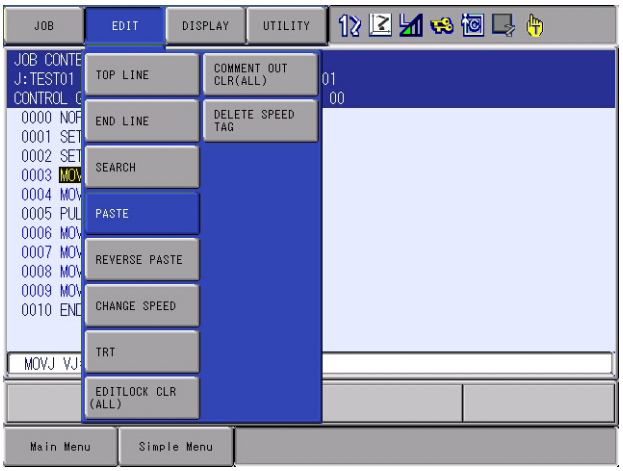
2. Select {CUT}.
   – The confirmation dialog box appears. When “YES” is selected, the specified range is deleted and copied to the buffer.
   – When “NO” is selected, the cutting operation is canceled.



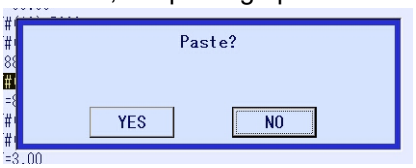
3.7.4 Pasting

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.



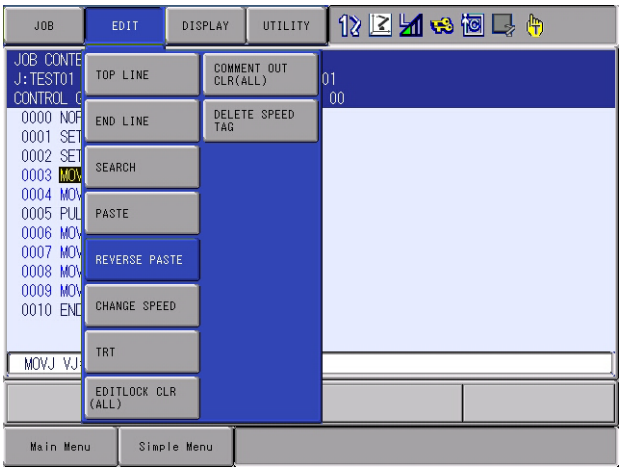
2. Select {EDIT} under the menu.
3. Select {PASTE}.
   – The confirmation dialog box appears.
   – When “YES” is selected, the contents of the buffer are inserted to the job.
   – When “NO” is selected, the pasting operation is canceled.



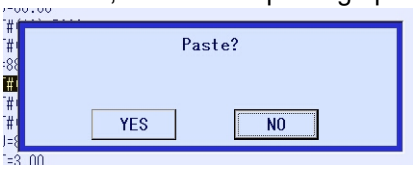
3.7.5 Reverse Pasting

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 canceled.



3.7.6 Commenting Out a Line

The lines in a job can be commented out by specifying line-by-line or multiple lines.

By commenting out a line, the line can be exempted from a target when executing a job.

When modifying or selecting the commented-out line, “ERROR 1012: This line is defined as a comment.” appears.

When performing the conversion operation, such as the parallel shift job conversion, for a job that includes the commented-out line, the conversion operation cannot be performed to the commented-out line.

Followings are the settings for the commented-out line:

- Treated equivalent as a comment instruction.
- Cannot be edited.
- Displayed as a line or a step.
- The set position can be confirmed by using direct open function.
- Exempted from a target for the conversion operation.

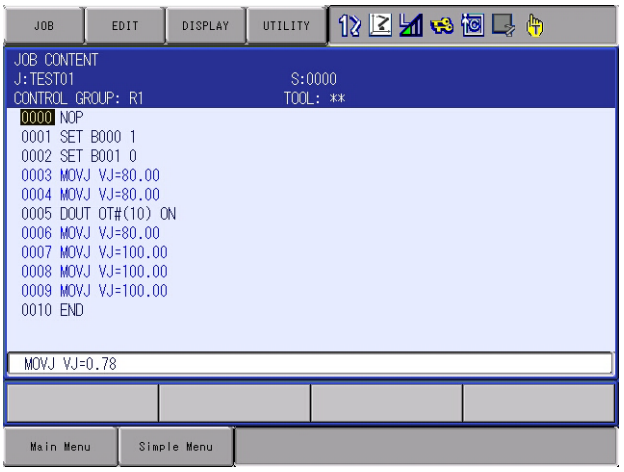
NOP and END cannot be commented out.

SUPPLE-MENT

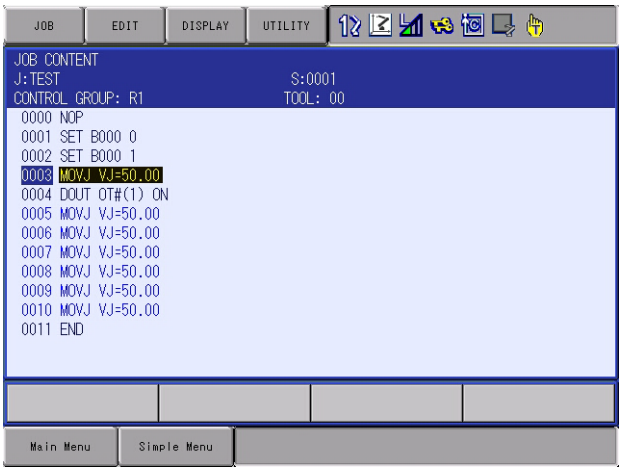
When NOP and END are tried to be commented out, “ERROR 2371: EDIT LOCK/COMMENT functions cannot be applied to NOP and END.” appears.

3.7.6.1 Commenting Out One Line

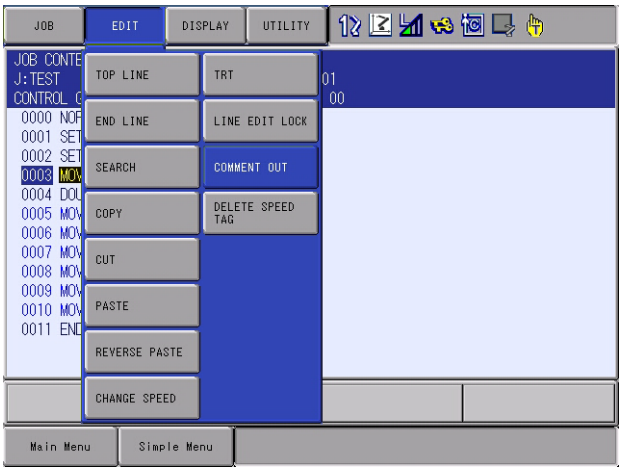
1. Display the {JOB CONTENT} window.
2. Move the cursor to the targeted line.
   – Place the cursor on the line to be commented out.
   – Move the cursor to the right (INST).



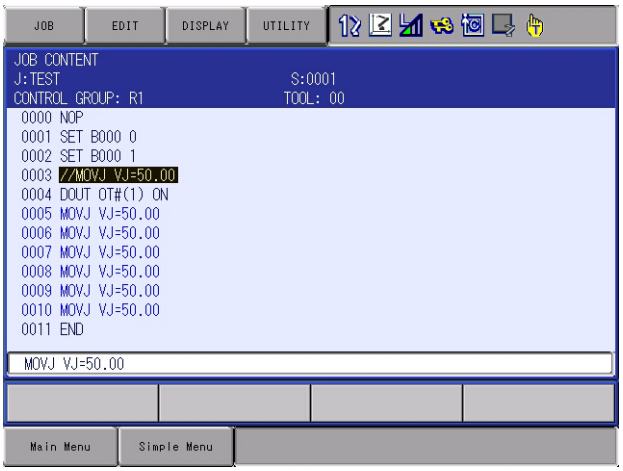
3. Press [SHIFT] + [SELECT].
   – The line is selected.



4. Select {EDIT} → {COMMENT OUT} under the pull-down menu.

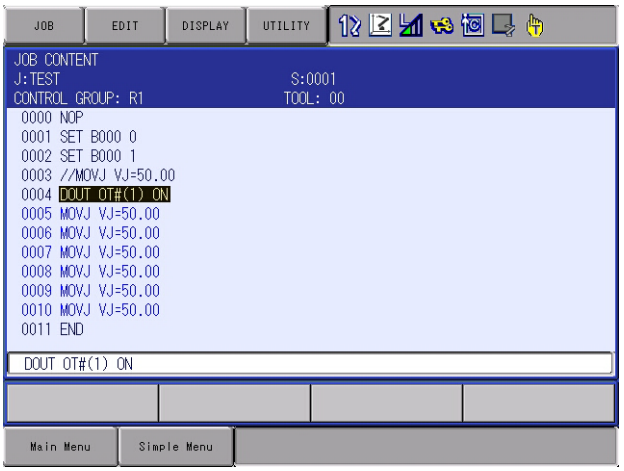


   – The selected line is commented out.
   – "//" is displayed at the head of the selected line.

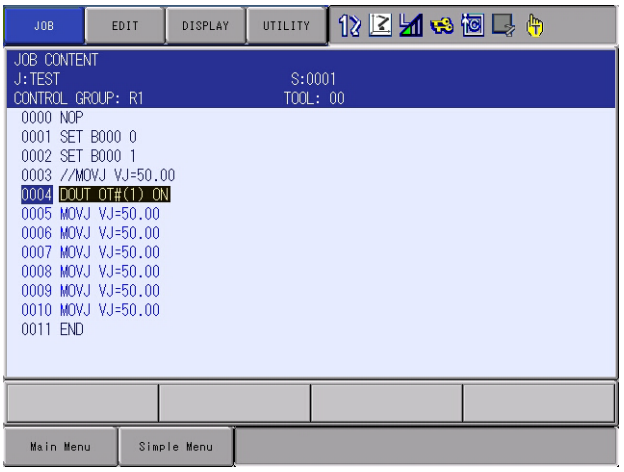


3.7.6.2 Commenting Out Multiple Lines

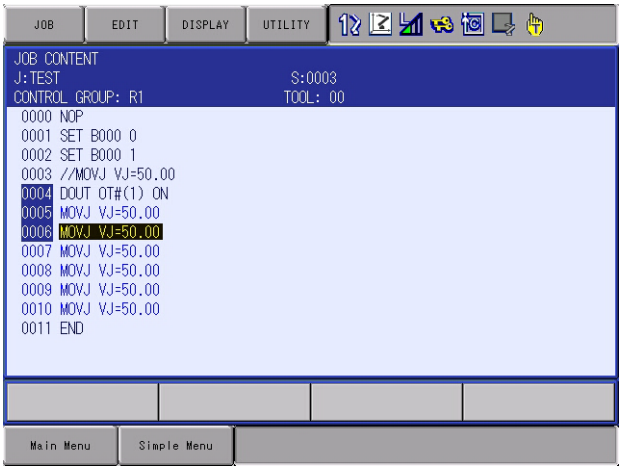
1. Display the {JOB CONTENT} window.
2. Move the cursor to the targeted line.
   – Place the cursor at the head of the line to be commented out.
   – Move the cursor to the right (INST).



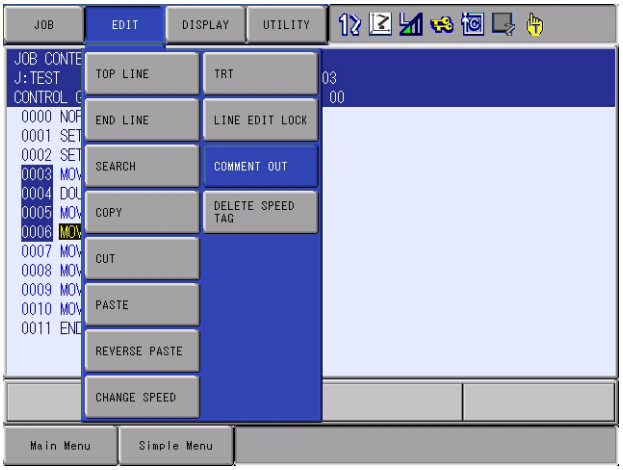
3. Press [SHIFT] + [SELECT].
   – The line is selected.



4. Press[↑] or[↓] to select multiple lines to be commented out.

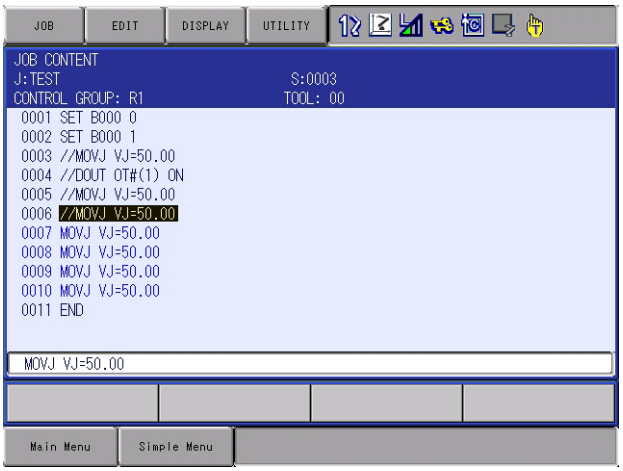


5. Select {EDIT} → {COMMENT OUT} under the pull-down menu.



– The selected lines are commented out.

– “//” is displayed at the head of the selected line.



3.7.6.3 Canceling the Comment Out of One Line

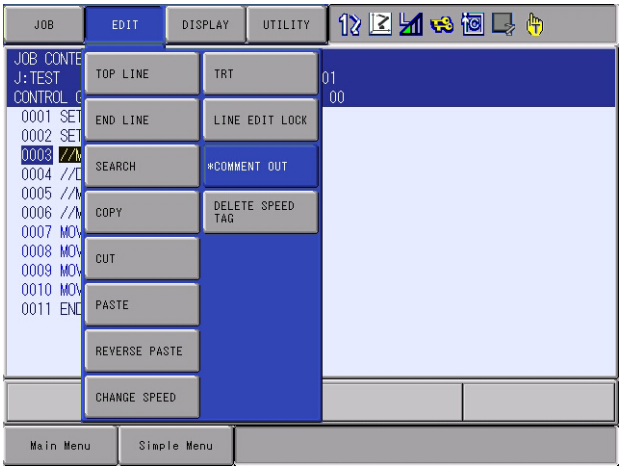
1. Display the {JOB CONTENT OUT} window.
2. Move the cursor to the targeted line.
   – Place the cursor on the line whose comment out is to be canceled.
   – Move the cursor to the right (INST).



3. Press [SHIFT] + [SELECT].
   – The line is selected.



4. Select {EDIT} → {*COMMENT OUT} under the pull-down menu.



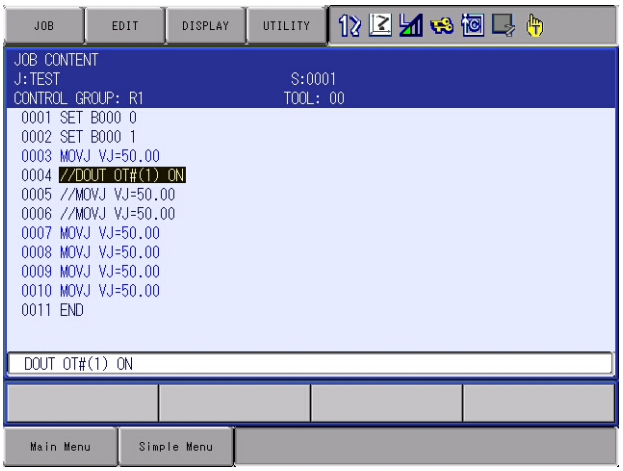
– The comment out of the selected line is canceled.

– “//” at the head of the line disappears.

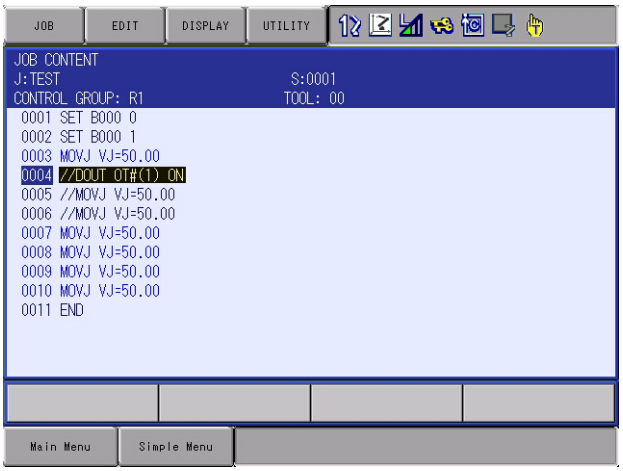


3.7.6.4 Canceling the Comment Out of Multiple Lines

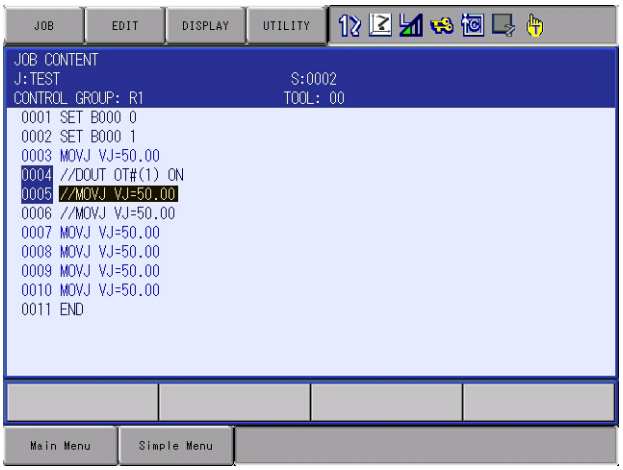
1. Display the {JOB CONTENT OUT} window.
2. Move the cursor to the targeted line.
   – Place the cursor at the head of the line whose comment out is to be canceled.
   – Move the cursor to the right (INST).



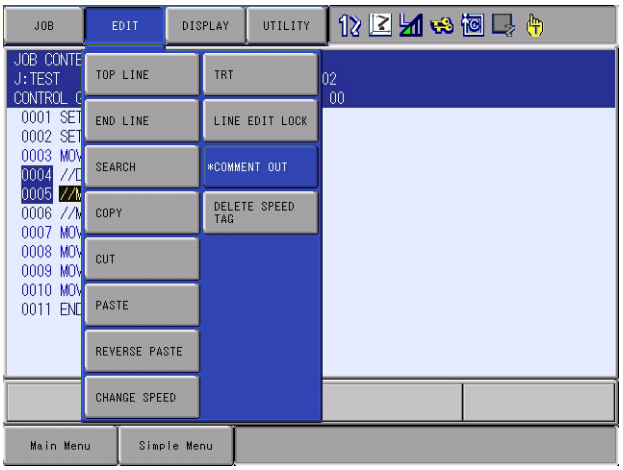
3. Press [SHIFT] + [SELECT].
   – The line is selected.



4. Press [↑] or [↓] to select multiple lines whose comment out is to be canceled.



5. Select {EDIT} → {*COMMENT OUT} under the pull-down menu.

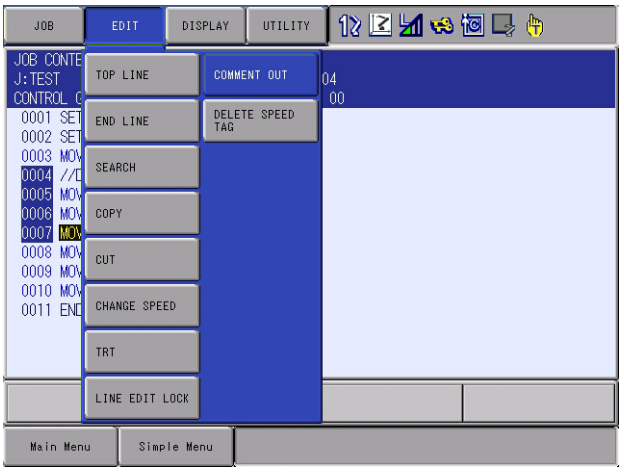


– The comment out of the selected lines is canceled.

– "//" at the head of the line disappears.

SUPPLE-MENT

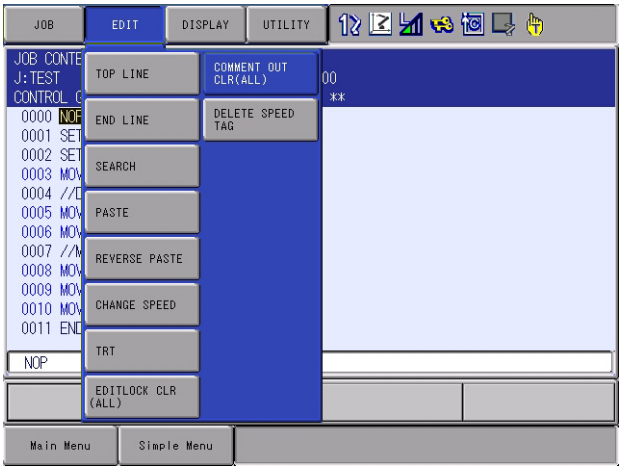
When the lines which are not commented out are included in the selected lines, {COMMENT OUT} (without "*") is displayed in the pull-down menu.



In this case, when {COMMENT OUT} is selected, all the selected lines will be commented out.

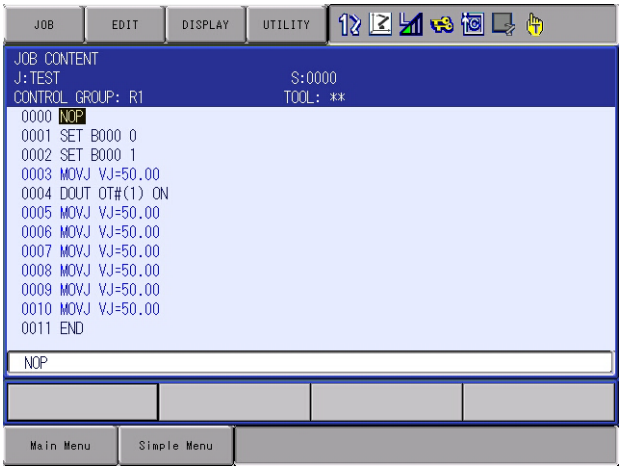
3.7.6.5 Canceling All the Comment Out of Lines

1. Display the {JOB CONTENT} window.
2. Move the cursor to the right (INST).
3. Select {EDIT} → {COMMENT OUT CLR (ALL)} under the pull-down menu.



– The comment out of all the lines of the displayed jobs are canceled.

– "//" at the head of the line disappears.



SUPPLE-MENT

For the following sets of instructions, only one of the instructions cannot be commented out independently. When commenting out, select both of the instructions.

When only one of the instructions are tried to be commented out, "Error 2372: This line cannot be defined as a comment." appears, and the comment out is not executed.

- IFTHEN,ENDIF
- SWITCH,ENDSWITCH

For the following sets of instructions, when one of the instructions is commented out, another instruction will automatically be commented out.

- FOR,NEXT
- WHILE, ENDWHILE

3.7.7 Prohibiting Editing Line-by-Line

The Edit Lock setting can be performed to the jobs line-by-line.

By setting the Edit Lock to a job line, the line will be prohibited from being edited.

When the editing operation, such as changing, deletion, selection, or cutting, is performed to the line to which the Edit Lock is set, “Error 1011: EDIT LOCK is set for this line.” appears.

Also, when the conversion operation such as the parallel shift job conversion is performed to the job including the lines to which the Edit Lock is set, the lines will not be converted.

SUPPLE-MENT

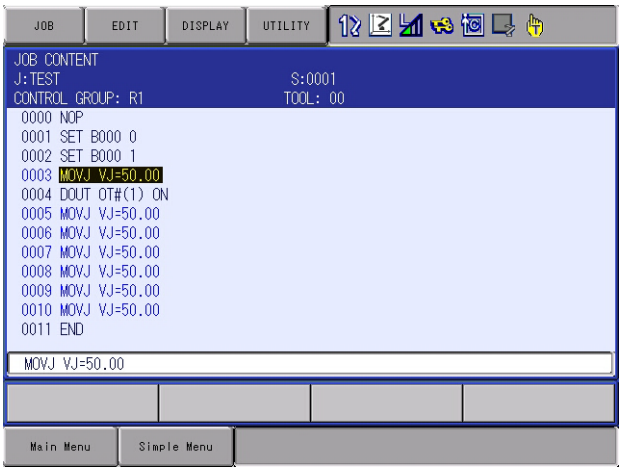
The Edit Lock cannot be set to NOP and END.

When Edit Lock is tried to be set to NOP and END, “ERROR 2371: EDIT LOCK/COMMENT functions cannot be applied to NOP and END.” appears.

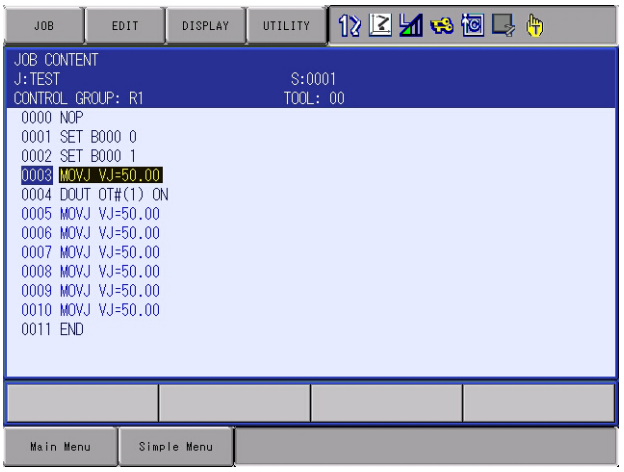
3.7.7.1 Prohibiting Editing One Line

For the Edit Lock operation of one line, follow the procedures below.

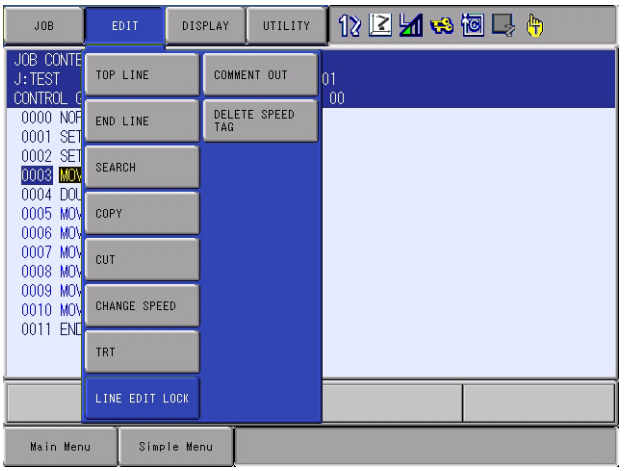
1. Display the {JOB CONTENT} window.
2. Move the cursor to the targeted line.
   – Place the cursor on the line to which the Edit Lock operation is to be performed.
   – Move the cursor to the right (INST).



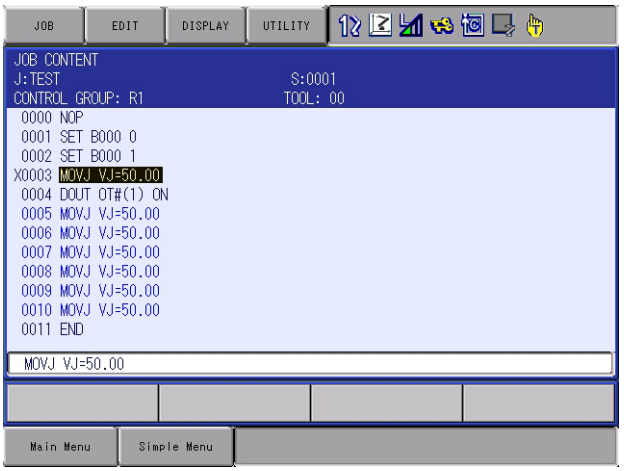
3. Press [SHIFT] + [SELECT].
   – The line is selected.



4. Select {EDIT} → {LINE EDIT LOCK} under the pull-down menu.



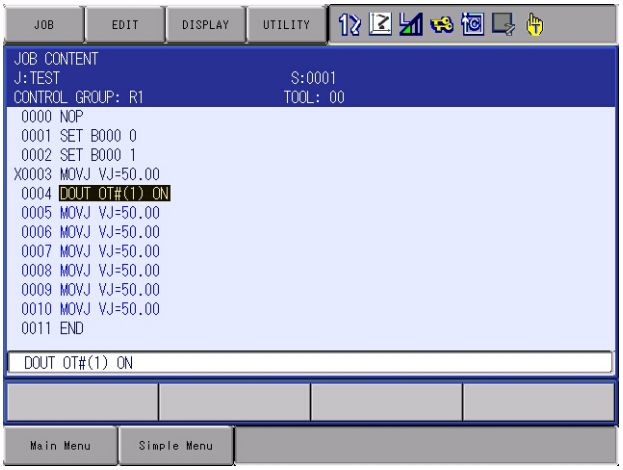
   – The selected line will be prohibited from being edited, and “X” is displayed at the head of the line.



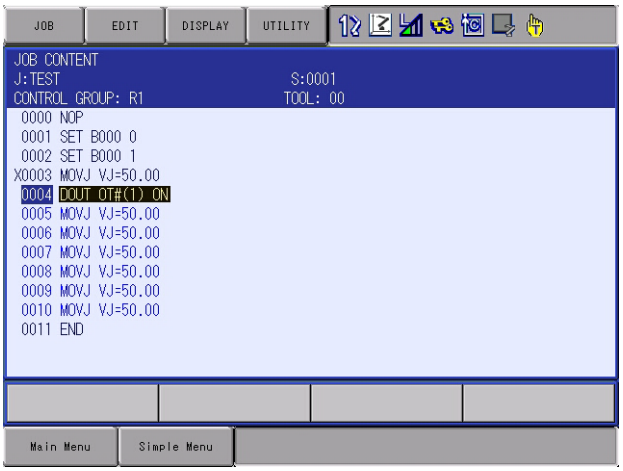
3.7.7.2 Prohibiting Editing Multiple Lines

For the Edit Lock operation of multiple lines, follow the procedures below.

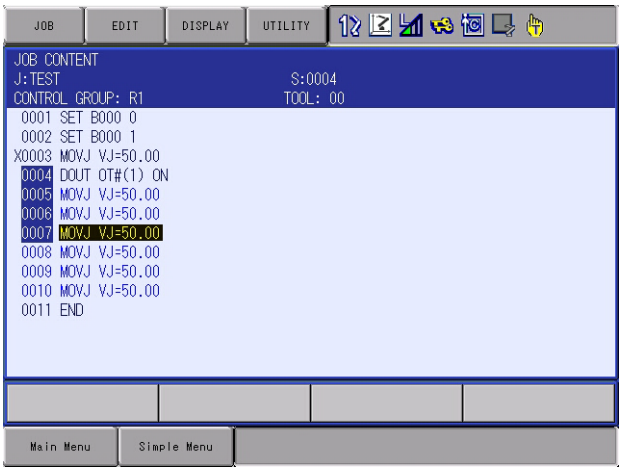
1. Display the {JOB CONTENT} window.
2. Move the cursor to the targeted line.
   – Place the cursor at the head of the line to which the Edit Lock operation is to be performed.
   – Move the cursor to the right (INST).



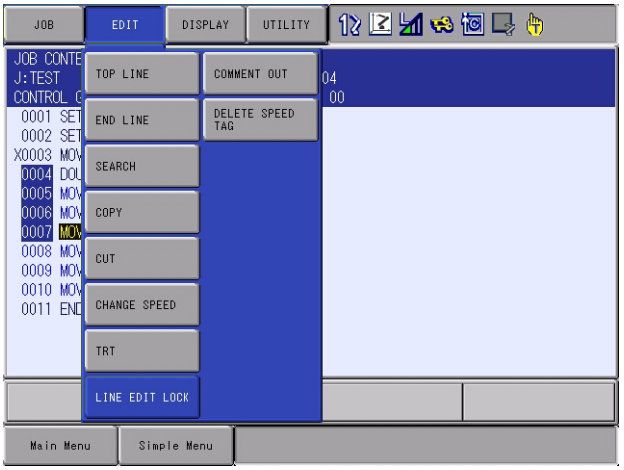
3. Press [SHIFT] + [SELECT].
   – The line is selected.



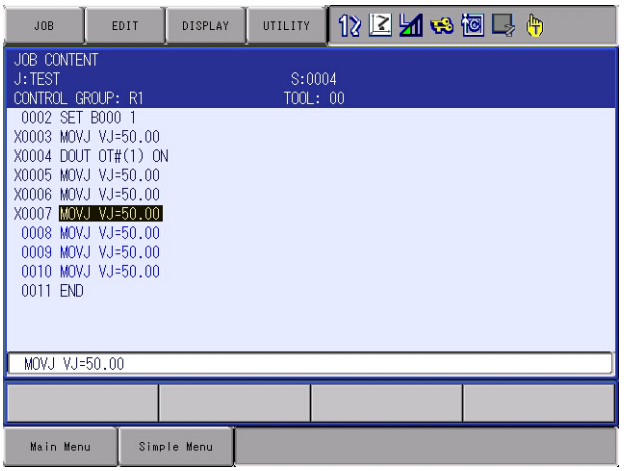
4. Press [↑]] or [↓] to select multiple lines to which the Edit Lock operation is to be performed.



5. Select {EDIT} → {LINE EDIT LOCK} under the pull-down menu.



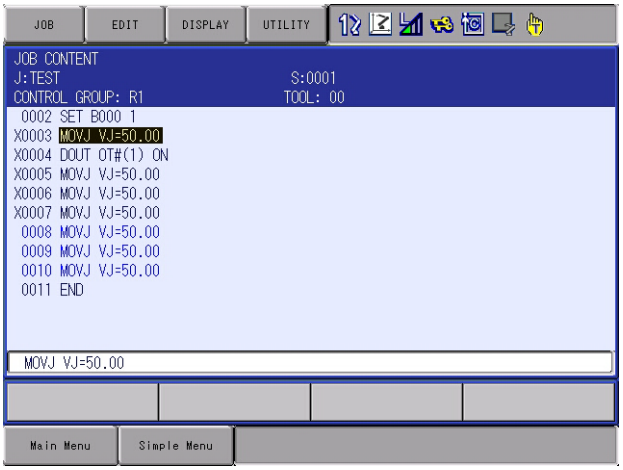
– The selected line will be prohibited from being edited, and “X” is displayed at the head of the line.



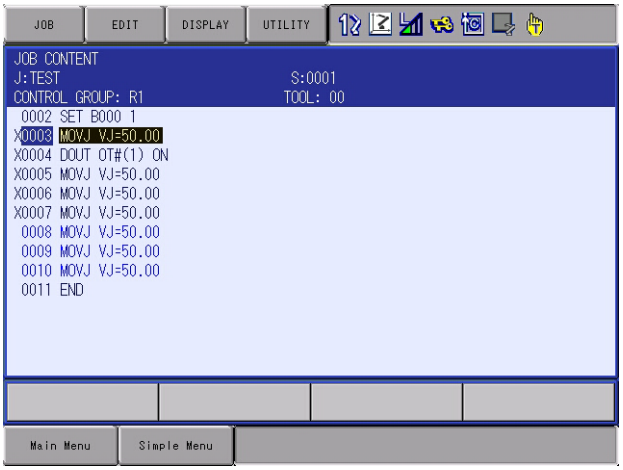
3.7.7.3 Canceling the Edit Lock of One Line

For canceling the Edit Lock of one line, follow the procedures below.

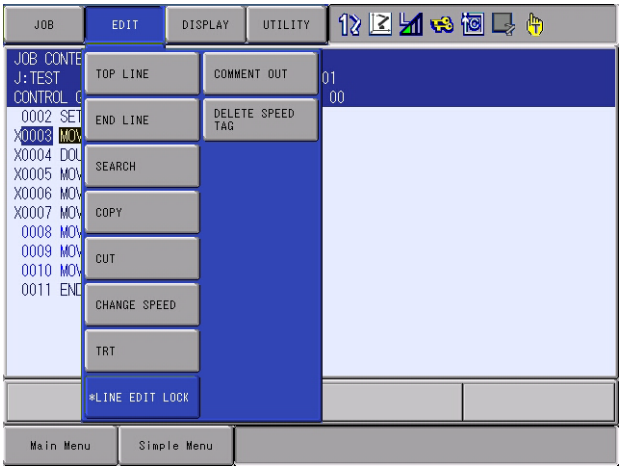
1. Display the {JOB CONTENT} window.
2. Move the cursor to the targeted line.
   – Place the cursor on the line whose Edit Lock is to be canceled.
   – Move the cursor to the right (INST).



3. Press [SHIFT] + [SELECT].
   – The line is selected.

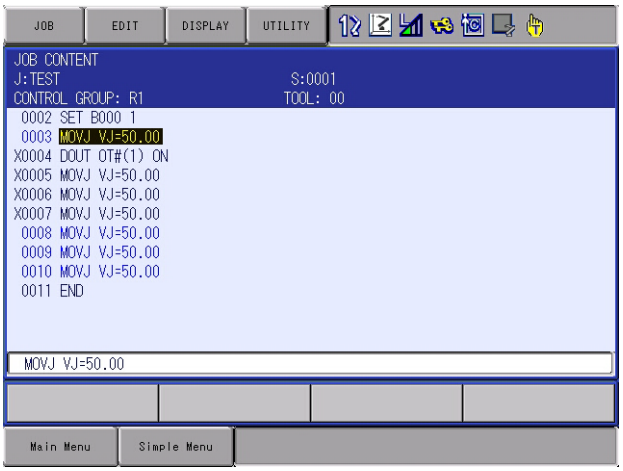


4. Select {EDIT} → {*LINE EDIT LOCK} under the pull-down menu.



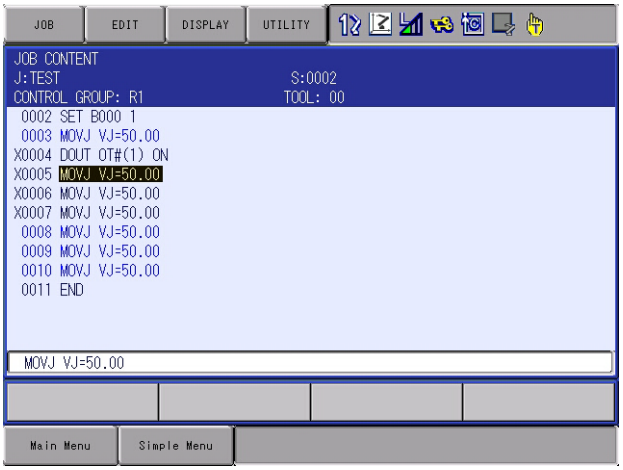
– The Edit Lock of the selected line is canceled.

– “X” at the head of the line disappears.

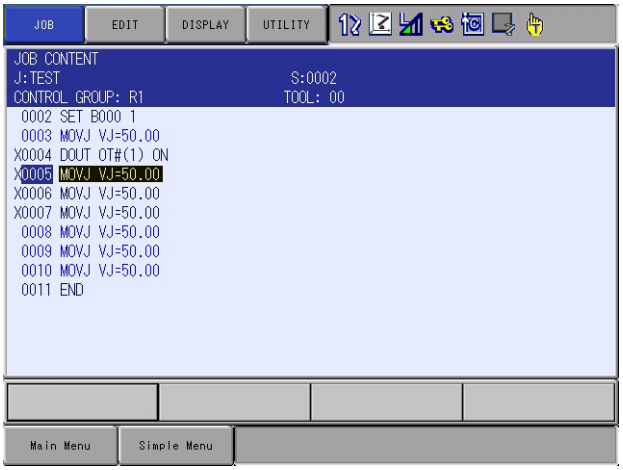


3.7.7.4 Canceling the Edit Lock of Multiple Lines

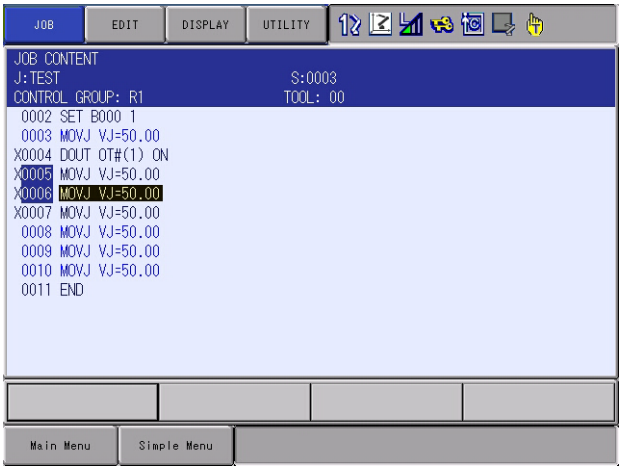
1. Display the {JOB CONTENT} window.
2. Move the cursor to the targeted line.
   – Place the cursor at the head of the line whose Edit Lock is to be canceled.
   – Move the cursor to the right (INST).



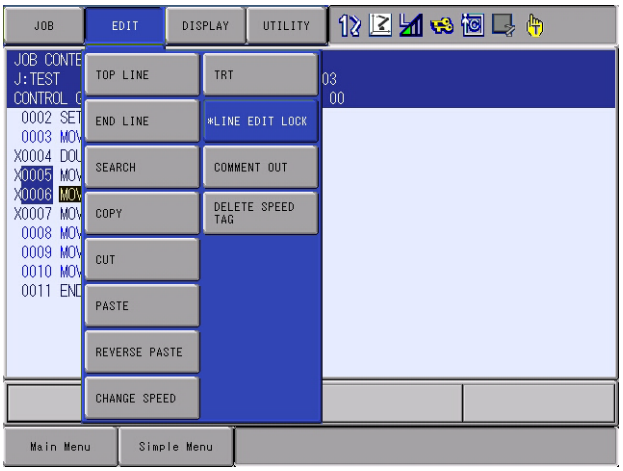
3. Press [SHIFT] + [SELECT].
   – The line is selected.



4. Press [↑]or [↓] to select multiple lines whose Edit Lock is to be canceled.



5. Select {EDIT} → {*LINE EDIT LOCK} under the pull-down menu.



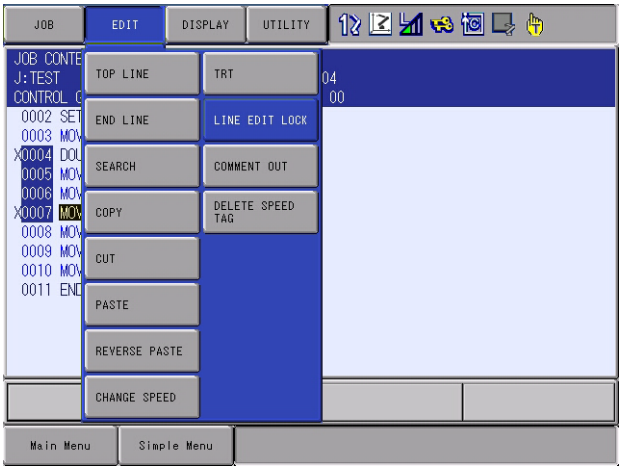
– The Edit Lock of the selected lines is canceled.

– “X” at the head of the line disappears.



SUPPLE-MENT

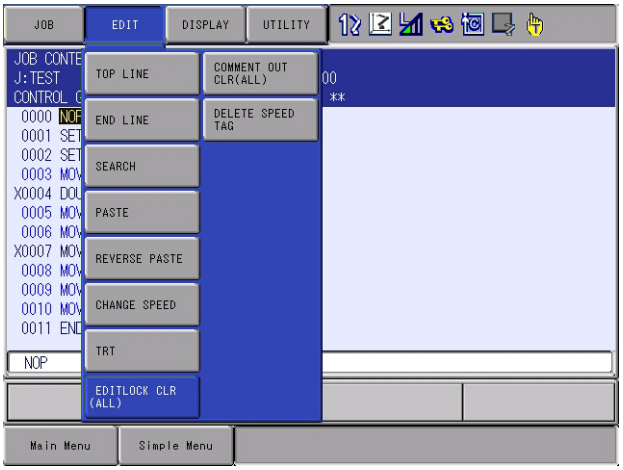
When the lines to which the Edit Lock is not set are included in the selected lines, {LINE EDIT LOCK} (without “*”) is displayed in the pull-down menu.



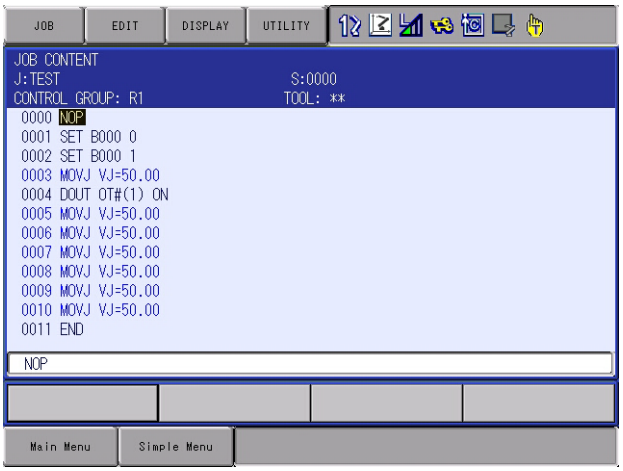
In this case, when {LINE EDIT LOCK} is selected, the Edit Lock will be set to all the selected lines.

3.7.7.5 Canceling All the Edit Lock of Lines

1. Display the {JOB CONTENT} window.
2. Move the cursor to the right (INST).
3. Select {EDIT} → {EDITLOCK CLR (ALL)} under the pull-down menu.



– The Edit Lock of all the lines is canceled, and the displayed “X” disappears.



3.8 Test Operations

Playback operations can be simulated in 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 play mode.

NOTE

- 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 play mode.
- Work instruction output such as TOOLON 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.

NOTE

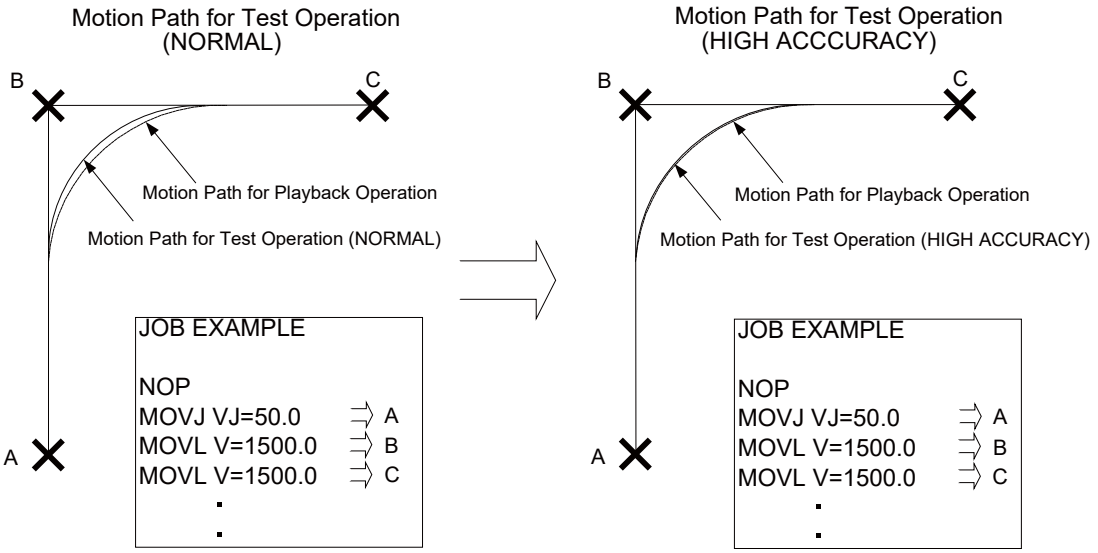
Always check safety conditions before starting the manipulator in motion.

3.8.2 Test Operation (High Accuracy)

3.8.2.1 Test Operation (High Accuracy)

In test operation (high accuracy), the motion path of the manipulator's control point for playback operation in the taught speed (speed override: 100%) is simulated by executing "test operation".

The repetitive accuracy of the motion path in test operation (high accuracy) had been greatly improved in comparison with the conventional test operation (normal).



SUPPLE -MENT For the "test operation", refer to *chapter 3.8.1 "Test Operation Procedures"* .

NOTICE

Following functions cannot be simulated in the test operation (high accuracy).

- Weaving function
- Twin/triple coordinated control function
- Conveyor synchronized function

When the functions above are tried to be executed in test operation (high accuracy), the alarm "4909 TEST RUN(HIGH ACCURACY) ERROR" occurs. As for the functions above, operate in the test operation (normal).

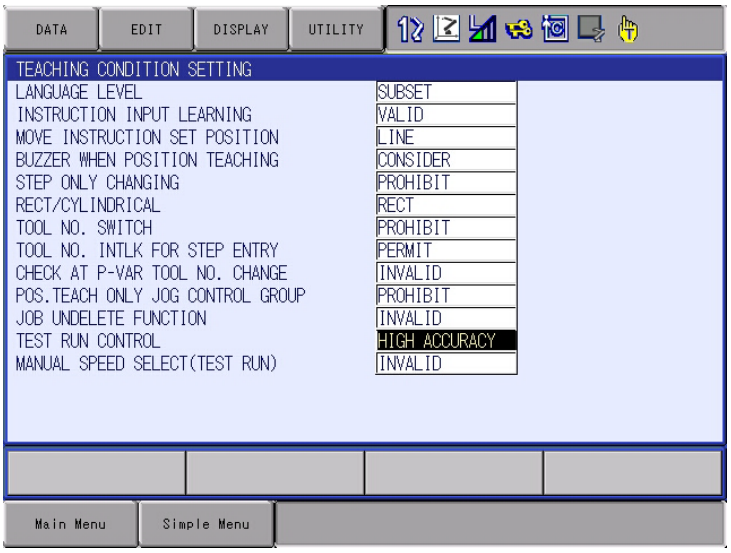
NOTE

The switching position of the cursor is different in test operation (high accuracy) and in test operation (normal).

Before performing the job editing (add or modify teaching position) or back operation after the test operation (high accuracy) is interrupted, make sure to check the cursor position.

3.8.2.2 Setting Method

1. Select {SETUP} under the main menu → {TEACHING CONDITION SETTING}.
2. Move the cursor to the “TEST RUN CONTROL” and select “HIGH ACCURACY”. (“NORMAL” and “HIGH ACCURACY” are displayed alternately.)
   “HIGH ACCURACY” is for test operation (high accuracy) and “NORMAL” is for the conventional test operation.



By executing “test operation” after the setting above, test operation (high accuracy) is started.

3.9 Other Job-editing Functions

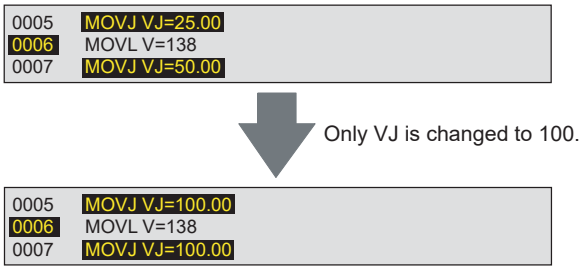
3.9.1 Editing Play Speed

There are two ways to modify play speed:

- Modification of Speed Type
- Relative Modification

3.9.1.1 Modification of Speed Type

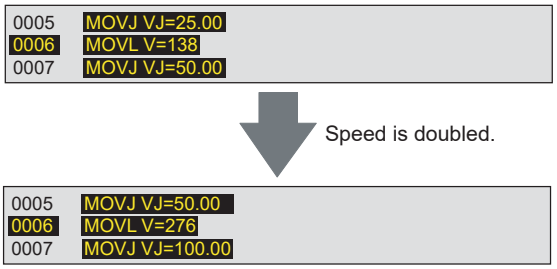
This method is used to modify the speed type (such as VJ, V, VR, etc.)



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

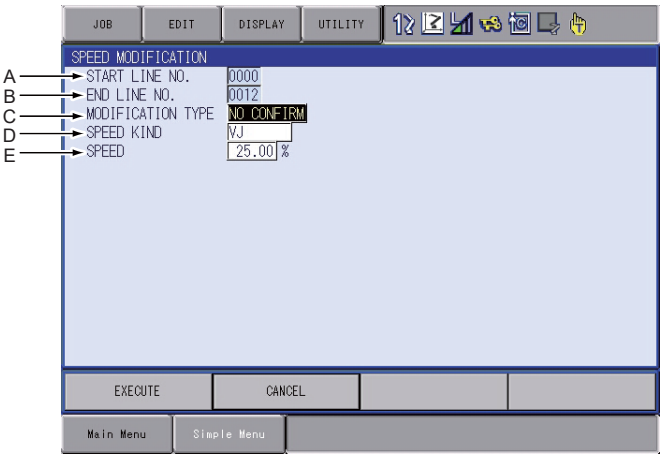
3.9.1.2 Relative Modification

All steps are selected for the play speed VJ, V,VR, VE. 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.
5. Select {EDIT} under the menu.
6. 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, the selection dialog box appears. Select the speed type to be changed.

To perform the relative modification of the play speed, select “RELATIVE”.

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.

3.9.1.3 Modification by TRT (Traverse Time)

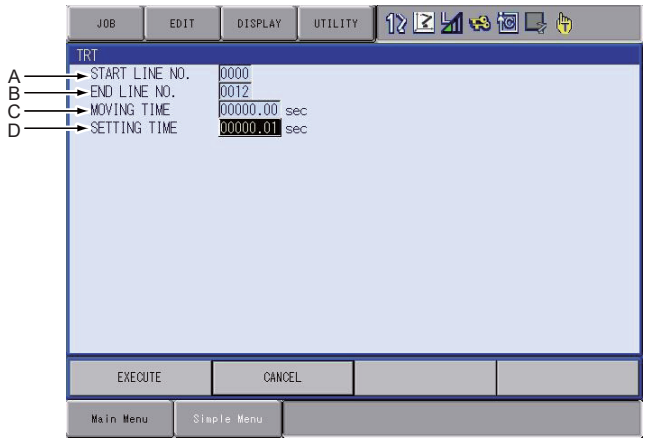
Modifications made by TRT have the following characteristics:

- 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.

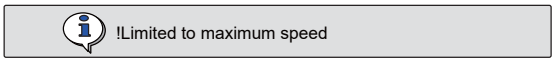
C. MOVING TIME
The weaving time needed to move from the first number to last number is measured and displayed.

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].

8. Select “EXECUTE”.
   – The speed is changed according to the setting.

NOTE

- If an instruction which includes specific speed data such as SPEED exists in the specified section, the speed data for those steps are not changed. Also, the speed which is set to the play speed VMAX is 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.

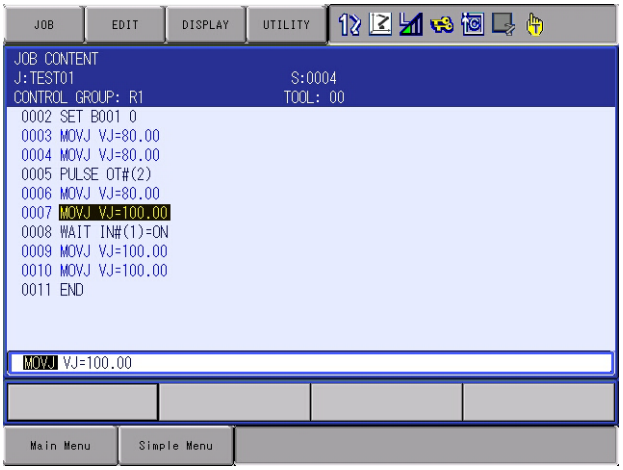


- The line to which the Edit Lock function is set or the comment out is performed cannot be changed.
  (For details, refer to *chapter 3.7.6 “Commenting Out a Line”* and *chapter 3.7.7 “Prohibiting Editing Line-by-Line”* .)

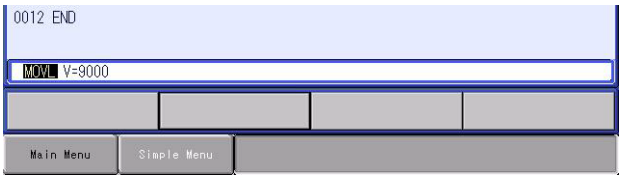
3.9.2 Editing Interpolation Type

To modify the interpolation type of an already registered instruction, use the interpolation modification function.

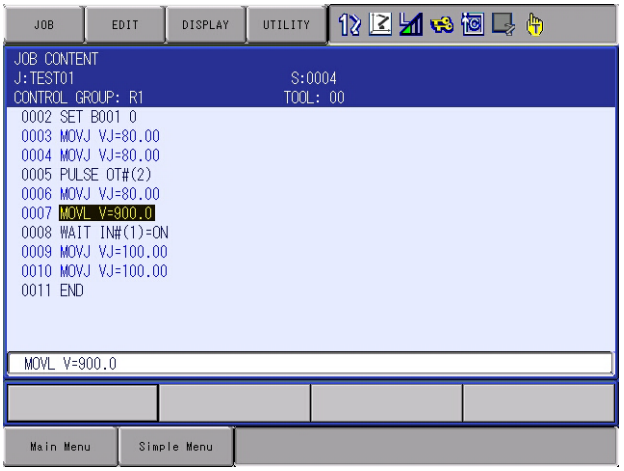
1. Select {JOB} under the main menu.
2. Select {JOB}.
   – The JOB CONTENT window appears.
3. Move the cursor to the instruction area.
4. Select the line to be modified.
   – The instruction on the cursor is displayed in the input buffer line.



5. Press [SHIFT] + the cursor 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
   (e.g.)
   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.

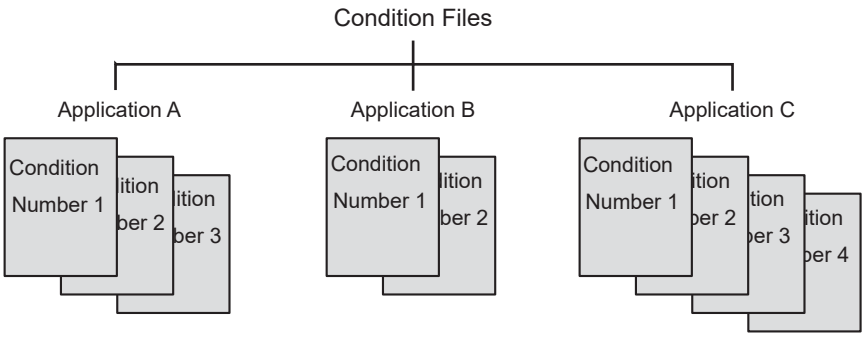


3.9.3 Editing Condition Files

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.

NOTE Regarding the contents and editing methods of the condition file, refer to *chapter 9 “Material Handling, Press Tending, Cutting, and Other Applications”* .



3.9.4 User Variables

User variables are used to temporarily store counters, calculation results, or input signals in the job. The user variables can be freely defined in the job. Since the same user variables can be used in multiple jobs, save the numerical values as common references for the jobs. 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 3-4: 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.
Boolean type (flag)	FL000 to FL1023 (1024)	Storable values are ON and OFF.
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. Teaching line coordinates system cannot be used.
	BP000 to BP127 (128)	
	EX000 to EX127 (128)	
Timer variable	TM000 to TM059 (60)	Range of storable values is from -2147483648 to 2147483647.

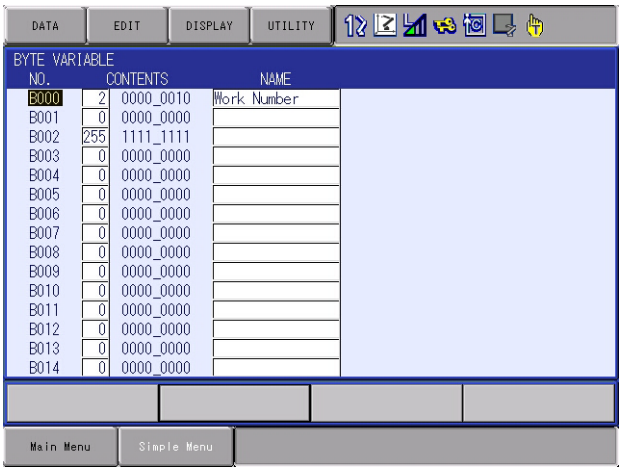
* For the timer variable, refer to *chapter 6.17.2 “Timer Variable”* .

NOTE

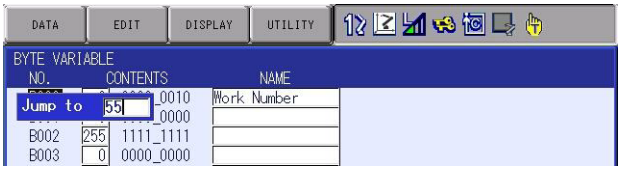
- **Play Speed V:**
  MOVL V = I000
  The variable I000 is used for speed V with this move instruction.
  The unit for V is 0.1 mm per second.
  For example, if I000 is set to 1000, the following is true:
  I000 = 1000 → unit for V is 0.1 mm/s → V = 100.0 mm/s
  Note that, depending on the unit being used, the value of the variable and the value of the actual speed may not be the same.
- **Play Speed VJ:**
  MOVL VJ = I000
  The unit for VJ is 0.01%.
  For example, if I000 is set to 1000, the following is true:
  I000 = 1000 → unit for VJ is 0.01% → VJ = 10.00%
- **Timer T:**
  TIMER T = I000
  The unit for T is 0.01 seconds.
  For example, if I000 is set to 1000, the following is true:
  I000 = 1000 → unit for T is 0.010 sec → T = 10.000 sec

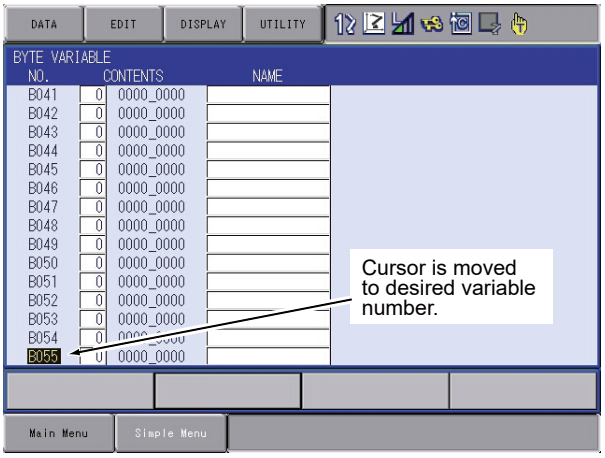
3.9.4.1 Setting Byte, Integer, Double Precision Integer, and Real Type Variables

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.)

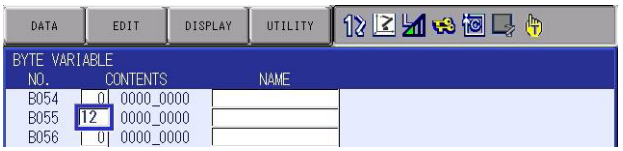


3. Move the cursor to the desired variable No.
   – When the desired variable number is not displayed, move the cursor with either of the following operations.
     • Move the cursor on the variable No. and press [SELECT]. Then input the variable No. using the [Numeric Keys] and press [ENTER].
     •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

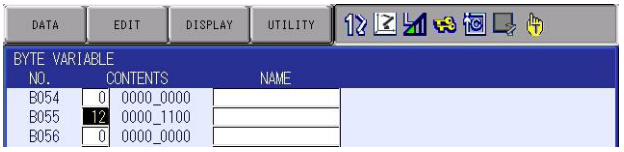




4. Move the cursor to the data of the variable.
   – The number can be directly typed.
5. Input the desired number.

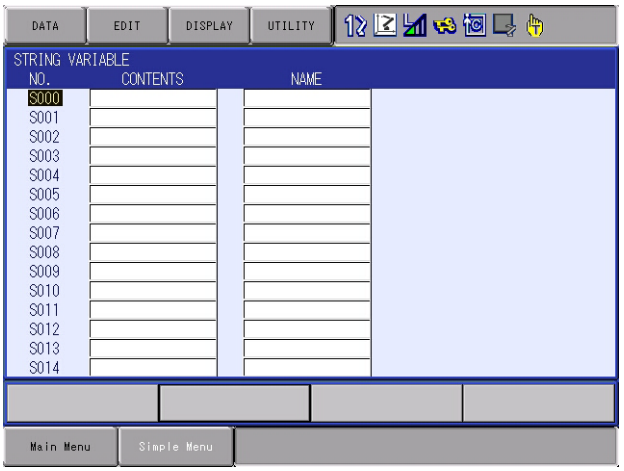


6. Press [ENTER].
   – Input value is set to the variable on the cursor position.



3.9.4.2 Setting Character Type Variables

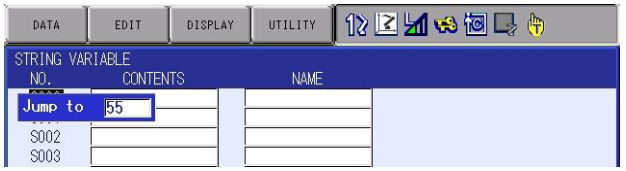
1. Select {VARIABLE} under the main menu.
2. Select {STRING}.
   – The STRING VARIABLE window appears.

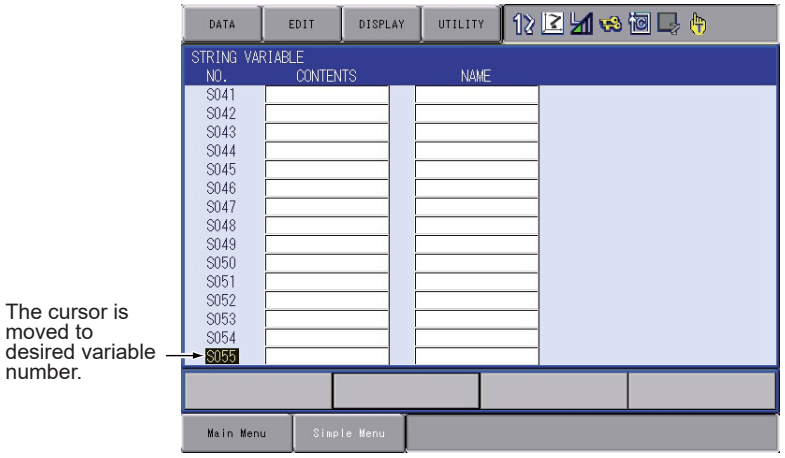


3. Move the cursor to the desired variable No.
   – When the desired variable number is not displayed, move the cursor with either of the following operations.

   • Move the cursor on the variable No. and press [SELECT]. Then input the variable No. using the [Numeric Keys] and press [ENTER].

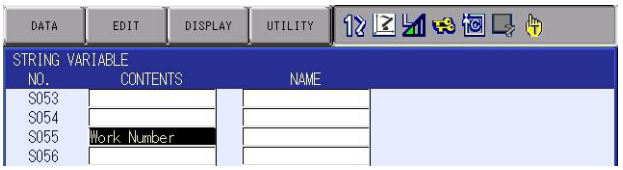
   • Move the cursor to the menu area and select {EDIT} → {SEARCH}. Then input the variable No. with the [Numeric Keys] and press [ENTER]





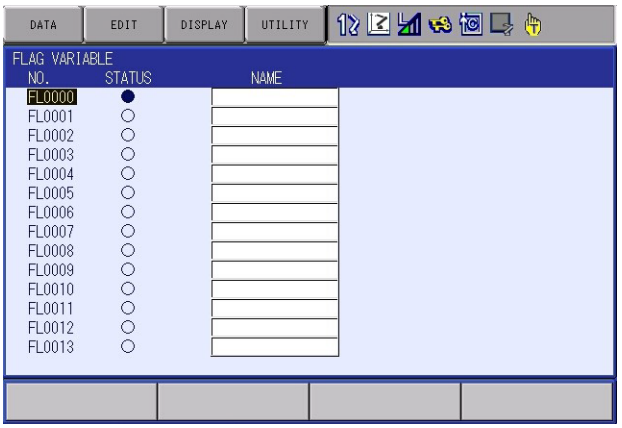
4. Move the cursor to the data of the variable.
   – The characters can be directly typed.

5. Input the desired characters.
   – For information on character input operation, refer to *chapter 1.2.6 "Character Input Operation"* .
6. Press [ENTER].
   – The input characters are set to the variable on the cursor position.



3.9.4.3 Setting Boolean Type (Flag) Variables

1. Select {VARIABLE} under the main menu.
2. Select {FLAG}.
   – The FLAG VARIABLE window appears.



3. Move the cursor to the desired variable No. to change.
   – Move the cursor to the STATUS ("○" or "●") of the variable to change.
4. Press [INTERLOCK] + [SELECT].
   – The STATUS is changed.
   (●: ON, ○: OFF)

S2C1253: FLAG STATUS WHEN CONTROL POWER IS ON

SUPPLE -MENT

Follow the procedure below to change the status of the flags.

0: Reset to the power OFF state (Default)

1: Initialized (all flags OFF)

3.9.4.4 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.

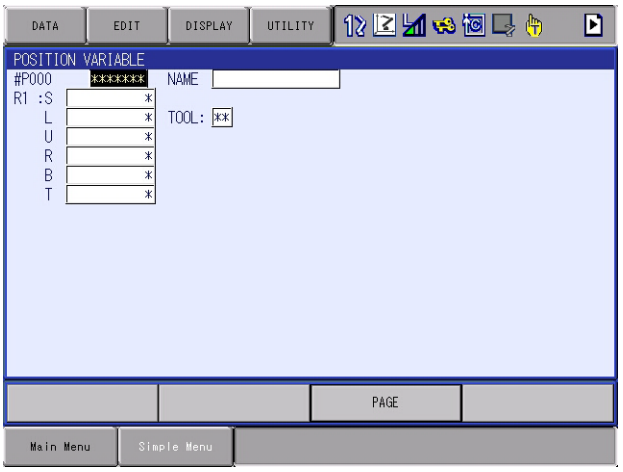
> SUPPLE-MENT
> Refer to *chapter 1.2.6 “Character Input Operation”* for the character input operation.

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

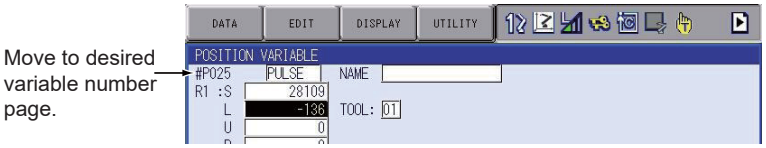


3.9.4.5 Displaying Position Variables

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. Move to a page with the objective variable number.
   – When the desired variable number is not displayed, move the cursor with either of the following operations.
   • Press [PAGE] or [SHIFT] + [PAGE].
   • Press page button, 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].



3.9.4.6 Setting Position Variables

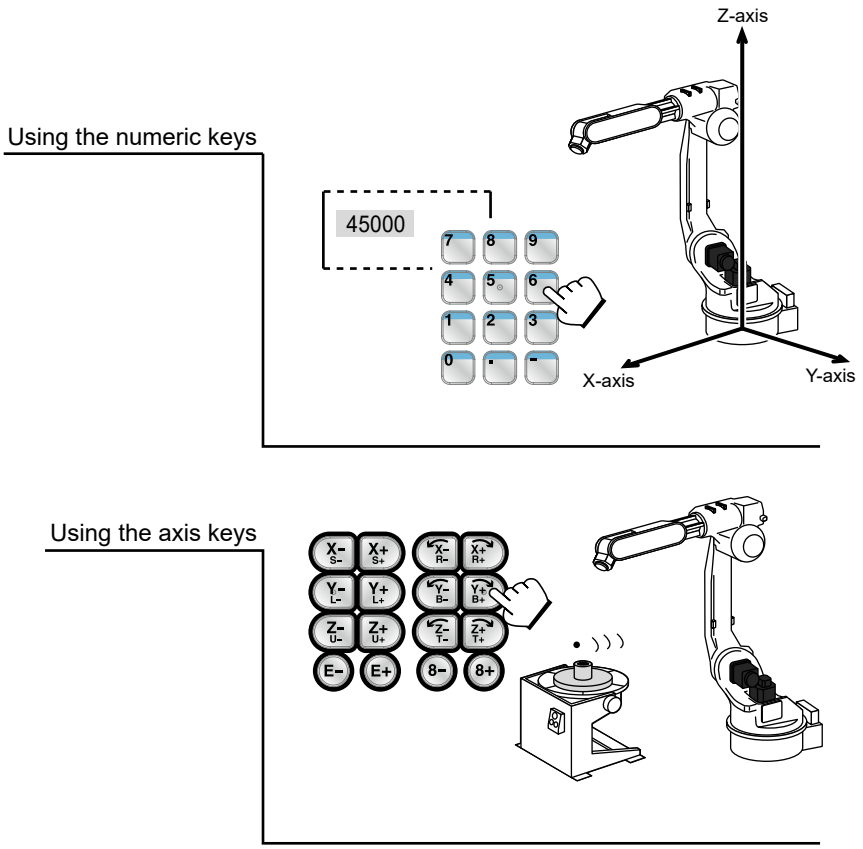
The following table shows the types of position variables and setting methods.

NOTE

- The setting of position variables is done in teach mode.
- Turn the servo power ON when setting the variables with the [Axis Keys].

Table 3-5: Types of Position Variables and Setting Method

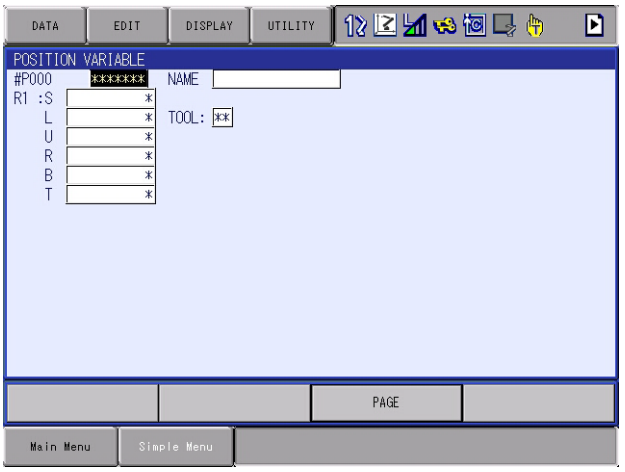
Type	Pxxx (Robot)		BPxxx (Base)		EXxxx (Station)
	Pulse Type	XYZ Type	Pulse Type	XYZ Type	Pulse Type
Setting Method		Select coordinates from base, robot, user, etc.			



3.9.4.7 Setting Position Variables Using the Numeric Keys

■ **Pulse Type**

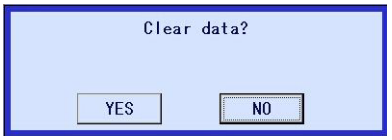
1. Select {VARIABLE} under the main menu.
2. Select desired position variable type.
   – The desired variable window appears (robot, base, or station). (The POSITION VARIABLE window is used for this example.)



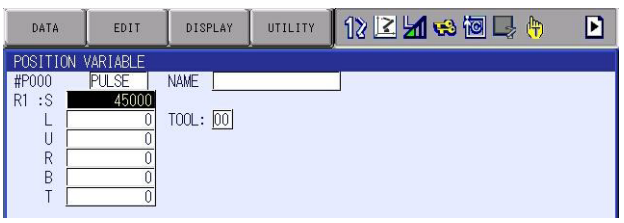
3. Select the variable data type.
   – The selection dialog box appears.



   – 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.

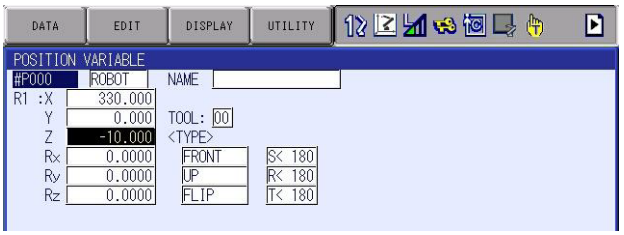


■ XYZ Type

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

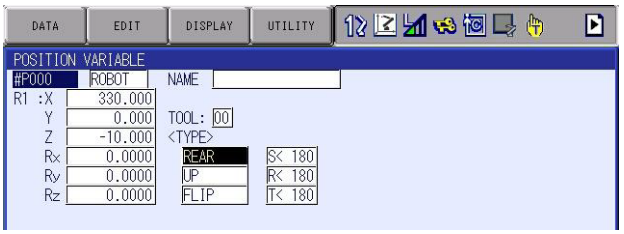


4. Select desired coordinates except PULSE.
5. Move the cursor to desired data to be input and press [SELECT].
6. Input the value.
7. Press [ENTER].
   – The value is set in the cursor position.



(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 3.9.4.11 “Manipulator Types”* .
  Current Position Window (XYZ) shows the current setting of a type.

3.9.4.8 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→R2.

   • Base or Station
   Each time [SHIFT]+[EX.AXIS] is pressed, the axis displayed on the status line changes:
   B1→B2→S1→S2→S3.

   (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].
6. 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.

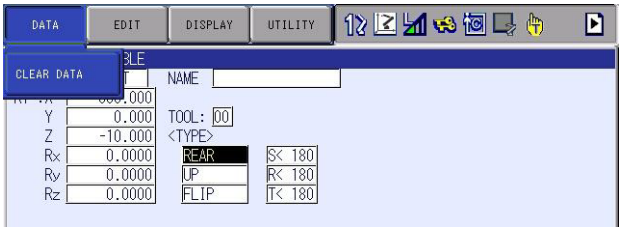
   • **Robot**
   Each time [SHIFT] + [ROBOT] is pressed, the axis displayed on the status line changes:
   R1→R2.

   • **Base or Station**
   Each time [SHIFT]+[EX.AXIS] is pressed, the axis displayed on the status line changes:
   B1→B2→S1→S2→S3.

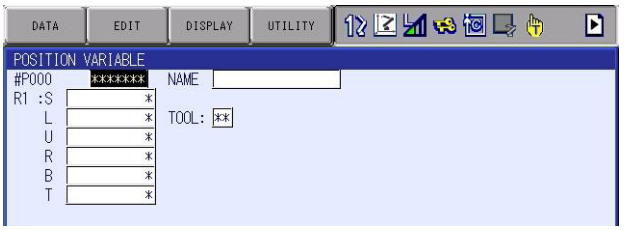
   (2) Check the selected axis on the status line.
3. Move the manipulator with the [Axis Keys].
   – Move the manipulator or the external axis to the desired position to be set to position variable.
4. Press [MODIFY].
5. Press [ENTER].

3.9.4.9 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.



3.9.4.10 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→R2.

   • **Base or Station**
   Each time [SHIFT]+[EX.AXIS] is pressed, the axis displayed on the status line changes:
   B1→B2→S1→S2→S3.

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

NOTE The selected axis (manipulator, base, or station) moves directly to the set variable position.
Before pressing [FWD], check that the surrounding area is safe.

3.9.4.11 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.

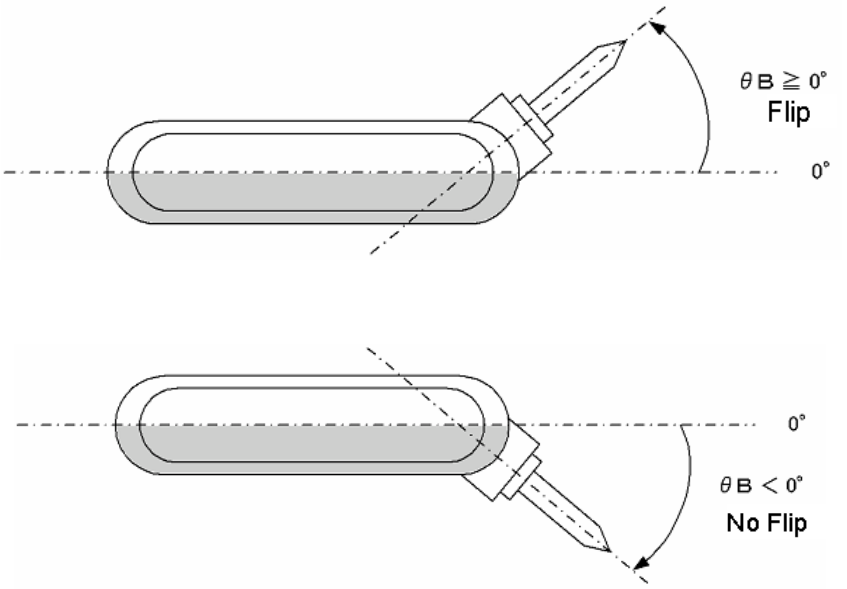
Thus, the manipulator's posture cannot be uniquely defined only by the coordinate value, and it is necessary to specify the data other than the coordinate value to define the manipulator's posture.

This is called "Type".

Type varies depending on the manipulator model.

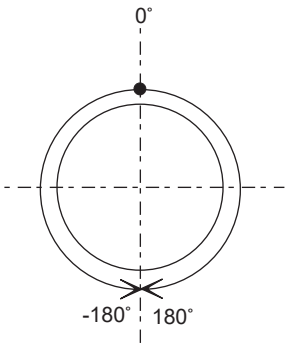
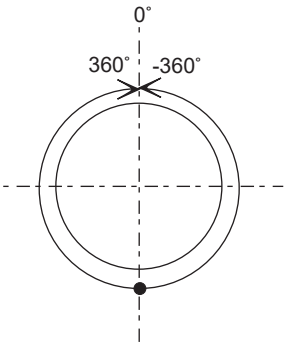
3.9.4.12 Flip/No Flip

When the angle of B-axis is within (+) range (θB ≥ 0°), it is called “Flip”, and when within (-) range (θB < 0°), “No Flip”.



3.9.4.13 R-Axis Angle

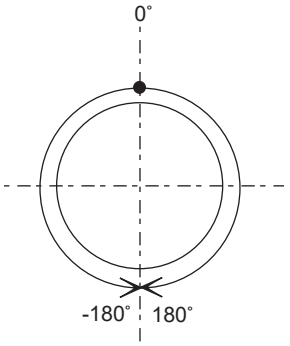
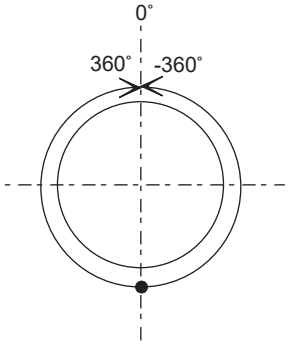
This specifies whether the R-axis angle is less than ±180° or greater than ±180°.

R < 180°	**R ≥ 180°**
	
-180° < θR ≤ 180°	180° < θR or θR ≤ -180°

Note that θR is the angle when the R-axis home position is 0°.

3.9.4.14 T-Axis Angle

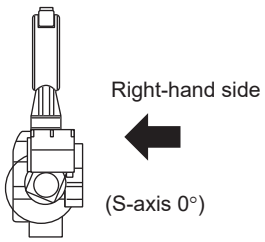
This specifies positions of the R-, B-, and T-axis.
For manipulators with wrist axes (three axes), this specifies whether the T-axis angle is less than ±180° or greater than ±180°.

T <180°	**T ≥ 180°**
	
-180° < θT ≤ 180°	180° < θT or θT ≤ -180°

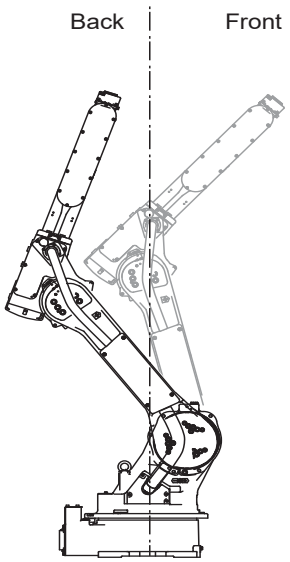
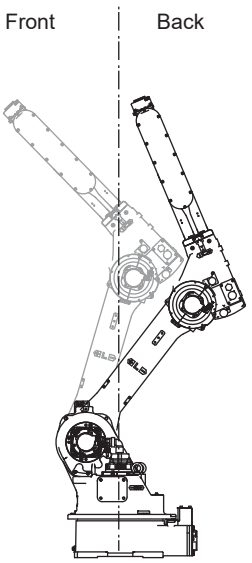
Note that θT is the angle when the T-axis home position is 0°.

3.9.4.15 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.

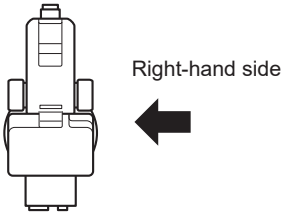


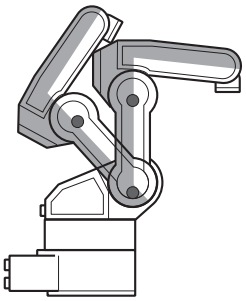
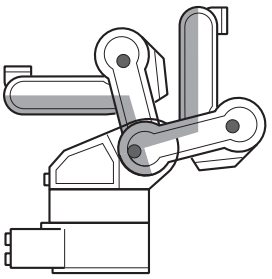
The diagram below shows the S-axis at 0° and at 180°. This is the configuration when the L-axis and the U-axis are viewed from the right-hand side.

S-axis 0°	**S-axis 180°**
	

3.9.4.16 Upper Arm/Lower Arm

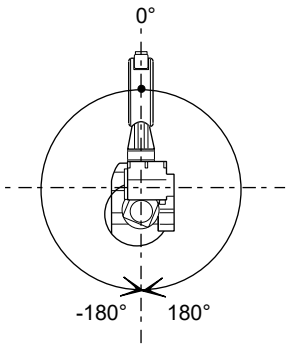
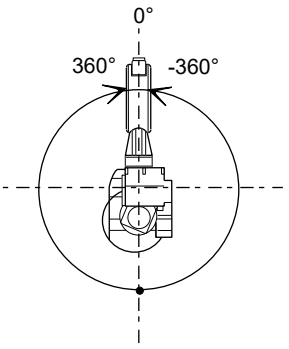
This specifies a type comprised of L-axis and U-axis when the L-axis and U-axis are viewed from the right-hand side.



Upper Arm	**Lower Arm**
	

3.9.4.17 S-Axis Angle

This designation is required for the manipulators which have working envelopes greater than ±180°.
This specifies whether the S-axis angle is less than ±180° or greater than ±180°.

S<180°	**S ≥ 180°**
	
-180° < θS ≤ 180°	180° < θS or θS ≤ -180°

Note that θS is the angle when the S-axis home position is 0°.

3.9.5 Editing Local Variables

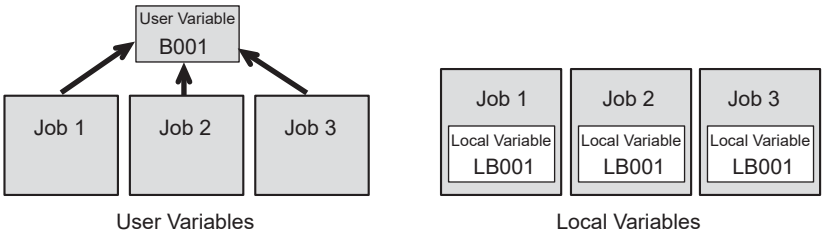
As well as user variables, local variables can be used for the storage of counters, calculations, and input signals. The data format is the same as that of user variables. As shown in the following table, the letter L is affixed to the variable number to indicate a local variable.

Table 3-6: Local Variables

Data Format		Variable No.	Functions
Byte type		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 type		LI000 to LI□□□	Range of storable values is from -32768 to 32767.
Double-precision integer type		LD000 to LD□□□	Range of storable values is from -2147483648 to 2147483647.
Real type		LR000 to LR□□□	Range of storable values is from -3.4E+38 to 3.4E+38 Accuracy: 1.18E-38 < x ≤ 3.4E+38
Character 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. XYZ type variables can be used as target position data for move instructions, and as incremental values for parallel shift instructions. Teaching line coordinates system cannot be used.
	Base axes	LBP000 to LBP□□□	
	Station axes	LEX000 to LEX□□□	

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.

- **Use user variables to display 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.

Alternatively, the status can be checked on the Local Variable screen (Refer to *chapter 3.9.5.2 "Displaying Local Variables"*). But, during job execution, the desired data may not be accessible depending on the timing.

- **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.



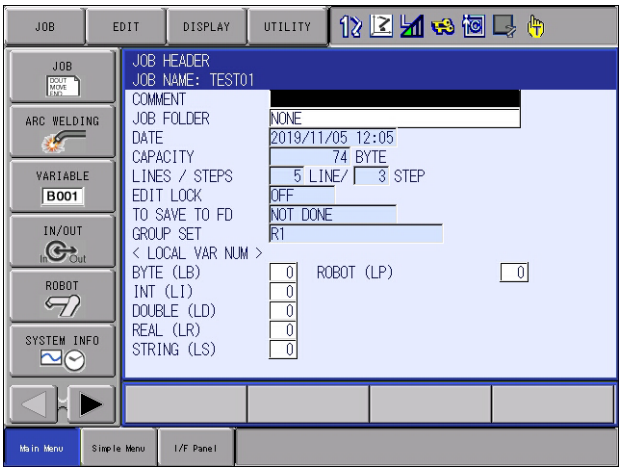
Precautions for Variables and Units
As was the case with user variables, note that, depending on the value of the unit being used, the value of the variable and the value of the actual speed or time an occasion might not match. Refer to *chapter 3.9.4 "User Variables"* .

3.9.5.1 Setting the Number of Local Variables

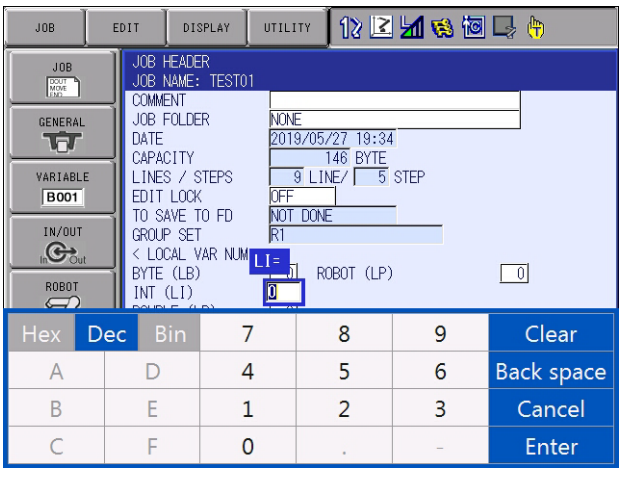
The number of local variables used in a job is set in the JOB HEADER window. When the number of local variables is set, memory is allocated for those variables.

> **NOTE**
>
> Only when expanding the “INSTRUCTION LEVEL”, it is possible to use local variables.
> However, when “PROHIBIT” is set to {COBTENT DISPLAY}, the number of local variables cannot be confirmed or changed.
>
> Refer to “8.12 Instruction Level Setting” of “YRC1000micro INSTRUCTIONS” (RE-CTO-A222) for details on setting the language level.

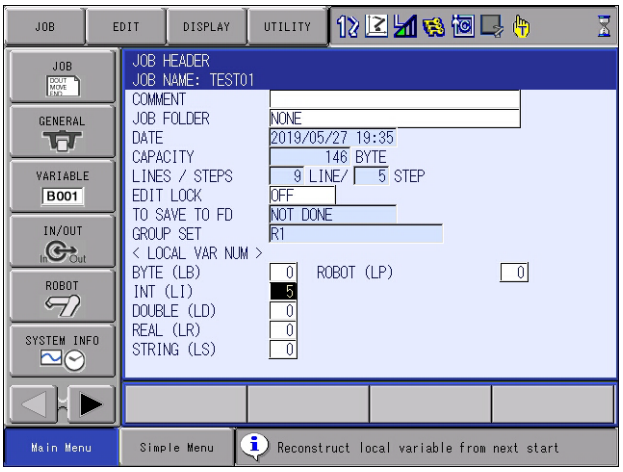
1. Select {JOB} under the main menu.
2. Select {JOB}.
3. Select {DISPLAY} under the menu.
4. Select {JOB HEADER}.
   – The JOB HEADER window appears. Scroll the window using the cursor.



5. Select the number of local variables to be set.
   – The input buffer line appears.

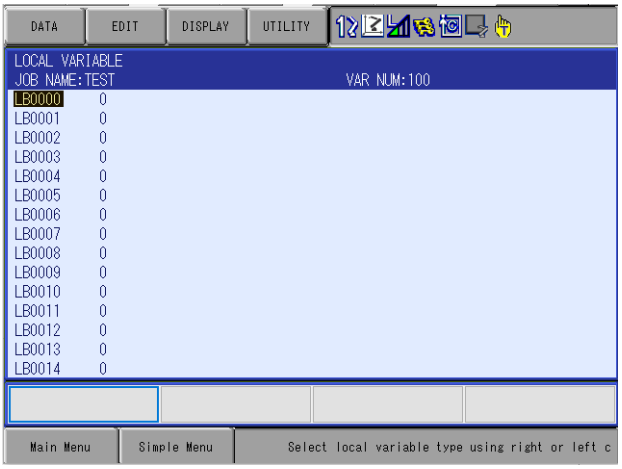


6. Input the number of variables.
7. Press [ENTER].
   – The number of local variables are set.



3.9.5.2 Displaying Local Variables

1. Select {VARIABLE} under {Main Menu}.
2. Select {LOCAL VARIABLE}.
   – The LOCAL VARIABLE window appears.

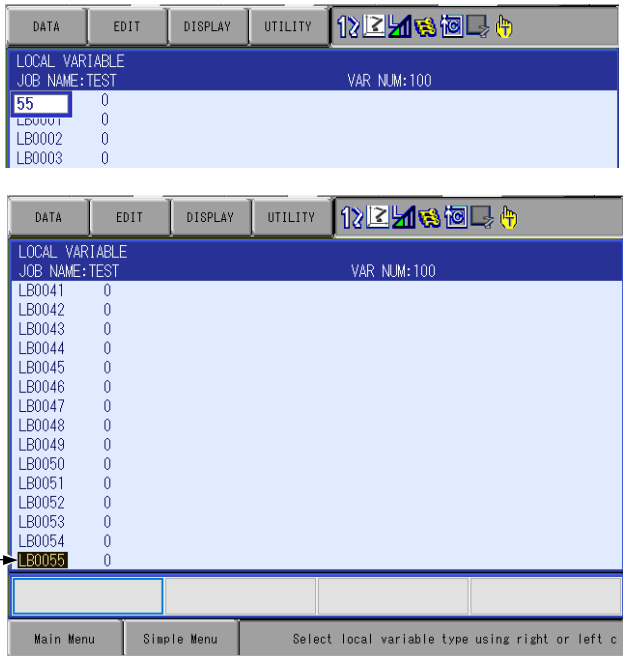


3. Select the desired job (only when the independent control function is enabled).
   – Use the page key to switch jobs.
4. Select the variable of the desired type.
   – Use the right or left cursor key to switch local variable types.

5. Move the cursor to the desired variable No.

– When the desired variable number is not displayed, move the cursor with 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].

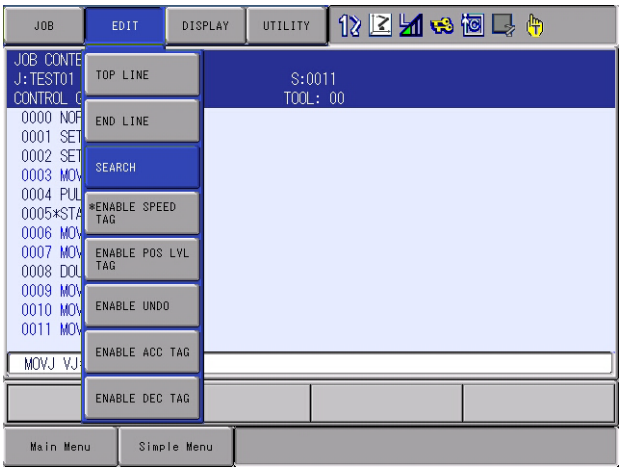


The cursor is moved to desired variable number.

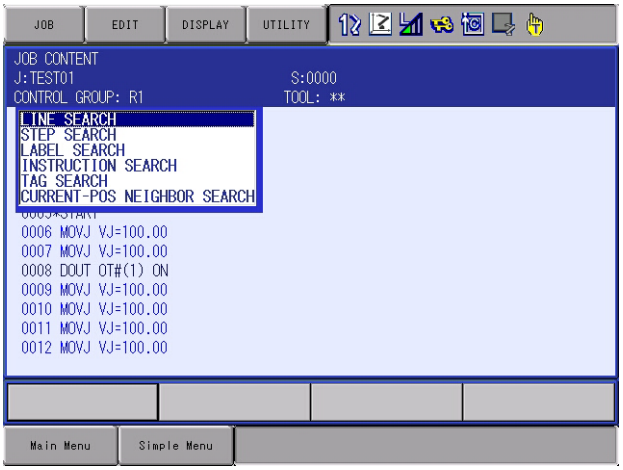
3.9.6 Search

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.



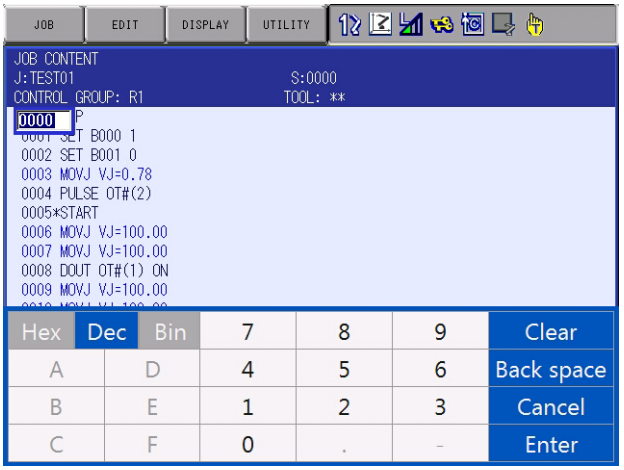
5. Select the search type.

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.

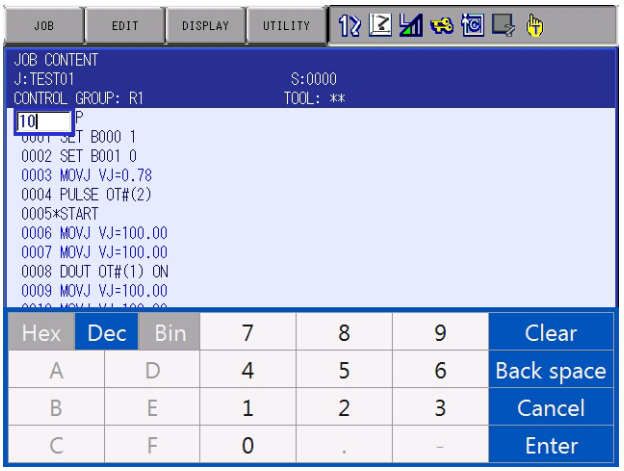
3.9.6.1 Line Search

This function moves the cursor to the desired line number.

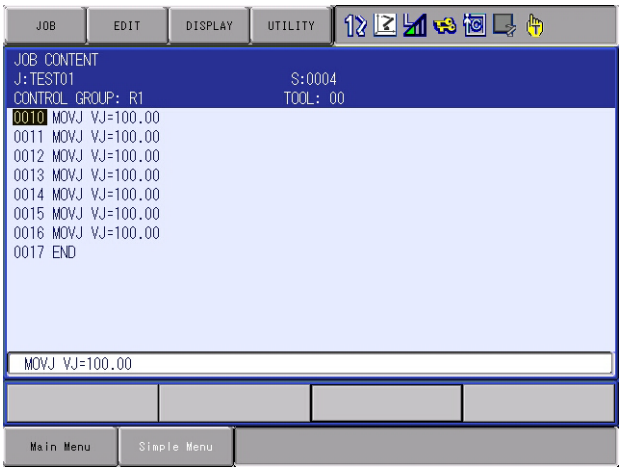
1. Select {EDIT], {SEARCH} and “LINE SEARCH”.
   – The number can be entered.



2. Input desired line number.



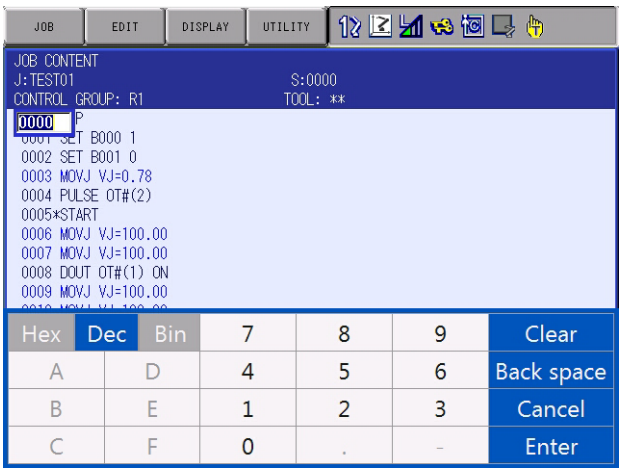
3. Press [ENTER].
   – The cursor is moved to the line number and the window appears.



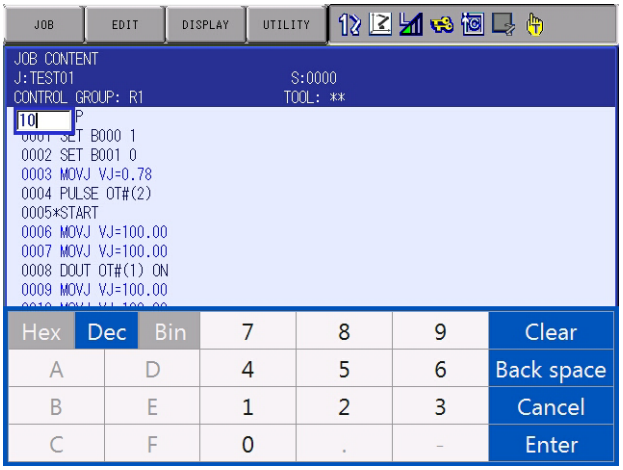
3.9.6.2 Step Search

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

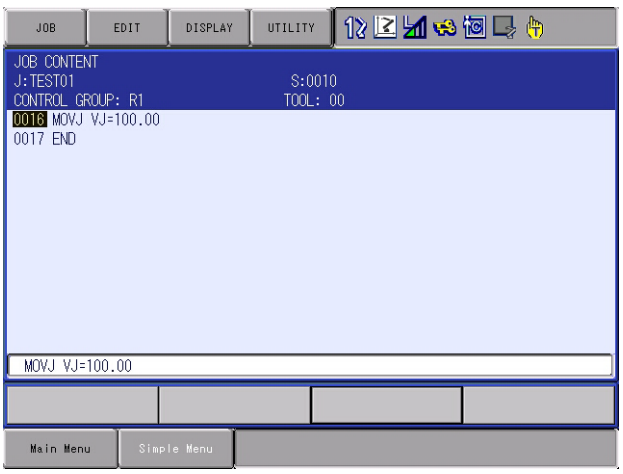
1. Select {EDIT], {SEARCH} and “STEP SEARCH”.
   – The number can be entered.



2. Input desired step number.



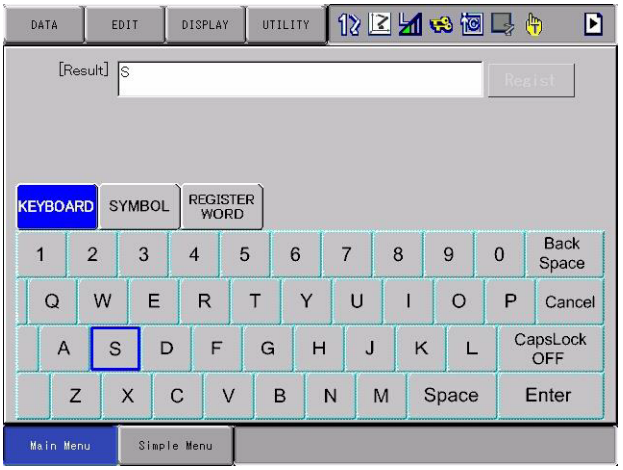
3. Press [ENTER].
   – The cursor is moved to the input step and the window appears.



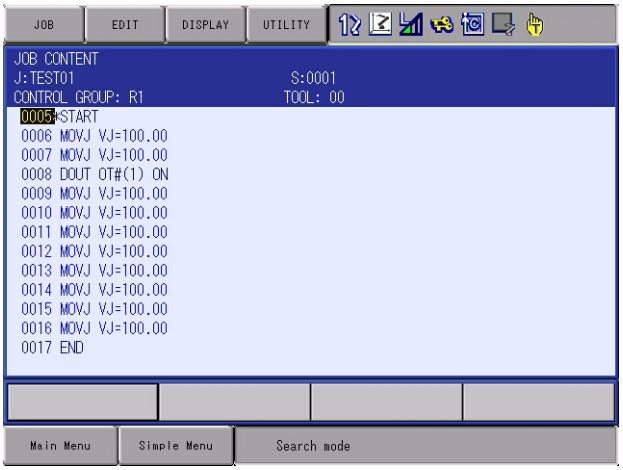
3.9.6.3 Label Search

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

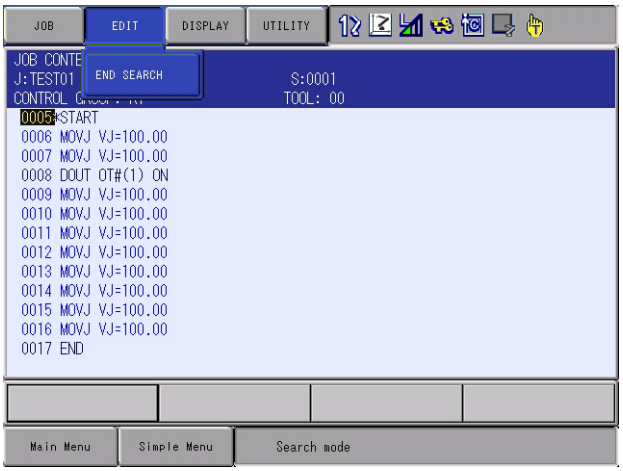
1. Select {EDIT}, {SEARCH} and “LABEL SEARCH”.
   – The characters can be entered.
2. Input desired label name.
   – For information on character input operation, refer to *chapter 1.2.6 “Character Input Operation”* .
   – At this time, search can be conducted by entering any one character of the label. 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.



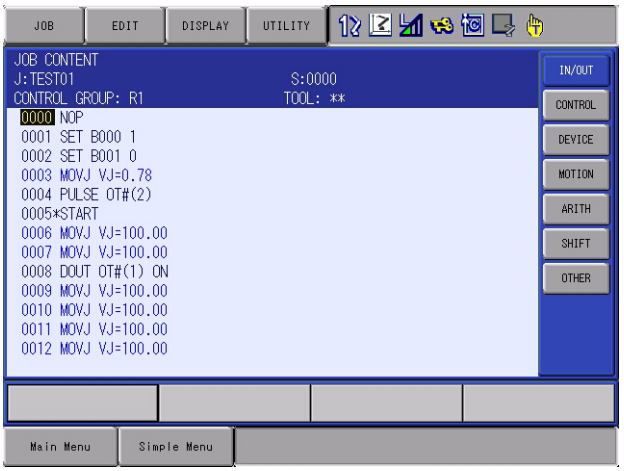
4. Use the cursor to continue search.
   – While searching, forward search and backward search are possible by pressing the cursor.
   – To end search, select {EDIT} → {END SEARCH} on the menu and press [SELECT].



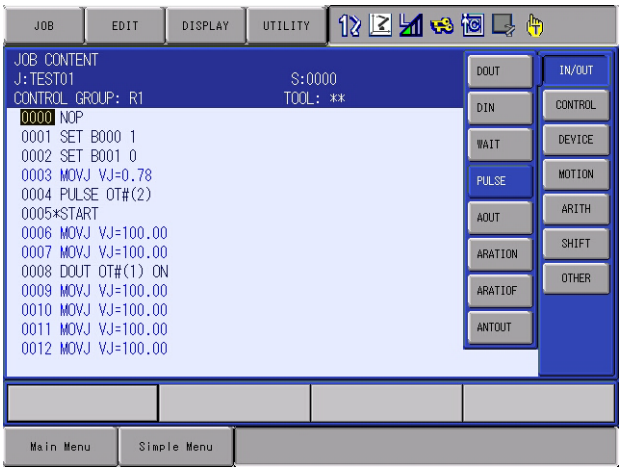
3.9.6.4 Instruction Search

This function moves the cursor to a desired instruction.

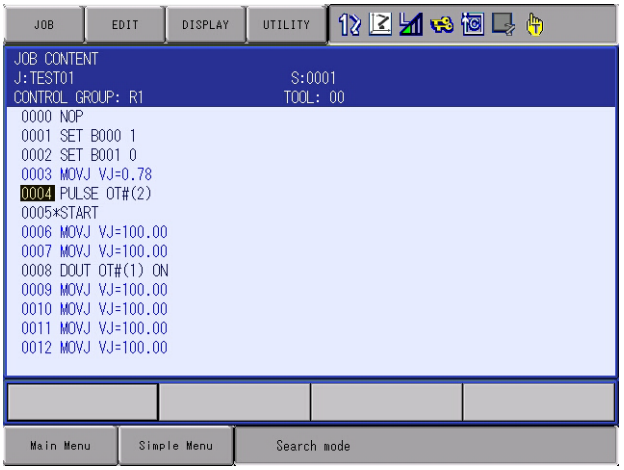
1. Select {EDIT}, {SEARCH} and “INSTRUCTION SEARCH”.
   – The INFORM command list appears.



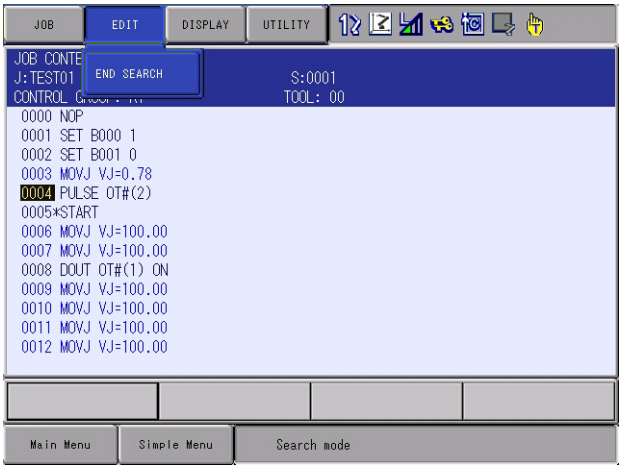
2. Select desired instruction group.
3. Select desired instruction.



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



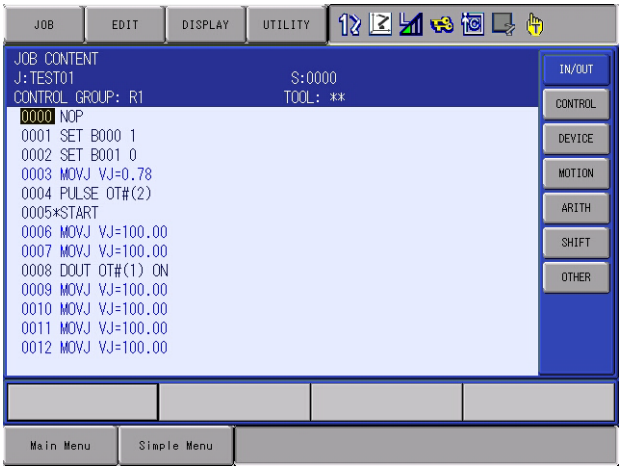
4. Use the cursor to continue search.
   – While searching, forward search and backward search are possible by pressing the cursor.
   – To end search, select {EDIT} → {END SEARCH} on the menu and press [SELECT], or press [CANCEL].



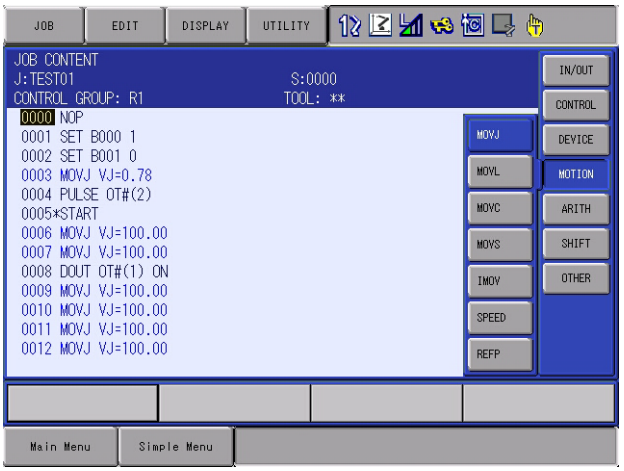
3.9.6.5 Tag Search

This function moves the cursor to the desired tag.

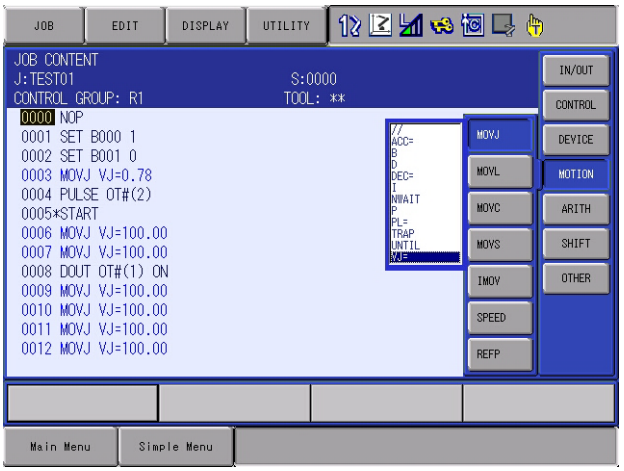
1. Select {EDIT}, {SEARCH} and “TAG SEARCH”.
   – The instruction list dialog box appears.



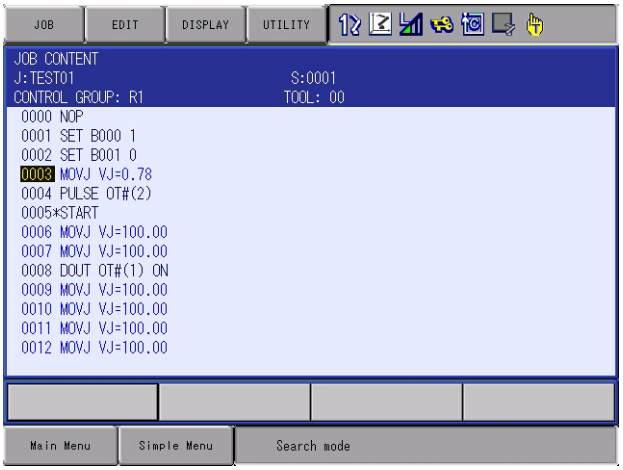
2. Select desired instruction group.
3. Select desired instruction for which the tag is to be searched.



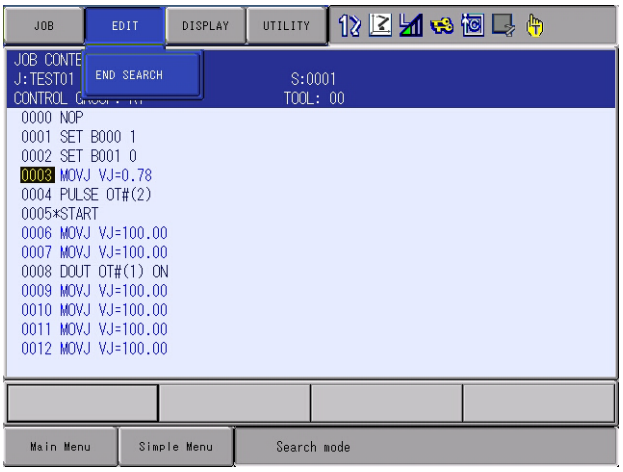
   – The tag list dialog box for selected instruction appears.



4. Select the desired tag.
   – The cursor is moved to the selected tag and the window appears.



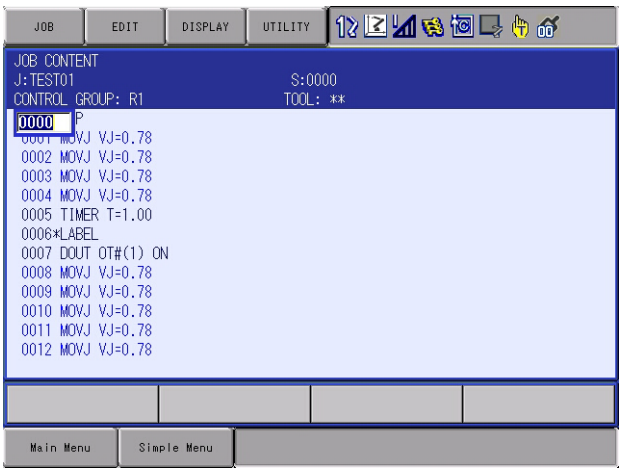
5. Use the cursor to continue search.
   – While searching, forward search and backward search are possible by pressing the cursor.
   – To end search, select {EDIT} → {END SEARCH} on the menu and press [SELECT], or press [CANCEL].



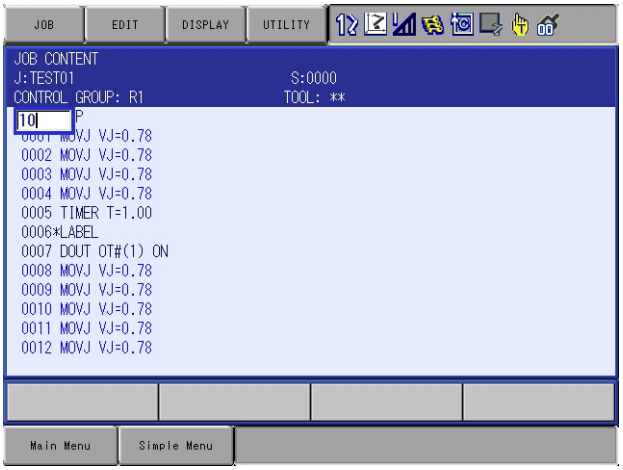
3.9.6.6 Current-Position Neighbor Search

This function searches for a teaching point adjacent to the current position of the manipulator.

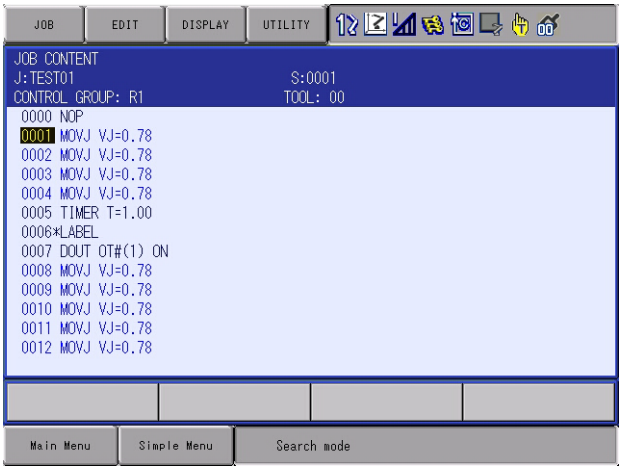
1. Select {EDIT}, {SEARCH} and “CURRENT-POS NEIGHBOR SEARCH”.
   – The number can be entered.



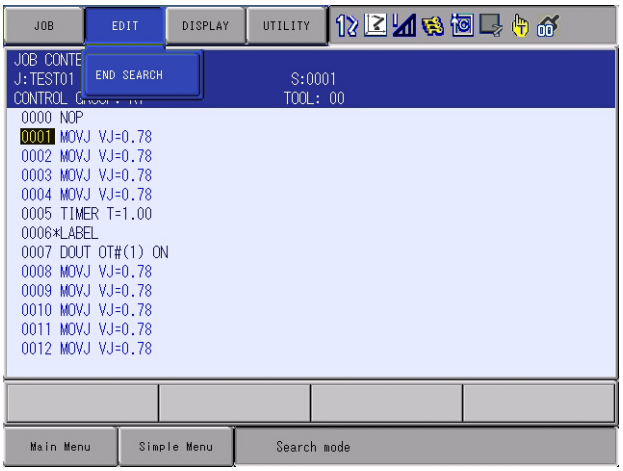
2. Enter the numerical value of the pulse range where the teaching point is searched.
   – Specify the pulse range so that the teaching point is present in the range from the value: the current position of the manipulator minus the pulse range, to the value: the current position of the manipulator plus the pulse range.



3. Press [ENTER].
   – The cursor moves to the step where all axes of the control group included in the job are present in the range from the value: the current feedback pulse minus the pulse range, to the value: the current feedback pulse plus the pulse range.



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



4 Playback

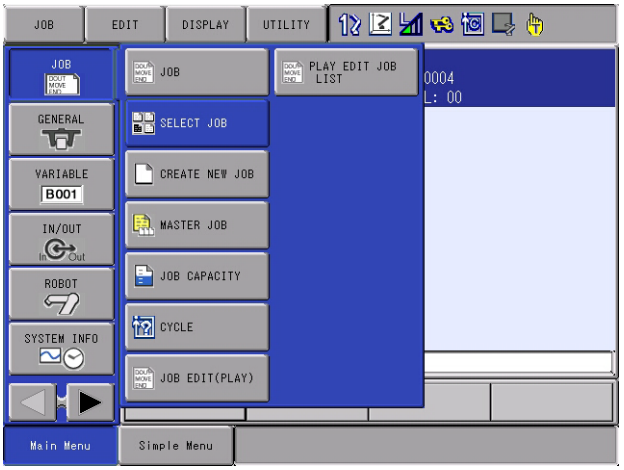
4.1 Preparation for Playback

4.1.1 Selecting a Job

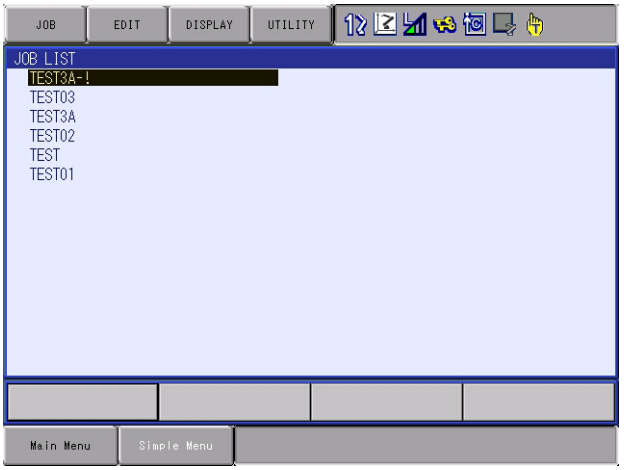
Playback is the act of executing a taught job. Before playback operation, first call the job to be executed.

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.

4.1.1.2 Registering the Master Job

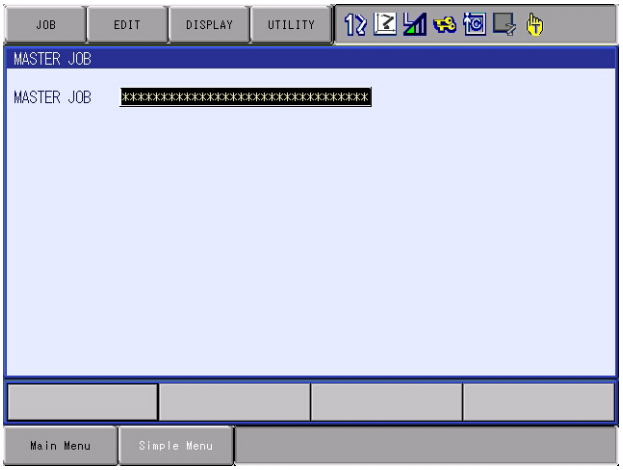
If a particular job is played back frequently, it is convenient to register that job as a master job (master registration). A job registered as the master job can be called more easily than the method described on the preceding page.

NOTE

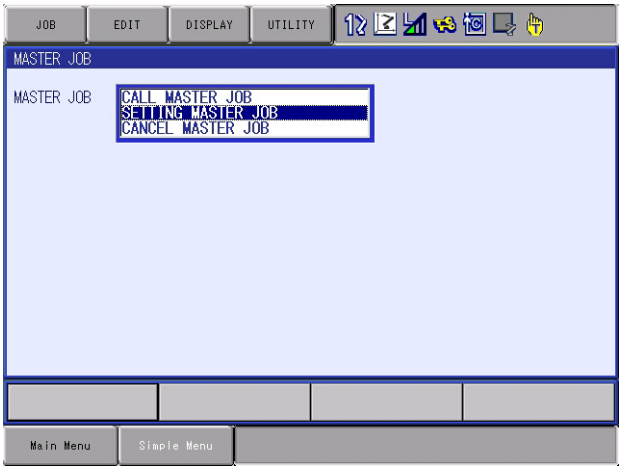
Only one job can be registered as the master job. Registering a master job automatically cancels the previously registered master job.

Be sure to register a master job in teach mode.

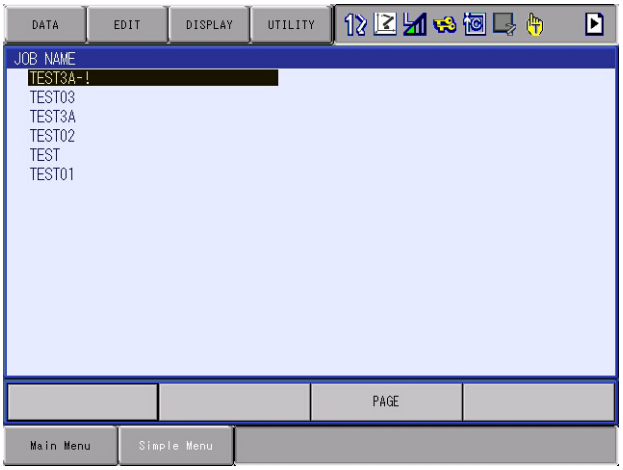
1. Select {JOB} under the main menu.
2. Select {MASTER JOB}.
   – The MASTER JOB window appears.



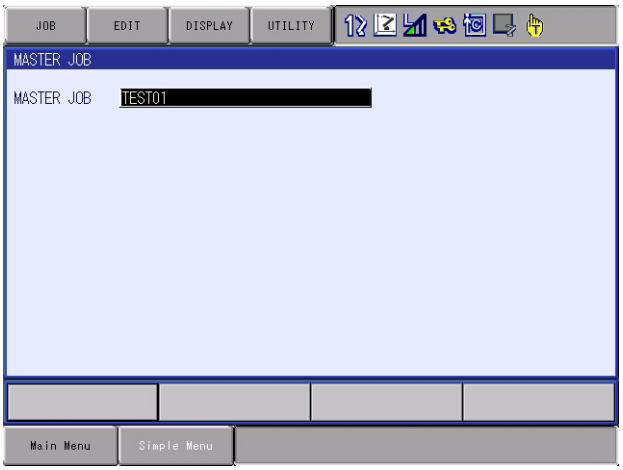
3. Press [SELECT].
   – The selection dialog box appears.



4. 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.



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**

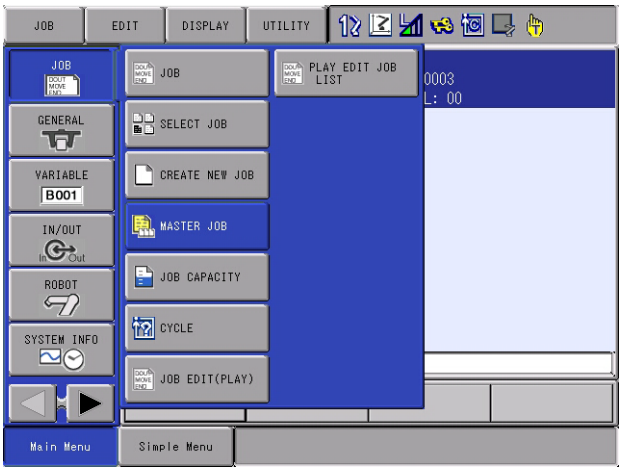
1. Select {JOB} under the menu.



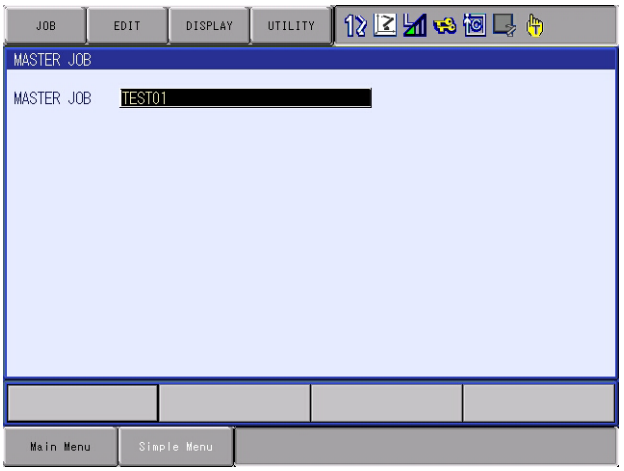
2. Select {MASTER JOB}.
   – The master job is called, and the JOB CONTENT window appears.

■ **Calling from the MASTER JOB Window**

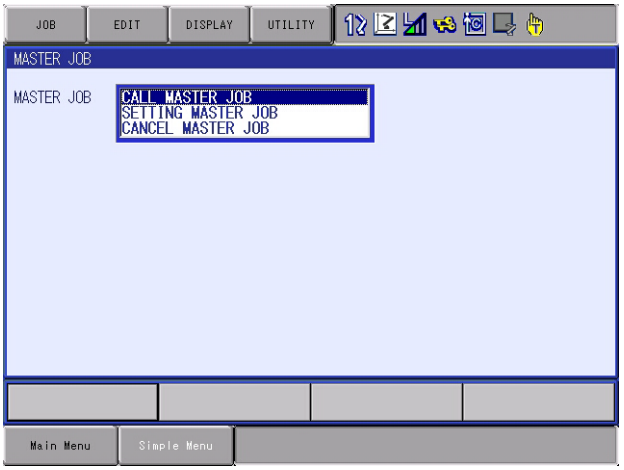
1. Select {JOB} under the main menu.



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 teach mode), or the PLAYBACK window (during play mode) appears.

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. Speed Adjustment Settings

Displayed when the speed override is set.

C. Cycle Time

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

D. Measure Start

First step in the measurement. Measurement starts when the [START] LED lights up and the playback starts.

E. Playback Time

Displays the time from the beginning to the end of the measurement. Measurement ends when the manipulator stops and the [START] LED turns 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.

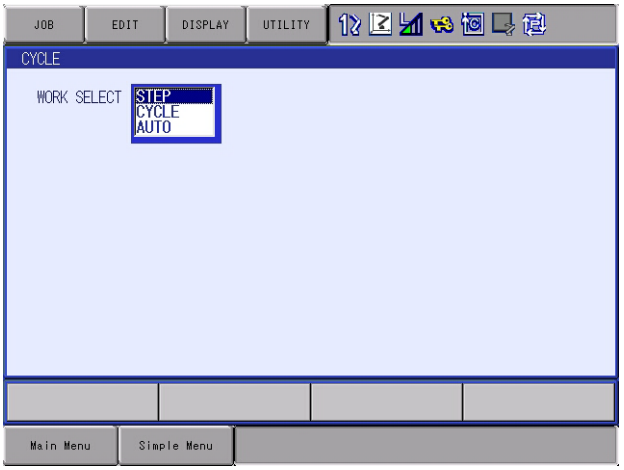
4.1.2.2 Operation Cycle

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.

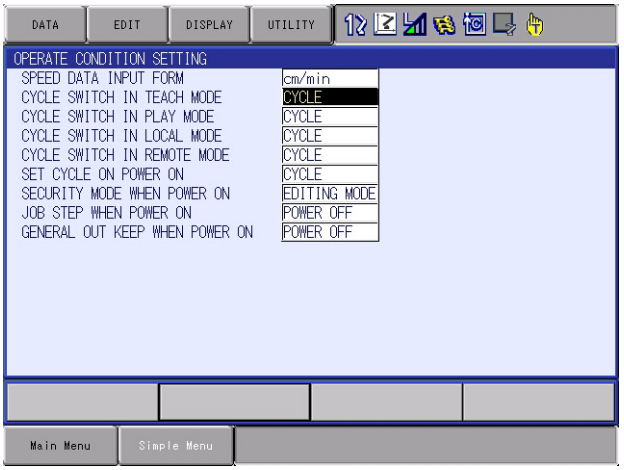


■ **Automatic Setting for Operation Cycle**

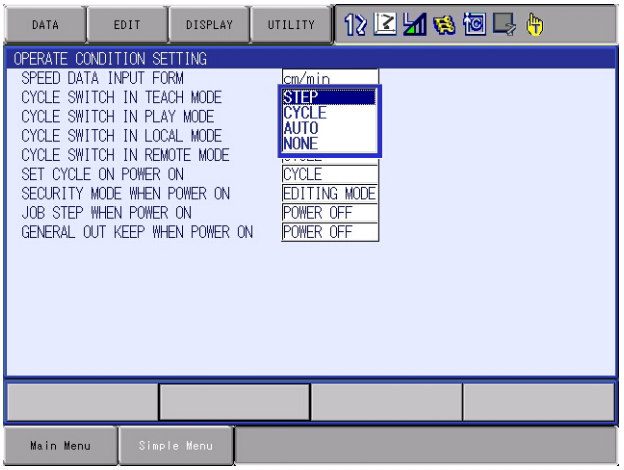
Automatic setting of the operation cycle can be changed by the following operation.

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.



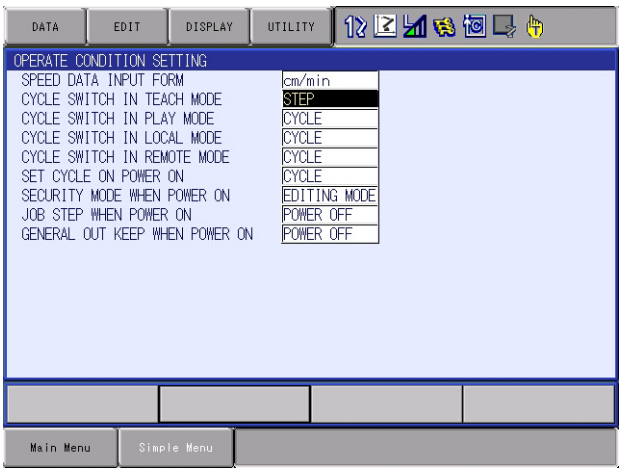
SUPPLE-MENT

"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 play mode.

4. Select a cycle.

   – The operation cycle when switching modes is set.



4.2 Playback

4.2.1 Playback Operation

NOTE 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.

Mode Switch on the programming pendant	Job is started up by
PLAY	[START] on the programming pendant
REMOTE	Peripheral device (external start input)

To perform playback by 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”.
   – Play mode is enabled so that the job is started up by the programming pendant.

4.2.1.2 Servo On

2. Press [SERVO ON READY].
   – The YRC1000micro servo power turns ON and the “SERVO ON” LED on the programming pendant lights up.

4.2.1.3 Start Operation

3. Press [START].
   – The LED of [START] lights up and the manipulator starts operation.

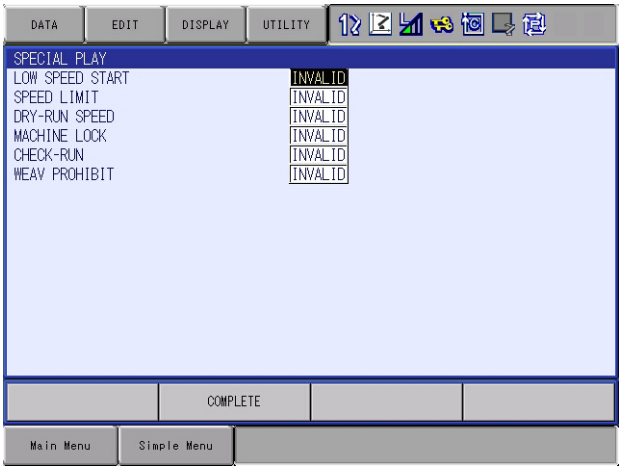
4.2.2 Special Playback Operations

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
- Weaving prohibited 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} → {SPECIAL PLAY}. 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.

During/After one step operation, pressing [START] allows the manipulator to move at the taught speed from the next step.

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.

4.2.2.2 Limited Speed Operation

The manipulator operates within the limited speed for teach mode. Usually, the limited speed is set to 250 mm/s at the TCP and the flange. For the step in which the speed at the TCP is 250 mm/s or less, operation is performed at the taught playback speed.

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.

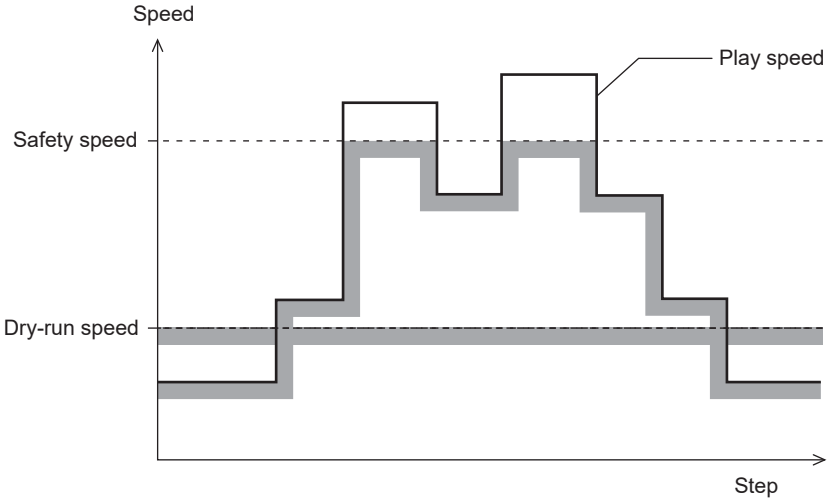
4.2.2.3 Dry-Run Speed Operation

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

NOTE 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



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.

NOTE

- The setting of “MACHINE LOCK” is maintained even after the mode is switched: If the machine lock is set to “VALID” in teach mode, it is still “VALID” after switching to play mode.
  The same applies when the mode is switched from play mode to 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 supply.
  - When executing “MACHINE LOCK”, select {SETUP} → {PLAYBACK COND.}. And set “CHECK/MACHINE LOCK” to “PERMIT”.

4.2.2.5 Check Mode Operation

The machine runs without issuing work instructions, such as the TOOLON 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.

NOTE

When executing “CHECK-RUN”, select {SETUP} → {PLAYBACK COND.}. And set “CHECK/MACHINE LOCK” to “PERMIT”.

4.2.2.6 Weaving Prohibited Operation

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

1. Select “WEAV PROHIBIT” under the SPECIAL PLAY window.
   – The setting alternates between “VALID” and “INVALID”.
2. Select “COMPLETE”.
   – The window returns to the PLAYBACK window.

4.2.2.7 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.

NOTE Special operations are also automatically canceled if the main power supply is shut OFF.

4.3 Stop and Restart

The manipulator or JOB in operations stops in the following conditions:

- Hold
- Emergency stop
- Stop by alarm
- Stop by other causes

4.3.1 Hold

By the hold operation, the JOB stops temporarily.

SUPPLE -MENT During the hold operation, the LED on [START] turns OFF.

4.3.1.1 Using the Programming Pendant

■ **Hold**

1. Press [HOLD] on the programming pendant.
2. The manipulator stops temporarily. The LED on [HOLD] lights up while [HOLD] is held down.

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] LED lights up.

■ **Release**

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

4.3.2 Emergency Stop

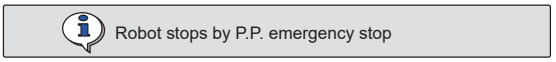
At an emergency stop, the servo power supply that drives the manipulator is turned OFF and the manipulator stops immediately. An emergency stop can be performed by using either of the following:

- Programming pendant
- External input signal (system input)

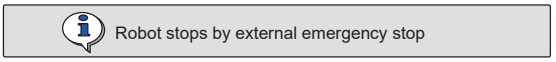
■ **Emergency Stop**

1. Press the emergency stop button .
   – The servo power turns OFF and the manipulator stops immediately.
   – On the 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 programming pendant: 

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





4.3.2.1 Restart After Emergency Stop

CAUTION

- Prior to restarting the manipulator's operation after an emergency stop, confirm the position of the manipulator by using FWD, etc., and make sure that there is no interference between the manipulator and the workpiece or fixture.
- When an emergency stop is performed during a high-speed operation of consecutive steps, the manipulator may stop two or three steps before the displayed step. If the manipulator's operation is restarted under such conditions, the manipulator may interfere with the workpiece or fixture.

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} under the main menu.

■ **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.

4.3.3.1 Restart After Stop by Alarm

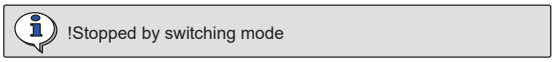
CAUTION

- Prior to restarting the manipulator's operation after it has been stopped by an alarm, confirm the position of the manipulator by using FWD, etc., and make sure that there is no interference between the manipulator and the workpiece or fixture.
- When an alarm occurs and stops the manipulator during a high-speed operation of consecutive steps, the manipulator may stop two or three steps before the displayed step. If the manipulator's operation is restarted under such conditions, the manipulator may interfere with the workpiece or fixture.

4.3.4 Others

4.3.4.1 Temporary Stop by Mode Change

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



To restart the operation, return to 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.

4.4 Modifying Play Speed

4.4.1 Speed Override

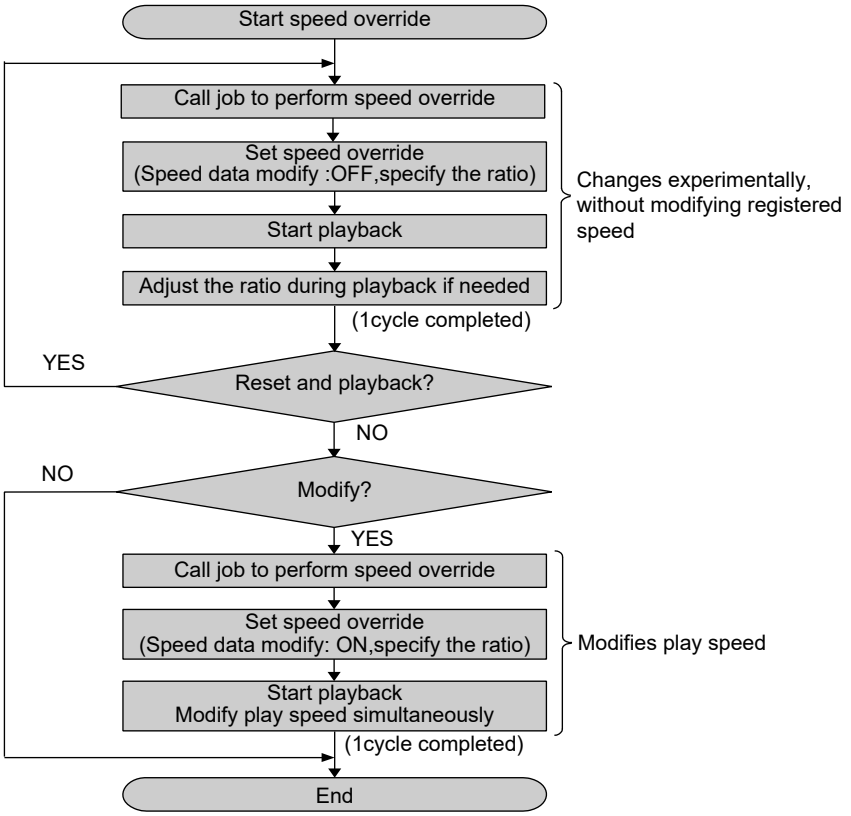
Speed modifications using the speed override have the following features:

- 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 motion path of the manipulator's control point for playback operation in the teaching speed (speed override: 100%) can also be operated and reproduced at a speed override less than 100%.

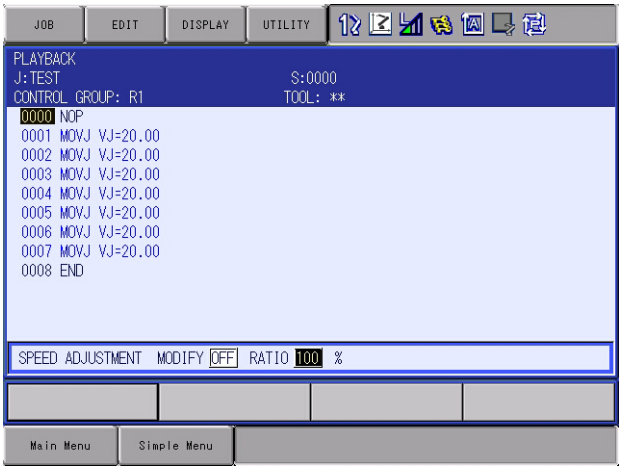
To enable the control described above, select {SETUP} → {TEACHING CONDITION SETTING}, and then set "TEST RUN CONTROL" to "HIGH ACCURACY". (For details, refer to *chapter 3.8.2.2 "Setting Method"* .)

The operation flow is shown below.



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].



4.4.1.2 Modifying Play Speed

1. 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 canceled.

NOTE

- 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 canceled 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 Canceling 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 canceled.
   – If canceled, the speed ratio setting is not displayed on the PLAYBACK window.

NOTE

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

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

4.4.2 Specification for Speed Override in AUTO Cycle Operation

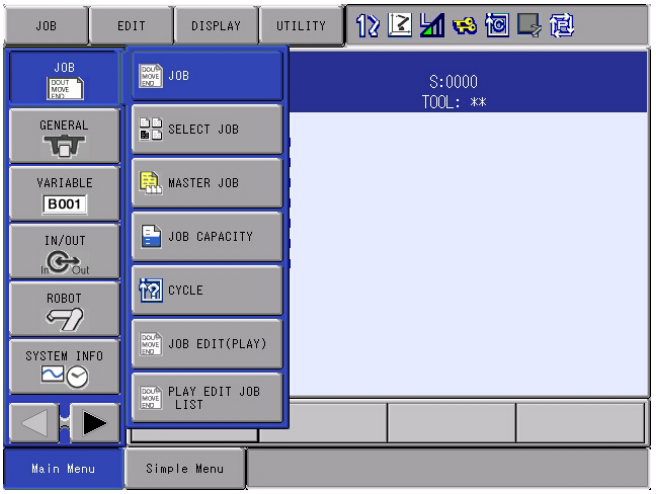
4.4.2.1 Functional Overview

This specification allows the manipulator to temporarily change its operation speed during playback.
The operation speed is specified by setting the Speed Override percentage (1 to 100% in increments of 1%) for the operation speed (play speed) specified in the current job.
This function also enables an automatic setting of the Speed Override function when changing modes from TEACH to PLAY.
Speed Override function can be performed with this specification by setting the parameter S2C701.

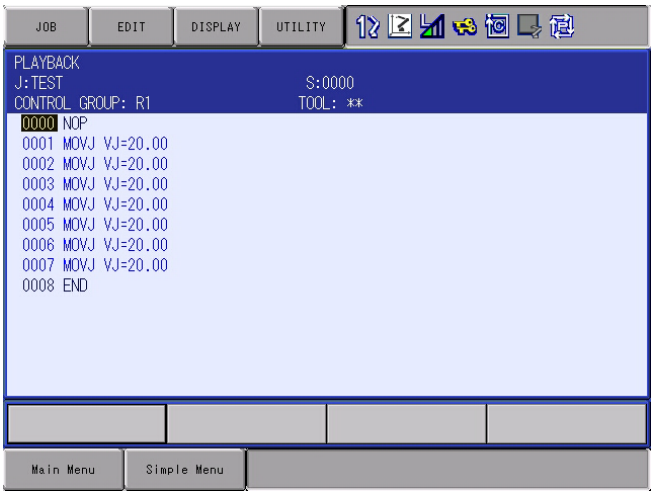
4.4.2.2 Setting the Speed Override Function

NOTE Set the mode selection switch to PLAY.

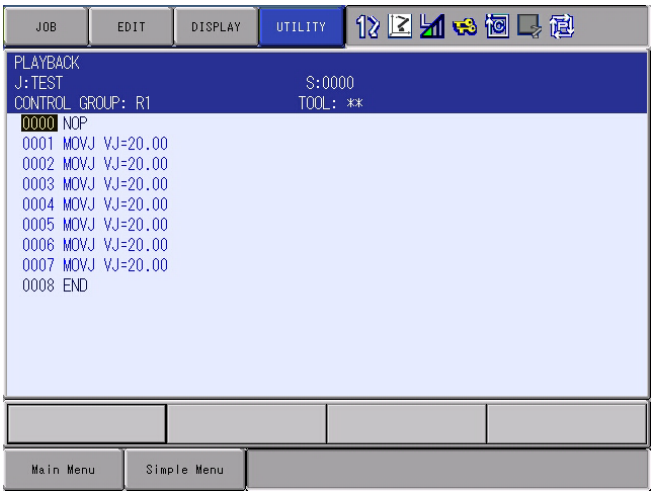
1. Select {JOB} under the main menu, and press {JOB}.



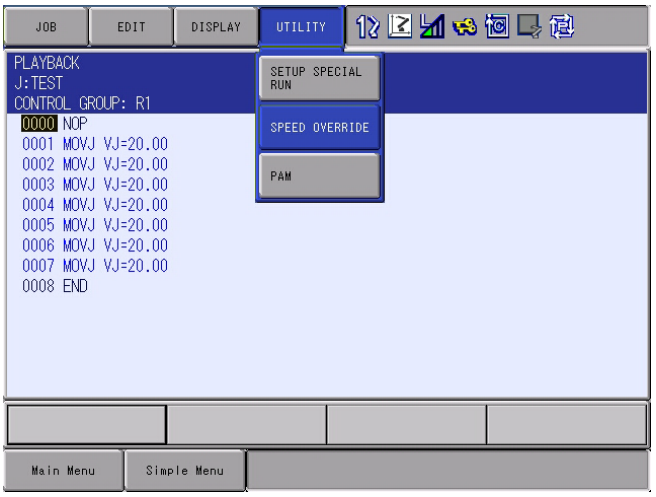
– The PLAYBACK screen appears.



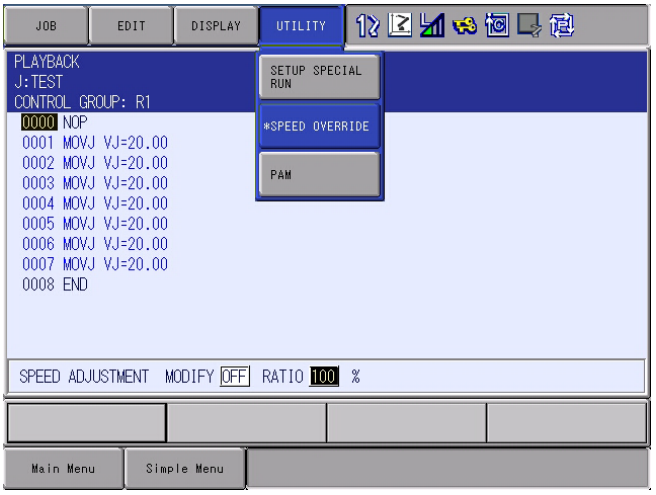
2. Select {UTILITY} in the Menu Area.



3. Select {SPEED OVERRIDE}.



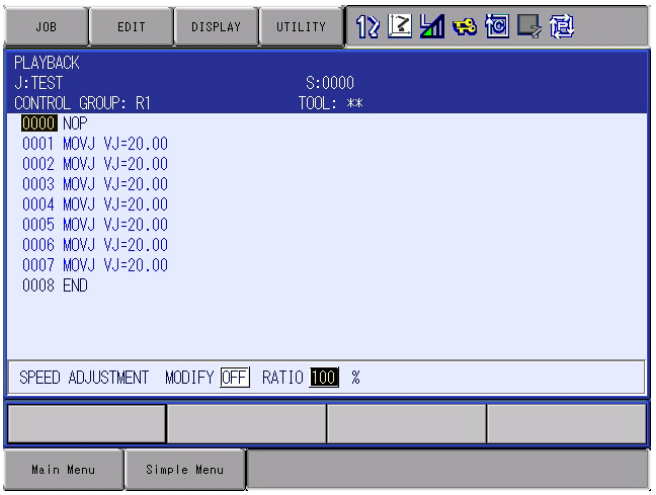
– The Speed Override setting is enabled. (As shown below, an asterisk “*” appears beside {SPEED OVERRIDE}, and “SPEED ADJUSTMENT” appears in the input buffer line.)



4. Set the override ratio.

   (1) Move the cursor to highlight the RATIO edit box.

   (2) Hold [SHIFT] and press the cursor (up or down) to modify the percentage.



   – To directly enter the value, perform the following:

   (1) Move the cursor to highlight the RATIO edit box, and press [SELECT].

   (2) Enter the desired percentage using [Numeric Key] pad.

   (3) Press [ENTER].

5. Setting completed.

4.4.2.3 Performing the Speed Override Function

SUPPLE -MENT

Set the mode selection switch to PLAY.

1. Start the job.

   – Press [START]

2. Speed Override is executed.

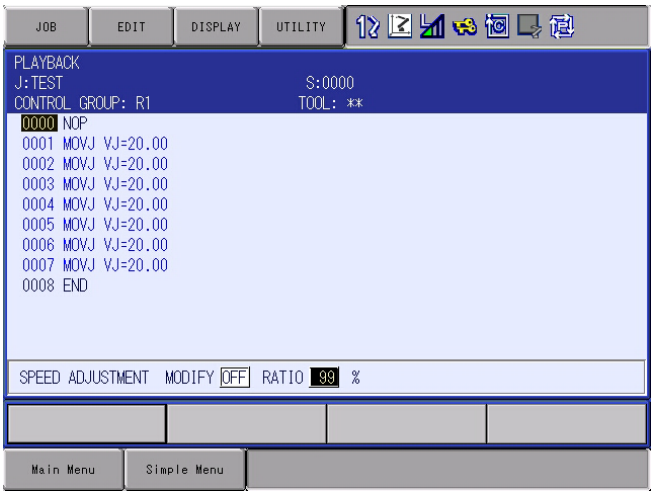
   – The manipulator moves in the specified speed percentage.

4.4.2.4 Modifying the Speed Override Percentage

SUPPLE -MENT

- Set the mode selection switch to PLAY.
- This operation can be performed during playback.

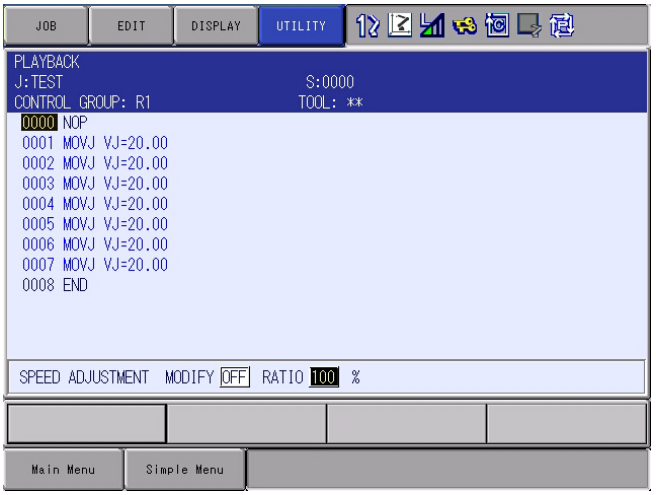
1. Modify the override ratio.
   – Highlight the RATIO edit box, and hold [SHIFT] and press the cursor (up or down) when SPEED ADJUSTMENT is displayed in the input buffer line.
   Note: The value is increased or decreased by 1% increments.



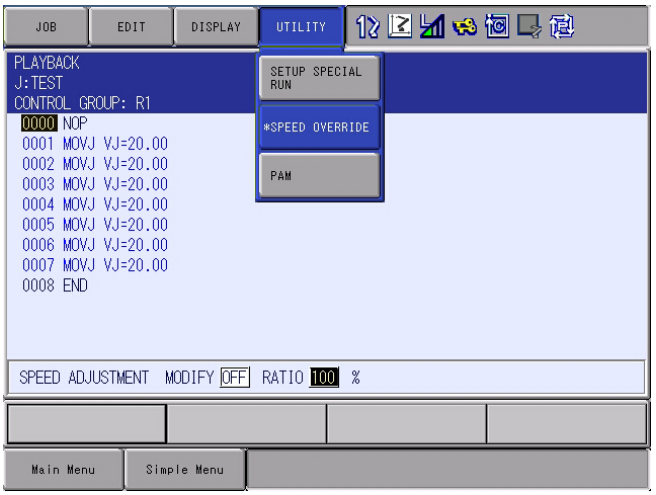
2. Modification completed.
   – The manipulator moves in the specified speed percentage.

4.4.2.5 Disabling the Speed Override Function

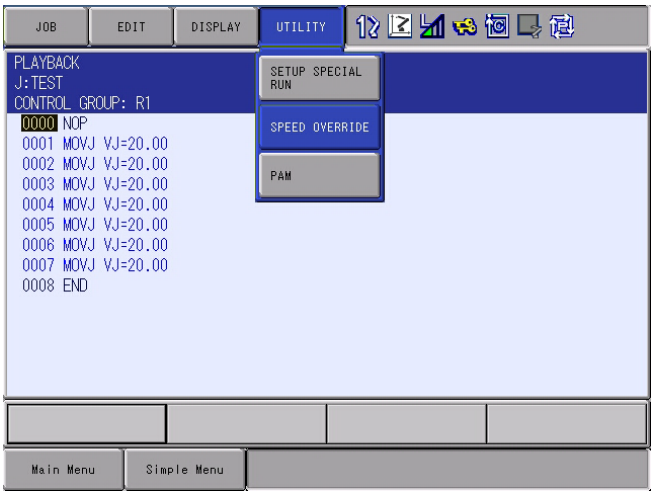
1. Select {UTILITY} in the Menu Area.



2. Select {*SPEED OVERRIDE}.



– The Speed Override function is disabled. (As shown below, the asterisk beside {SPEED OVERRIDE} and the “SPEED ADJUSTMENT” input buffer line disappears)



3. Operation completed.
   – Additionally, the Speed Override function is automatically disabled when:
     • Setting the Dry-Run Speed mode.
     • Changing the mode to any mode other than PLAY.
     • Alarm or error occurs.
     • Power is turned OFF.

4.4.2.6 Enabling an Automatic Setting of Speed Override



The function is enabled by setting the parameter S2C702.

This function allows Speed Override to be automatically set when the operation mode is changed from TEACH to PLAY.
The percentage corresponds to the manual speed selected during TEACH mode.

Manual Speed	Applicable Percentage
Inching	Maximum jog operation link speed x S1CxG045
Low	Maximum jog operation link speed x S1CxG045
Medium	Maximum jog operation link speed x S1CxG046
High	Maximum jog operation link speed x S1CxG047

4.4.2.7 Manual Speed in TEACH Mode



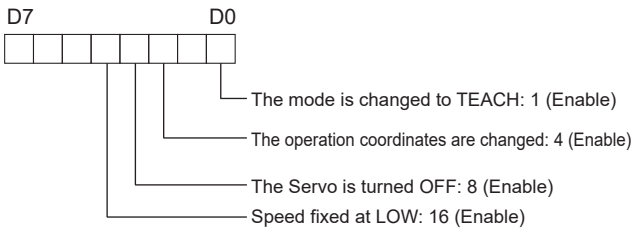
The function is enabled by setting the parameter S2C699.

The manual speed (inching, low, medium, and high) in TEACH mode is changed by using [MANUAL SPEED] on the programming pendant.

The manual speed is automatically set at LOW when:

• Changing modes from PLAY to TEACH.
• Changing coordinate system in TEACH mode.
• Turning OFF the SERVO power in TEACH mode.

4.4.2.8 Parameter

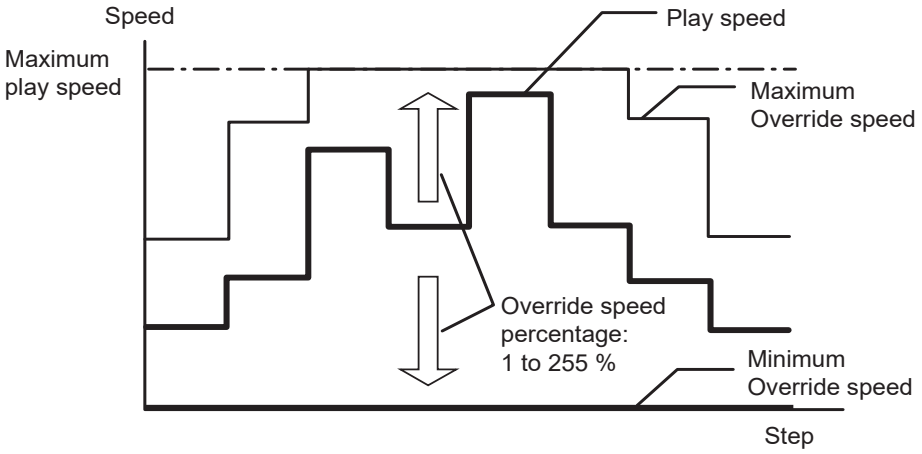
Parameter	Description	Details	Setting Value
S2C699	Automatic change of manual speed to LOW	Automatically sets the manual speed to LOW.  	0
S2C701	Speed Override setting	Specifies the usage of Speed Override. 0: Disables continuous cycle operation; Enables speed modification (standard specification). 1: Enables the Continuous Cycle operation; Disables speed modification.	0
S2C702	Automatic Speed Override Setting 1 in mode change (When S2C701 = 1)	Specifies whether to automatically set Speed Override when the mode is changed to PLAY. 0: Disables Speed Override. 1: Sets the percentage corresponding to the manual speed.	0 to 1
S2C709	Automatic Speed Override Setting 2 in mode change (When S2C701 = 1)	Specifies whether to automatically set Speed Override when the mode is changed to PLAY. 0: Disables Speed Override. 1: Sets the percentage applied last time.	0 to 1

4.4.3 Specification for Speed Override with Input Signals

4.4.3.1 Functional Overview

This specification allows the manipulator to temporarily change its operation speed during playback using the external input signals.
The operation speed is specified by setting the speed override percentage (1 to 255% in increments of 1%) for the operation speed (play speed) specified in the current job.

Fig. 4-2: Play Speed and Override Speed



NOTE

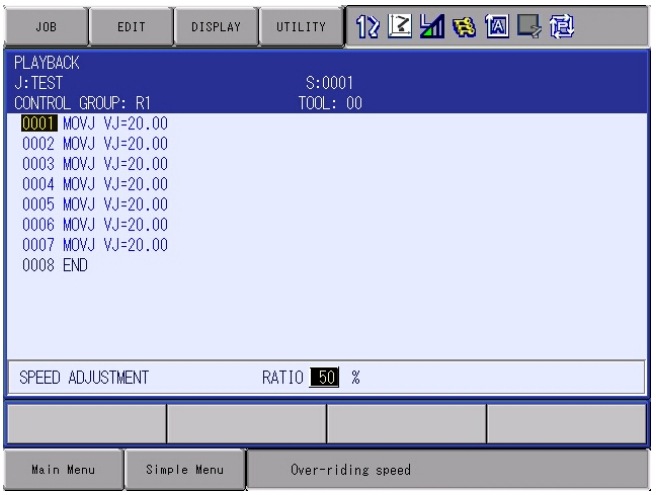
- The speed override function can be continued in the auto cycle operation.
- The play speed data of the job will not be modified.
- The maximum and minimum manipulator speeds limit the play speed modified by speed override.

4.4.3.2 Performing the Speed Override Function

SUPPLE -MENT

- Set the mode selection switch to PLAY.
- Refer to *chapter 4.4.3.4 "Parameters"* when performing Speed Override with this specification.

1. Playback a job.
2. Input the external signals for Speed Override.
   – The message "Over-riding speed" and the Speed Override percentage appears on the screen.



3. Speed Override is executed.
   – The manipulator moves in the specified speed percentage.

4.4.3.3 Disabling the Speed Override Function

Speed Override is disabled when:

- External signals are OFF.
- Changing modes from PLAY to TEACH.

4.4.3.4 Parameters

Parameter	Description	Details	Setting Value
S2C701	Speed Override setting	Specifies the usage of Speed Override. *To enable Speed Override with external signals, set “1” for the setting value. 0: Disables the Continuous Cycle operation; Enables speed modification (standard spec). 1: Enables the Continuous Cycle operation; Disables speed modification.	1
S4C287	Universal Input Group number setting (signals 1 to 8)	Specifies the signals to be used. Eight Universal Input points correspond to the signals 1 to 8 of S4C288 to S4C295.	1 to 512
S4C288	Speed percentage (%) Signal 1	Specifies the speed percentage by the Universal Input signals set in S4C287. Priority: Signal 1 > Signal 8 If S4C288 to S4C295 are all “0”, the input status 1 to 255 of the Universal Input signals (8 points) will be applied to the speed percentage.	0 to 255
S4C289	Speed percentage (%) Signal 2		
S4C290	Speed percentage (%) Signal 3		
S4C291	Speed percentage (%) Signal 4		
S4C292	Speed percentage (%) Signal 5		
S4C293	Speed percentage (%) Signal 6		
S4C294	Speed percentage (%) Signal 7		
S4C295	Speed percentage (%) Signal 8		

The Override Speed percentage can be specified with the parameters (S4C288 to S4C295) in two ways as follows:

Setting a Speed Percentage with Respect to Each Signal

- Specify the speed percentage 1 to 255 in the parameters (S4C288 to S4C295). As to the speed percentage for unused signals, set “0”: Speed Override will not take effect even when the external signals are input.
- The signal priority is: “Signal 1 > Signal 8”. For example, when the signals 1 to 3 are input simultaneously, Speed Override will be performed applying the speed percentage of signal 1.

Using Eight Points of External Signals as the Speed Percentage Data

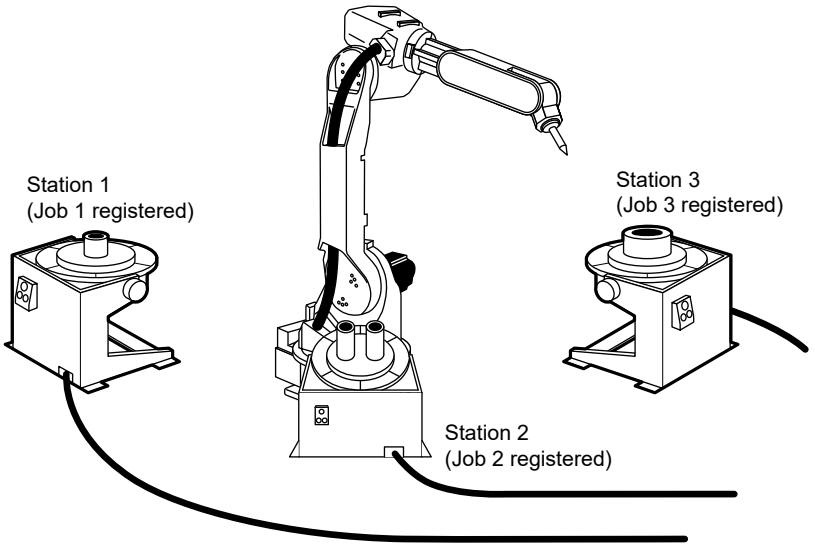
- Set “0” for all the parameters (S4C288 to S4C295).
- Speed Override will be performed applying the input status of signals 1 to 255 as the speed percentage.
  For example, when the signals 5 and 7 are input simultaneously, Speed Override will be performed applying 80% of the speed percentage.

NOTE When this function is enabled, Speed Override cannot be operated with a programming pendant.

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.

4.5.1.1 Enabling Reserved Start

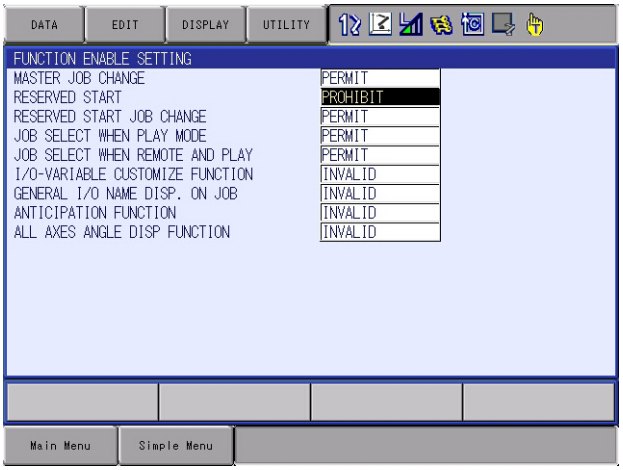
The start button on the station is operative when the reserved start function is enabled, and the following start operations are disabled.

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

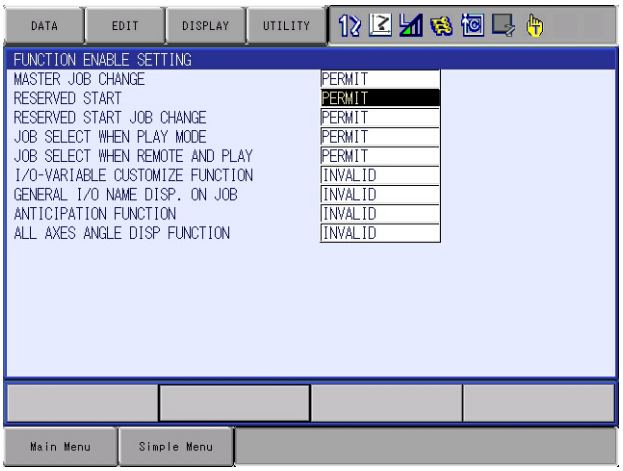
SUPPLE -MENT

The FUNCTION ENABLE SETTING window is shown only when the security mode is set to the 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 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”.



NOTE

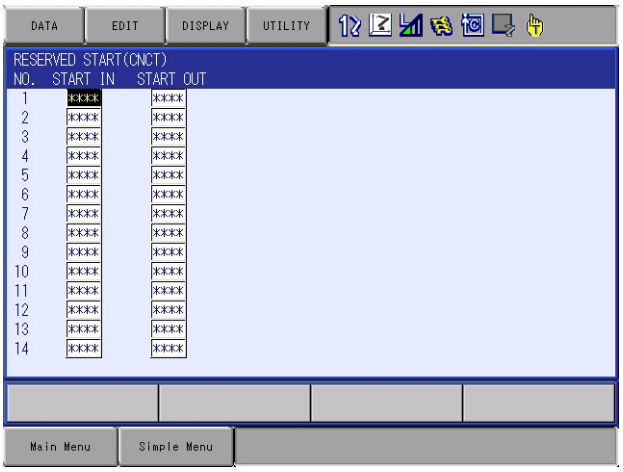
When the reserved start is enabled, the external start and the programming pendant start are prohibited even if setting is “PERMIT” in the OPERATE ENABLE SETTING window. Regardless of the operation cycle selected, it is automatically set to “1 CYCLE”.

4.5.1.2 Registering Reserved Start I/O Signal

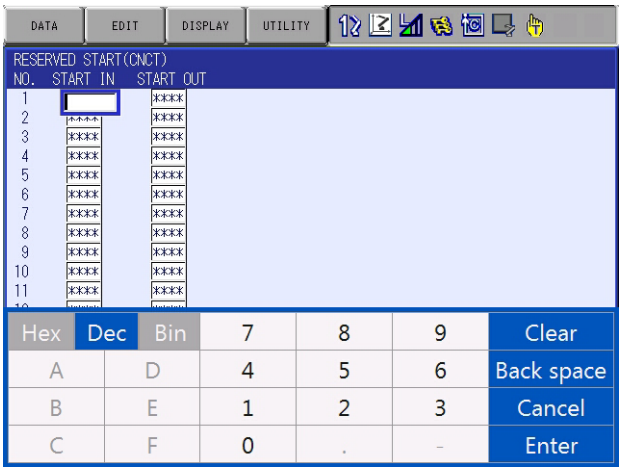
Register the start I/O signal as a preparation to perform the start operation from the station.

> **NOTE** This operation can be done only when the operation mode is set to teach mode and the security mode is set to the management mode, and only when the setting of “RESERVED START JOB CHANGE” is “PERMIT” in the FUNCTION ENABLE SETTING window.

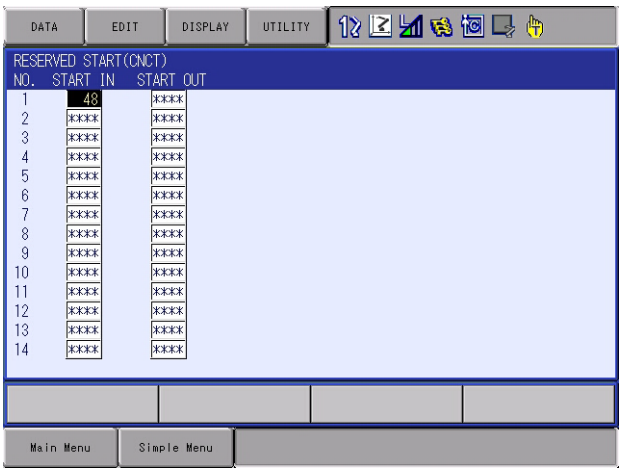
1. Select {SETUP} under the main menu.
2. Select {RES. START(CNCT)}.
   – The RESERVED START (CNCT) window appears.



3. Select “START IN” or “START OUT” for each station.
   – The number can now be entered.



4. Input signal number and press [ENTER].
   – The input/output signal number is registered.

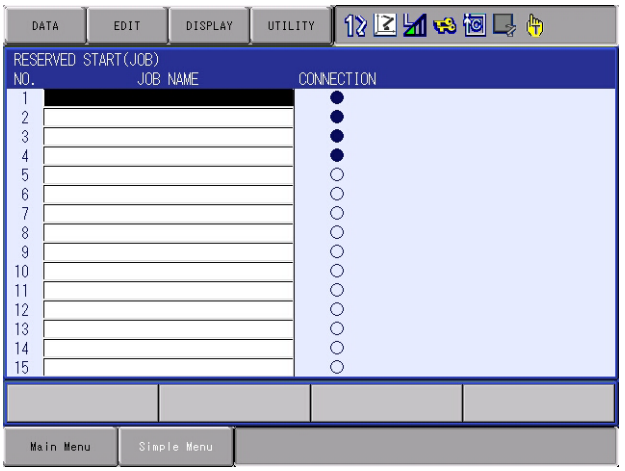


4.5.1.3 Registering Jobs to Stations

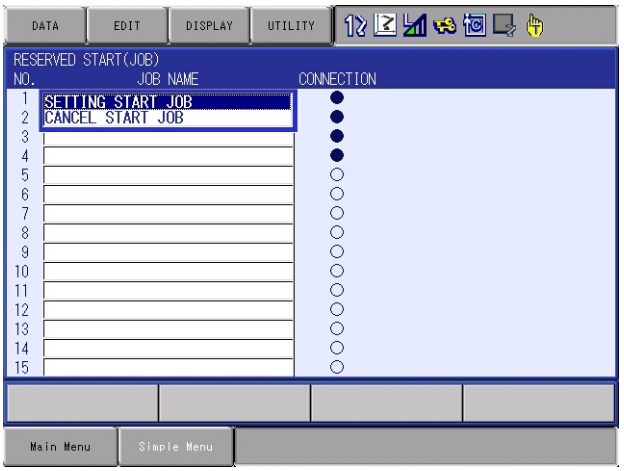
Register the starting job of each station.

NOTE This operation can be done only when the operation mode is set to teach mode and the setting of “RESERVED START JOB CHANGE” is “PERMIT” in the FUNCTION ENABLE SETTING window.

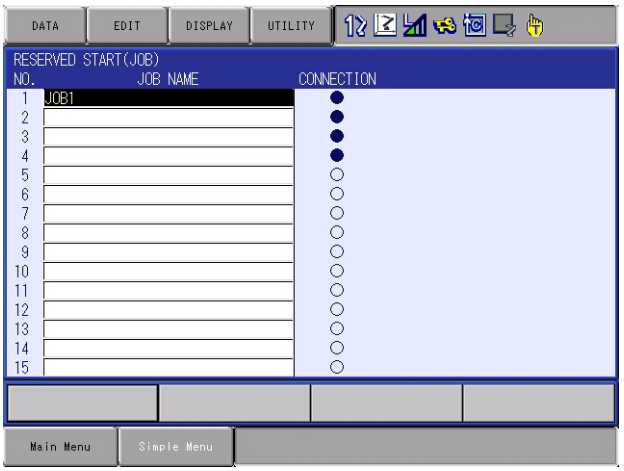
1. Select {JOB} under the main menu.
2. Select {RES. START(JOB)}.
   – The RESERVED START (JOB) window appears.
   – ● indicates that the input/output number is registered.
   – ○ indicates that the input/output number is not registered.



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.
   – The starting job is registered.

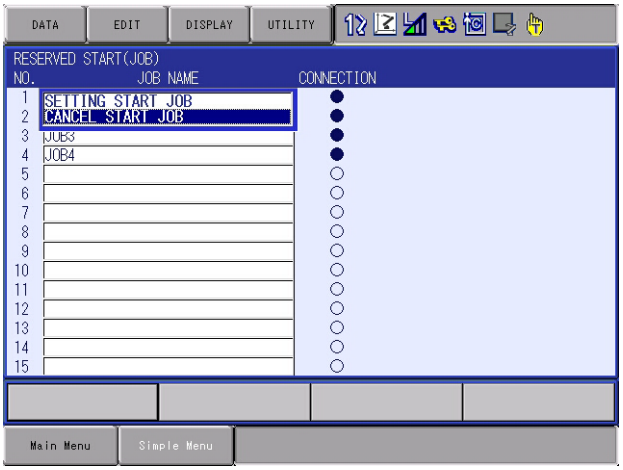


4.5.1.4 Deleting Registered Jobs from Stations

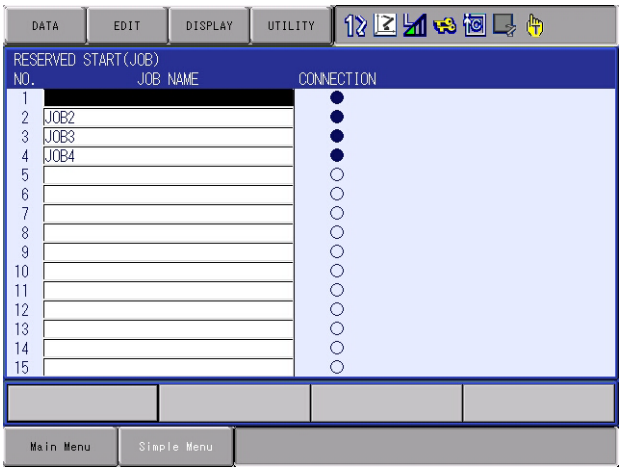
Delete the registered job of each station.

> **NOTE** This operation can be done only when the operation mode is set to teach mode and the setting of “RESERVED START JOB CHANGE” is “PERMIT” in the FUNCTION ENABLE SETTING window.

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.



4.5.2 Playback from Reserved Start

NOTE

- While the job is being executed, the start button LED on the station lights up.
- If the workpiece must be prepared at the station, prepare it before pressing the start button.
- During the execution of a job for one station, if the start button of another station is pressed, the job of the latter station is reserved and prepared to start. Jobs are reserved and executed in the order that the start buttons have been pressed.
- When a job is reserved, the start button LED on the station blinks.
- 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 opera-tion.

4.5.2.1 Start Operation

1. Set the Mode Switch of the programming pendant to “PLAY”.
   – Play mode is set.
2. Press start button on the station.
   – The job registered for the station starts up and the manipulator performs one cycle operation.

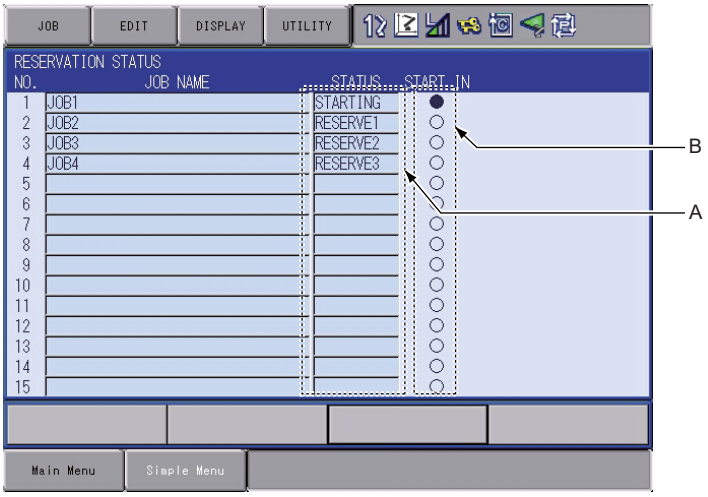
SUPPLE-MENT

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

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.

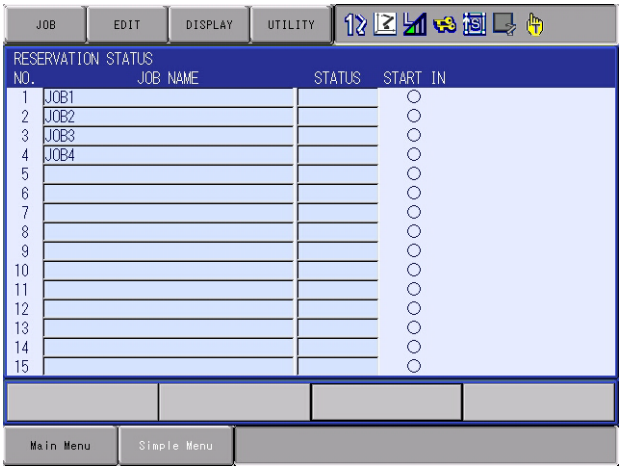
B. START IN

Input signal status is displayed.
“●”: Input signal ON
“○”: Input signal OFF

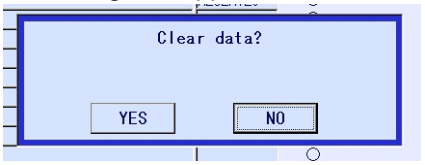
4.5.2.3 Resetting Job Reservation

NOTE 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”.

NOTE 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 FUNCTION ENABLE SETTING window.)
- When another job is called or an edit operation is performed.

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

SUPPLE -MENT During the hold operation, the LED on [START] turns OFF.

4.5.3.1 [HOLD] on the Programming Pendant

■ **Hold**

1. Press [HOLD] on the programming pendant.
   – The manipulator stops temporarily.
   – The [HOLD] LED 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 LED for the external output signal lights.
   – The [HOLD] LED on the programming pendant lights and the [START] LED 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.

4.5.3.3 Hold at the Station

■ **Hold**

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



■ **Release**

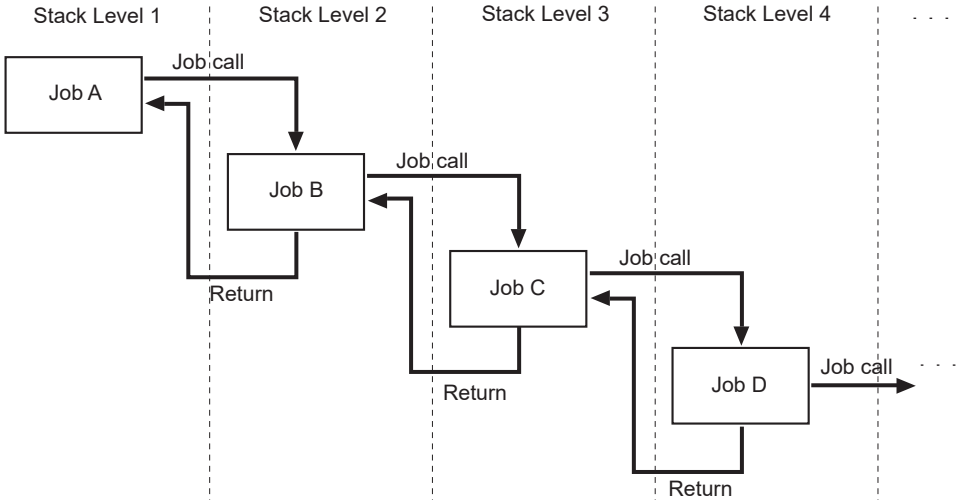
1. Press the hold button on the suspended station.
   – Hold is released.
   – Press the start button on the station, then the manipulator restarts its operation from the position where it was stopped.



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.

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.

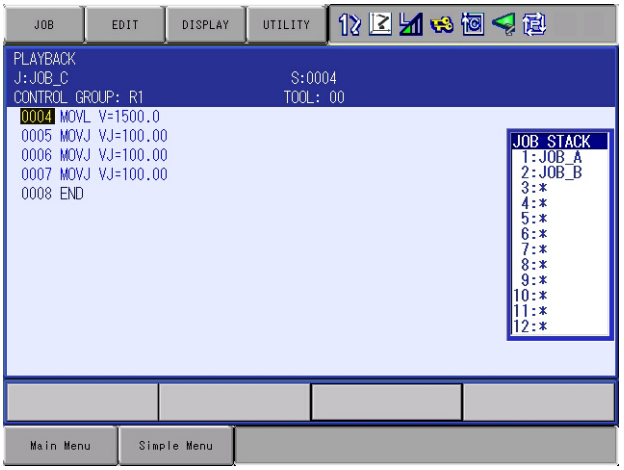


SUPPLE -MENT Job calls can be used for up to 12 stack levels.

1. Select {DISPLAY} under the menu on the PLAYBACK window.



2. Select {JOB STACK}.
   – The job stack status dialog box appears.
   – 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 “Job C” is called from “Job B”. Also, “Job B” is called from “Job A”.

SUPPLE-MENT

If any of the following operations are performed, the job stack is canceled.

- Creating a new job
- Calling the master job
- Selecting jobs
- Copying and renaming jobs
- Job conversion
  (relative job conversion, parallel shift job conversion, mirror shift job conversion)
- Editing the job header window
  (change of axis operation control group, change the coordinate display)
- Displaying jobs by operating the direct open function
- The operation of UNDO and REDO
- Four point teaching
- Executing TRT

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 teach mode. Other operations can be done in any mode.

NOTE

Edit operations are restricted when the edit lock is applied.

NOTE

Editing Move Instructions

See *chapter 3 "Teaching"* 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"* 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.

SUPPLE -MENT

Refer to *chapter 1.2.6 "Character Input Operation"* for the character input operation.

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.

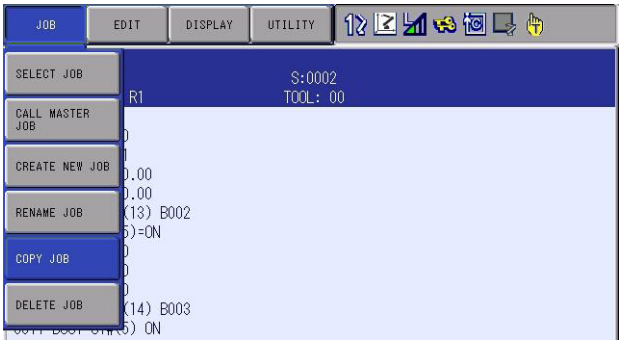
5.1.0.1 Copying Jobs on the JOB CONTENT Window

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

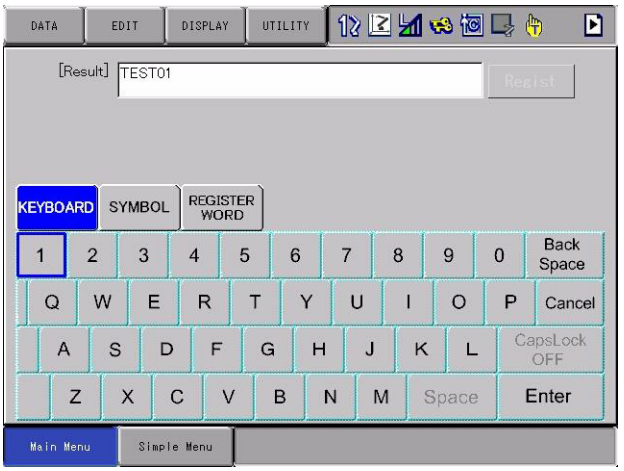
1. Select {JOB} under the main menu.
2. Select {JOB}.
   – The JOB CONTENT window appears.



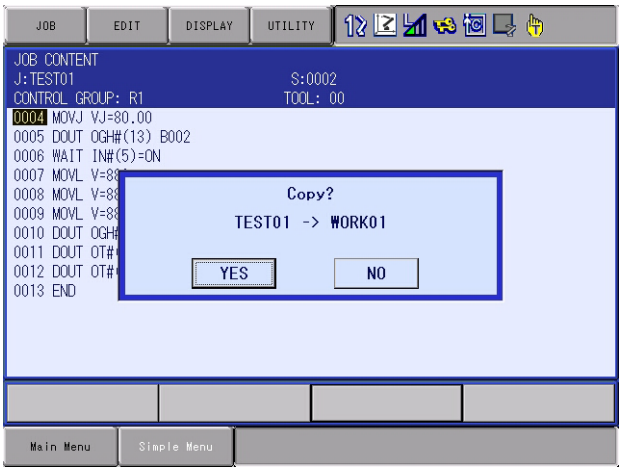
3. Select {JOB} → {COPY JOB} under the pull-down menu.



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. 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 canceled.



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} → {SELECT JOB} under the main menu.
   – The JOB LIST window appears.



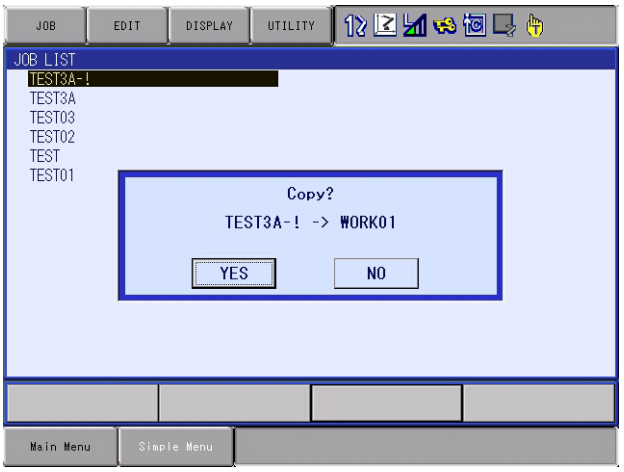
2. Move the cursor to the copy source job.
3. Select {JOB} → {COPY JOB} under the pull-down menu.



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. 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 canceled.



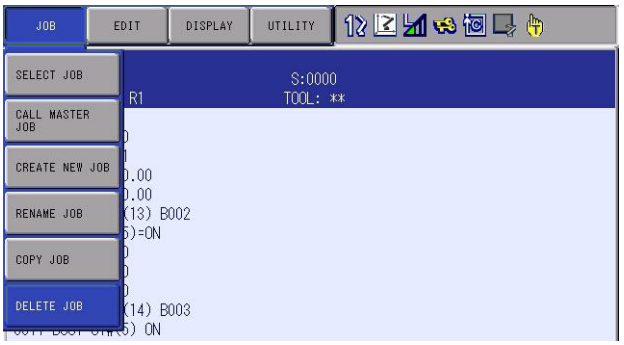
5.2 Deleting Jobs

This operation is used to delete jobs that are registered on the YRC1000micro. It can be performed in either the JOB CONTENT window or the JOB LIST window.

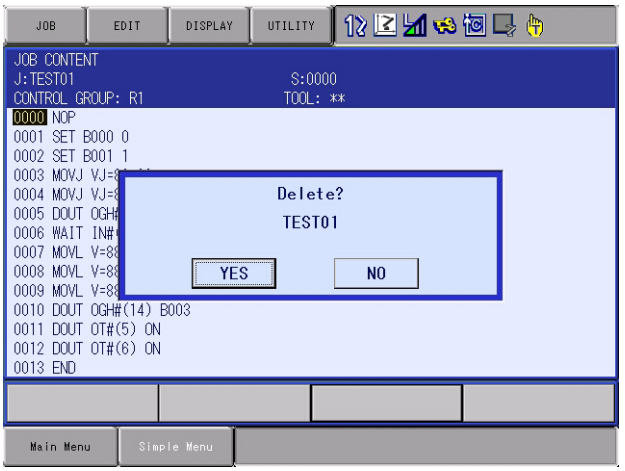
5.2.0.1 Deleting Jobs on the JOB CONTENT Window

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 canceled.



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.

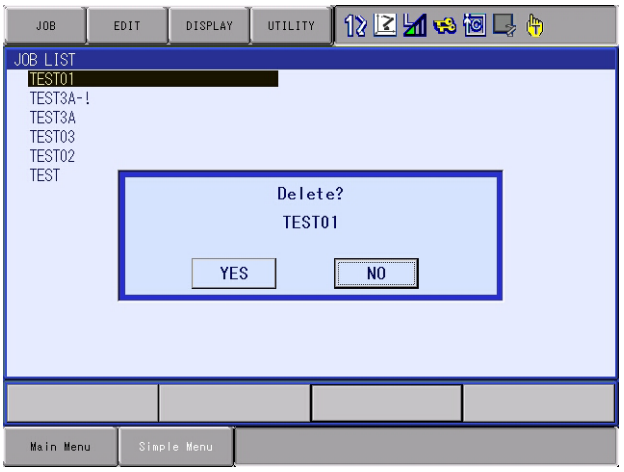
1. Select {JOB} → {SELECT JOB} under the main menu.
   – The JOB LIST window appears.



2. Move the cursor to the job to be deleted.
3. Select {JOB} → {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 canceled and the JOB LIST window appears.



SUPPLE-MENT To select all the registered jobs at a time, select {EDIT} from the menu and then select “SELECT ALL”.

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

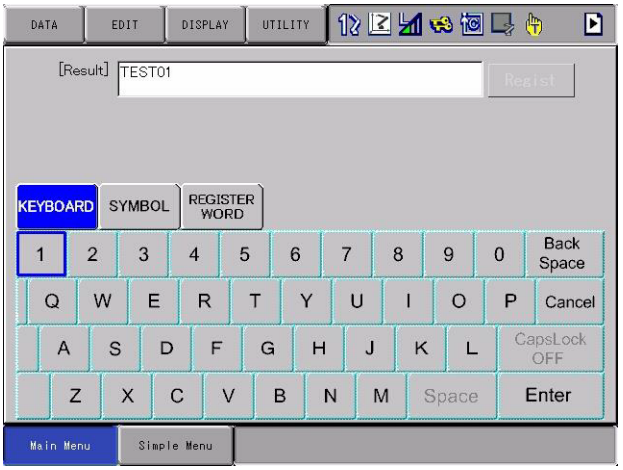
1. Select {JOB} under the main menu.
2. Select {JOB}.
   – The JOB CONTENT window appears.



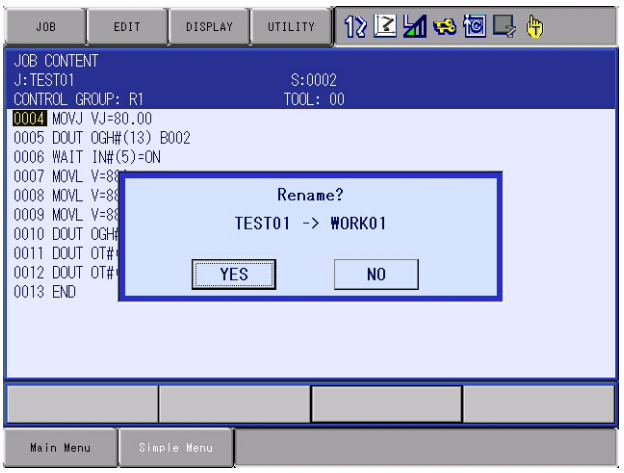
3. Select {JOB} → {RENAME JOB} under the pull-down menu.



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.



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 canceled.



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.

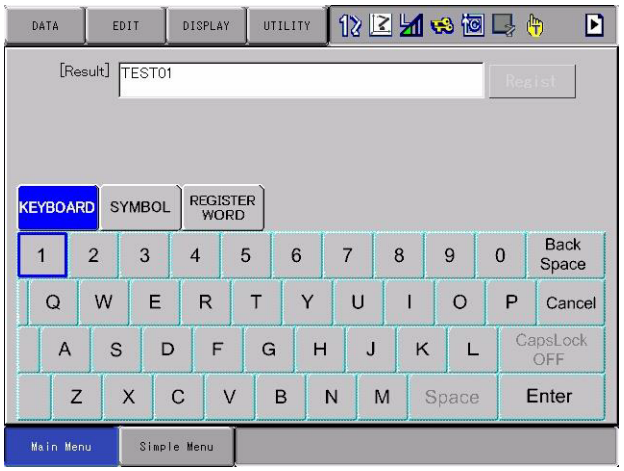
1. Select {JOB} → {SELECT JOB} under the main menu.
   – The JOB LIST window appears.



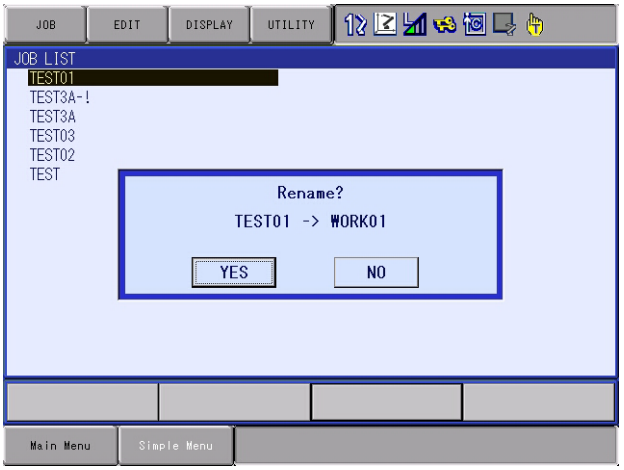
2. Move the cursor to the name to be changed.
3. Select {JOB} → {RENAME JOB} under the pull-down menu.



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.



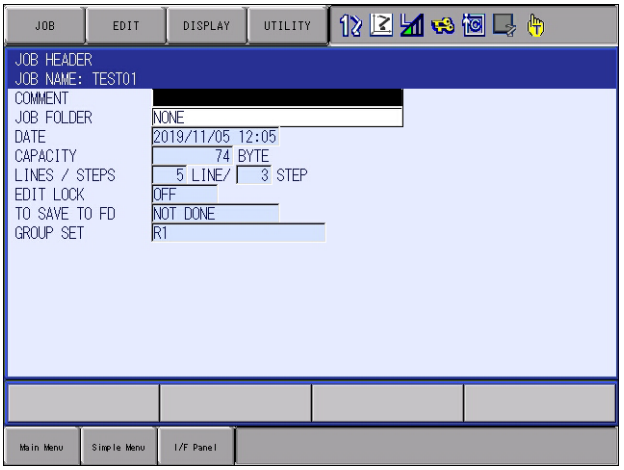
5. Press [ENTER].
   - The confirmation dialog box appears.
   - When “YES” is selected, the job name is changed and a new job name is displayed.
   - When “NO” is selected, the job name is not changed, and the process is canceled.



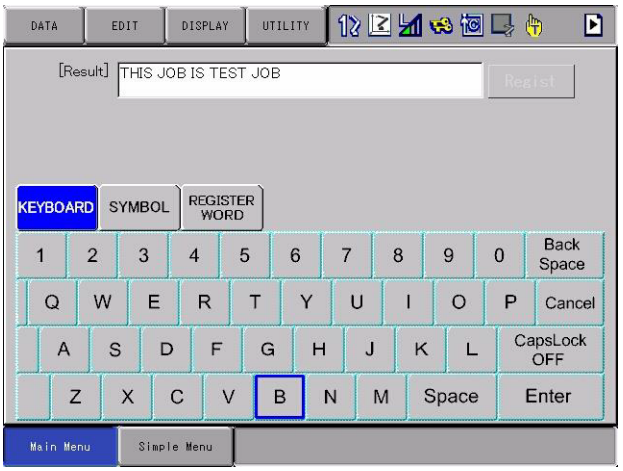
5.4 Editing Comments

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.

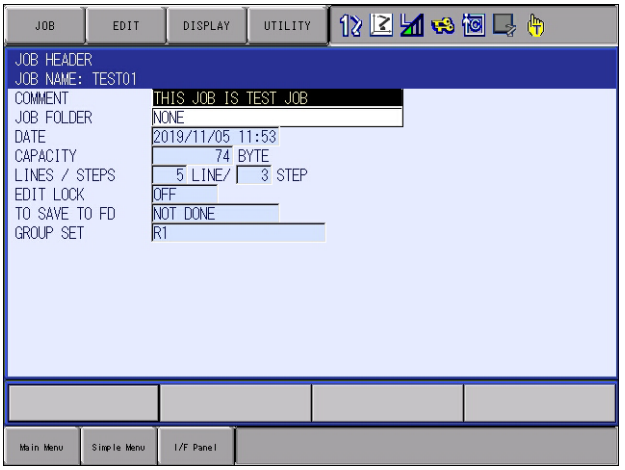
1. Select {JOB} under the main menu.
2. Select {JOB}.
3. Select {DISPLAY} under the pull-down menu.
4. Select {JOB HEADER}.
   – The JOB HEADER window appears.



5. 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.



7. Press [ENTER].
   – The comment on the input area is registered and is displayed on the “COMMENT” area in the JOB HEADER window.



5.5 Job Folder Function

This function enables to classify the jobs in each folder.

The jobs can be classified and displayed, so the visibility improves.

Up to 100 folders, including NONE (no folders), can be registered to this function.

For the folder name, up to 32 one-byte characters can be used.

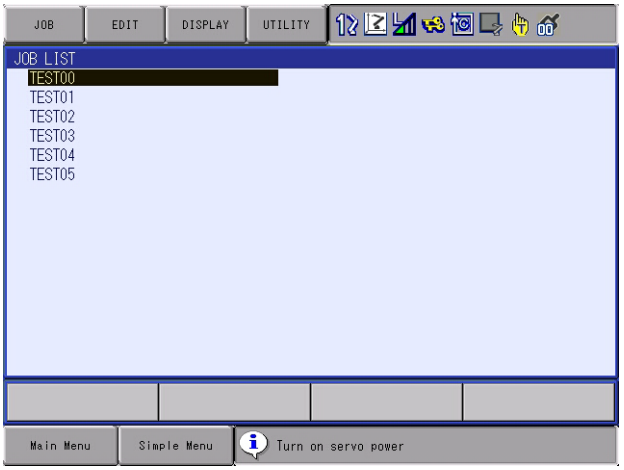
However, the name of NONE (no folders) cannot be changed.

5.5.1 Displaying Jobs by Folders

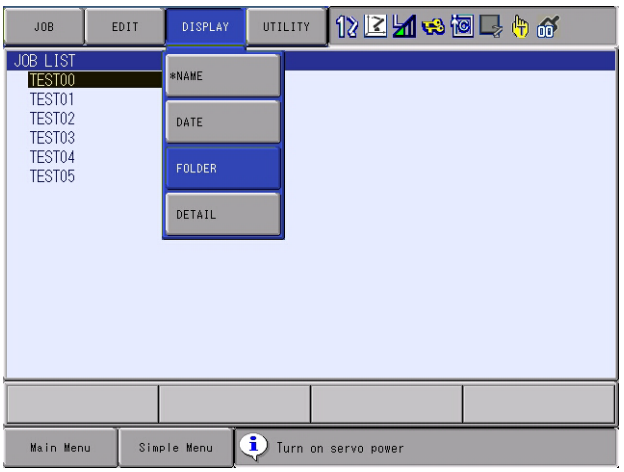
5.5.1.1 Operation for Displaying Jobs by Folders

For displaying the jobs by folders, follow the procedures below.

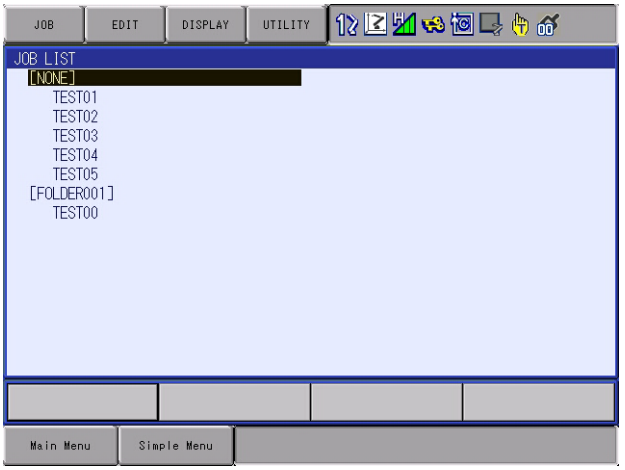
1. Display the {JOB LIST} window.



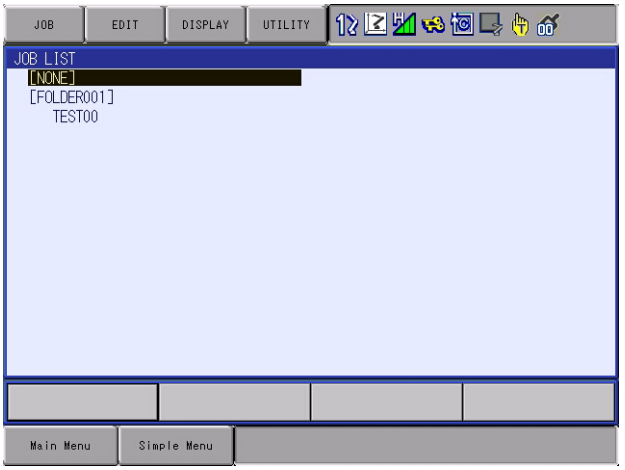
2. Select {DISPLAY} → {FOLDER} under the pull-down menu.



– The folder name is displayed at the head of each job.



– Pressing [SELECT] at the folder name enables to hide the jobs registered in the folder.



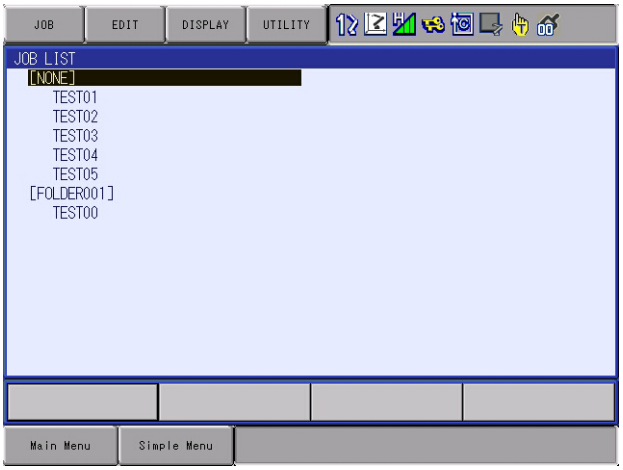
SUPPLE-MENT

- On the {JOB LIST} window in which the jobs are displayed by folders, the folders with no jobs are not displayed.
- When the cursor is moved to the folder name while the job details are displayed, all the information is displayed as asterisks “*”.

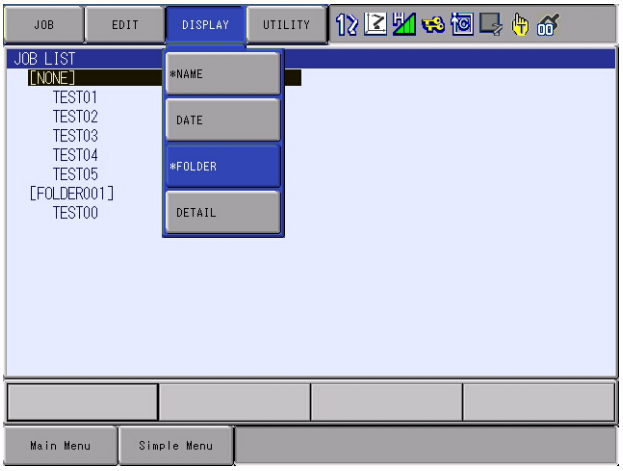
5.5.1.2 Operation for Canceling Displaying Jobs by Folders

For canceling displaying the jobs by folders, follow the procedures below.

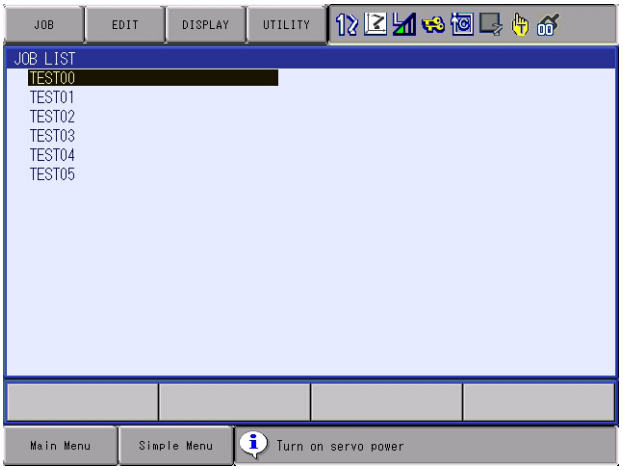
1. Display the {JOB LIST} window.



2. Select {DISPLAY} → {*FOLDER} under the pull-down menu.



– The folder name disappears, and only the JOB names are displayed.



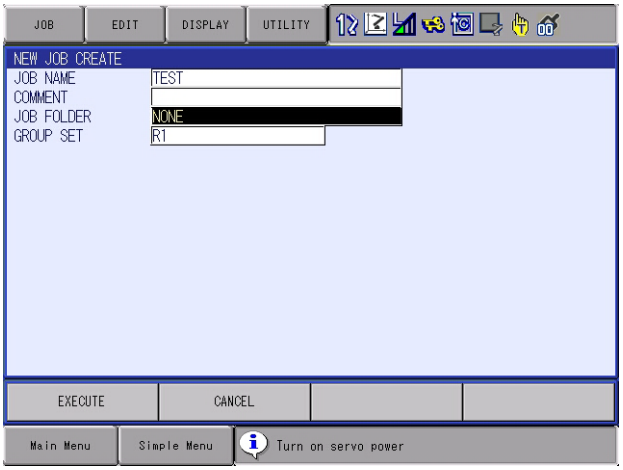
5.5.2 Registering Jobs in Folders

This section explains how to set the jobs to the specified folders.

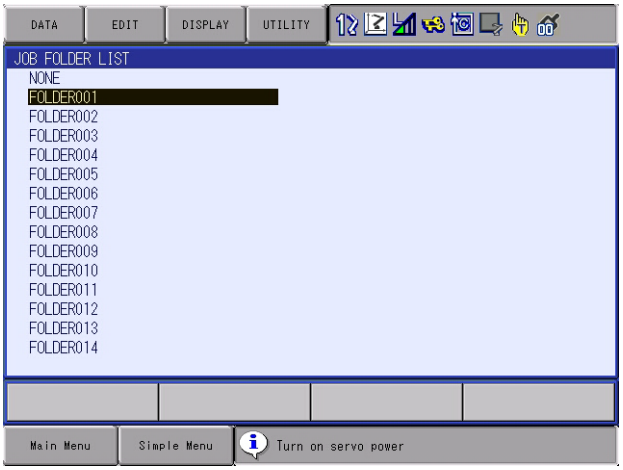
A job can be set in the specified folder when creating a new job or by changing the folder after the job creation.

5.5.2.1 Registering Jobs in Folders (At a New Job Creation)

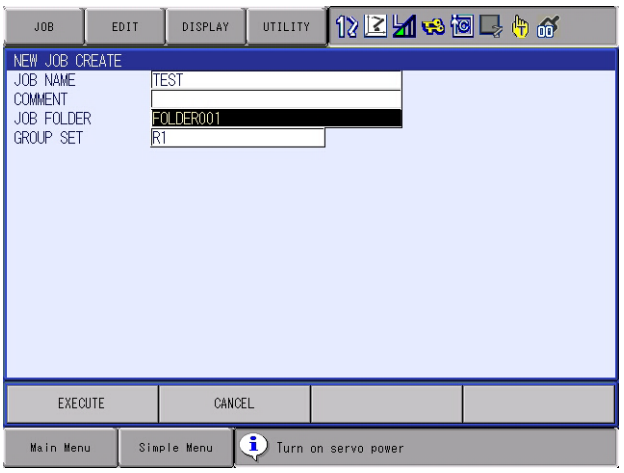
1. Display the NEW JOB CREATE window.



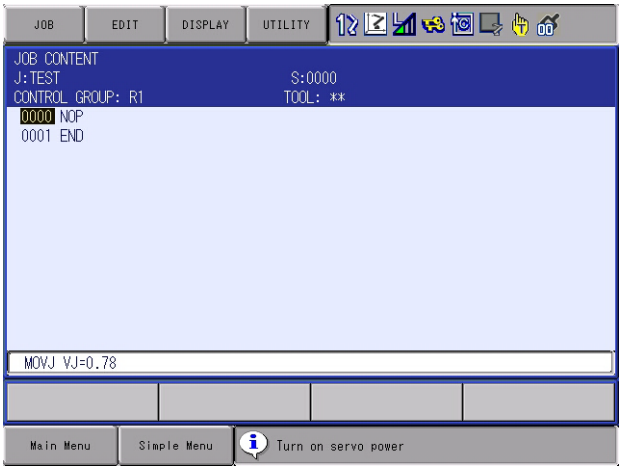
2. Move the cursor to the folder name field, and then press [SELECT].
   – The JOB FOLDER LIST is displayed.



3. Move the cursor to the folder name to select, and then press [SELECT].
   – The selected folder name is displayed in the folder name field.



4. Press [ENTER].
   – A JOB is created.



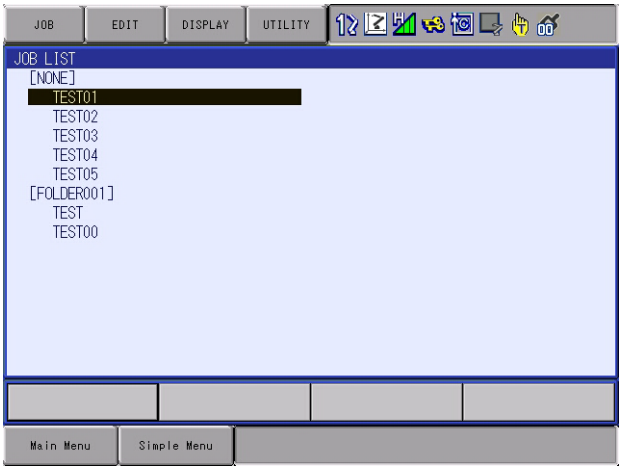
SUPPLE-MENT The folder name is set as NONE or FOLDER001 to 099 before shipment.

5.5.2.2 Changing the Folder Registration of Jobs

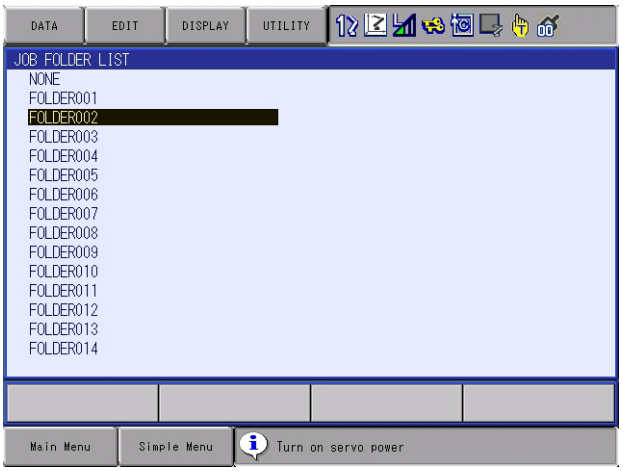
The folder in which the created job is registered can be changed to the other folder.

■ **When changing the folder of one job**

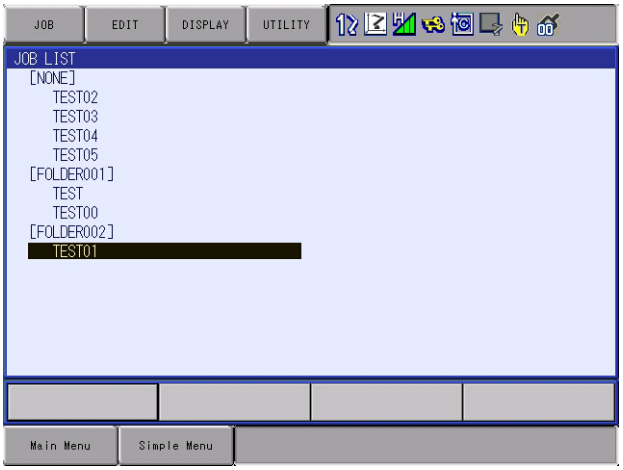
1. Display the JOB LIST window.
2. Move the cursor to the job whose registered folder is to be changed.



3. Select {JOB} → {FOLDER CHANGE} under the pull-down menu.
   – The JOB FOLDER LIST window appears.
4. Move the cursor to the folder name to which the job is to be moved, and press [SELECT].

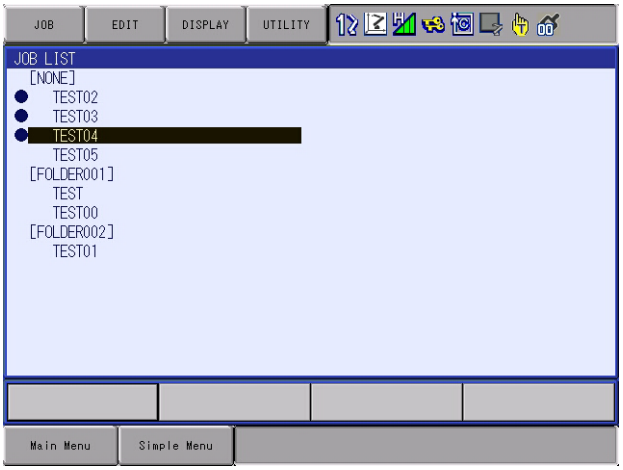


– The job is moved to the specified folder.

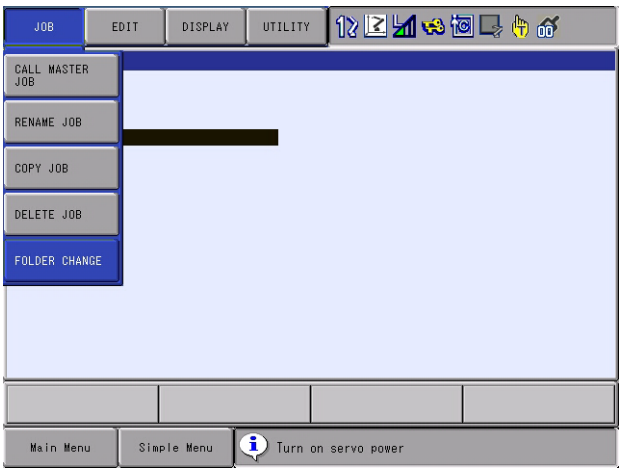


■ **When changing the folder of multiple jobs**

1. Display the JOB LIST window.
2. Move the cursor to the job whose registered folder is to be changed.
3. Press [SHIFT] + [SELECT] to select the job.
   – Select all jobs to be changed.

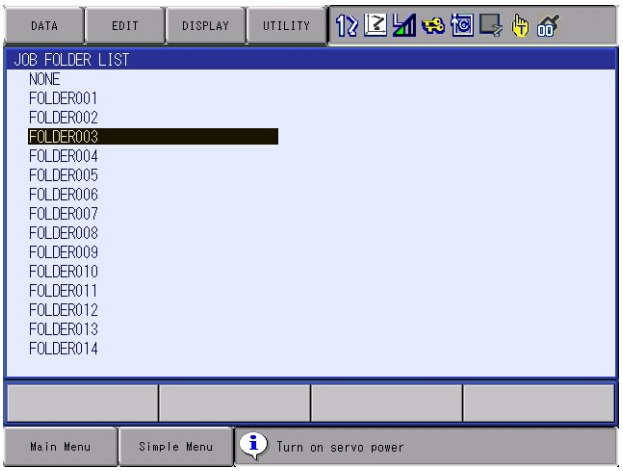


4. Select {JOB} → {FOLDER CHANGE} under the pull-down menu.

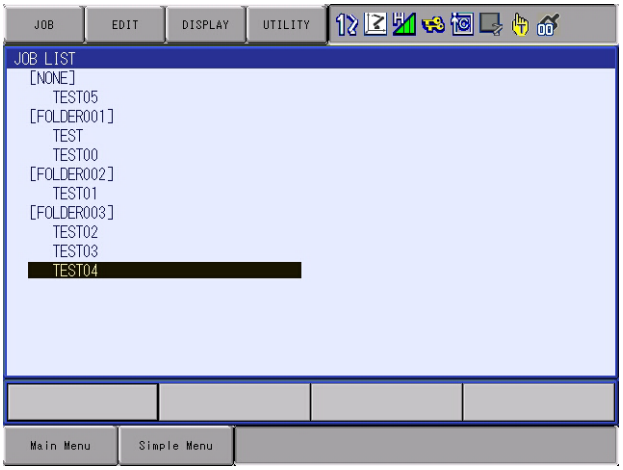


– The JOB FOLDER LIST is displayed.

5. Move the cursor to the folder name to which the job is to be moved, and press [SELECT].



– The jobs are moved to the specified folder.



SUPPLE -MENT

When loading a job from an external memory device, if the loaded job has a folder name and the same name does not exist in the folder names registered in the controller, the folder name of the loaded job will automatically be registered. However, it is necessary to meet the following requirement:

Requirement: Among the 99 folder names except for NONE, there should be a folder with the default value name in which any jobs are not registered.

If there are no folders which meet this requirement, the folder name of the loaded job will be registered to NONE.



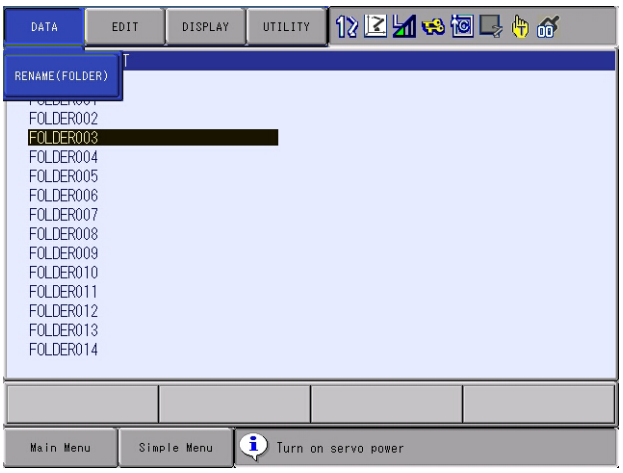
When the bilingual function is activated;

- Respective folder names can be registered to the first and second languages.
  Example:
  The following folder names can be set to FOLDER001:
  First language: “FOLDER 1”
  Second language: “FOLDER-1”
- When the name of the folder to which the jobs are loaded from an external device is automatically registered, the language of the folder name depends on the language used at loading.

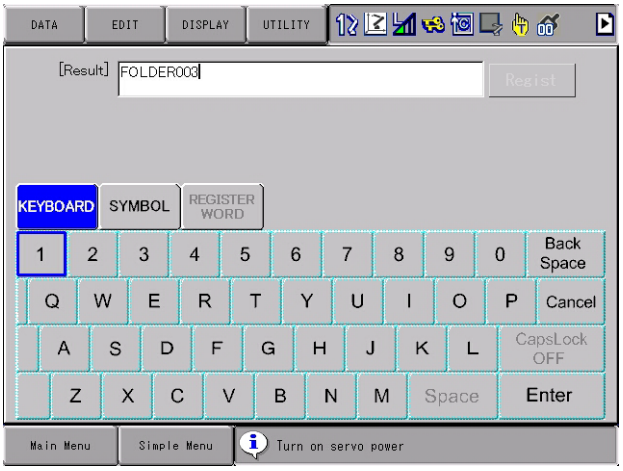
5.5.3 Changing the Folder Name

5.5.3.1 Changing the Folder Name While Displaying Folder List Window

1. Display the JOB FOLDER LIST window.
2. Move the cursor to the folder name to be changed.
3. Select {DATA} → {RENAME(FOLDER)} in the sub-menu.



4. Input the new name of the folder.

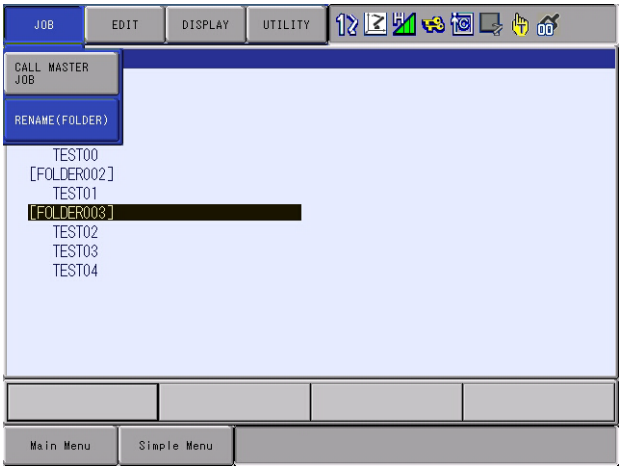


– The folder name will be changed.

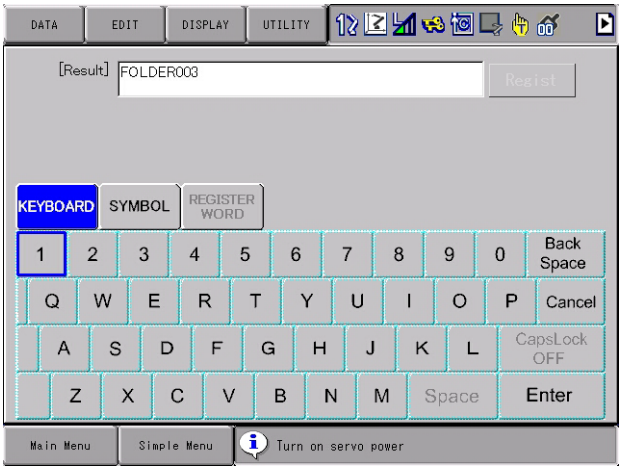
– The folder name of the job registered in the folder will also be changed.

5.5.3.2 Changing the Folder Name While Displaying Jobs by Folders in Job List Window

1. Display the jobs by folders in the JOB LIST window.
2. Move the cursor to the folder name to be changed.
3. Select {JOB} → {RENAME(FOLDER)} in the sub-menu.



4. Input the new name of the folder.



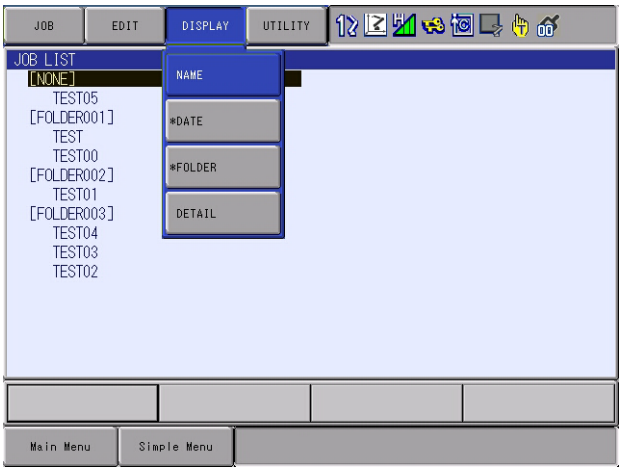
– The folder name will be changed.
– The folder name of the job registered in the folder will also be changed.

5.5.4 Changing the Display Order While Displaying Jobs by Folders

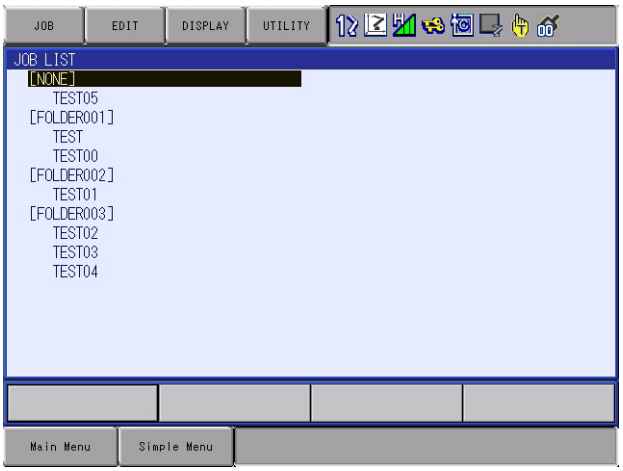
The order of the jobs can be changed while the jobs are displayed by folders.

■ **Displaying by name**

1. Select {DISPLAY} → {NAME} in the sub-menu.

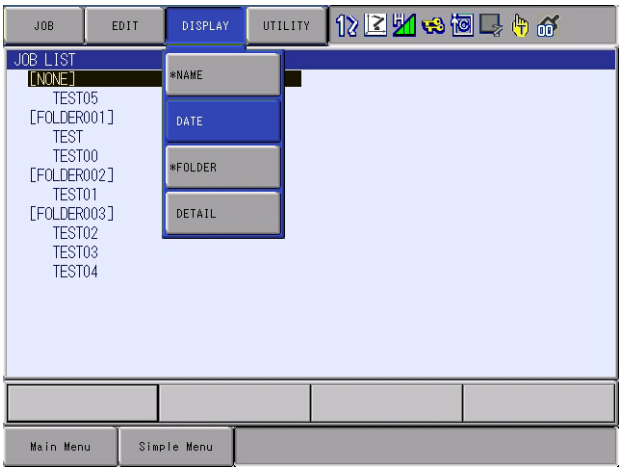


– The jobs are displayed in name order for each folder.

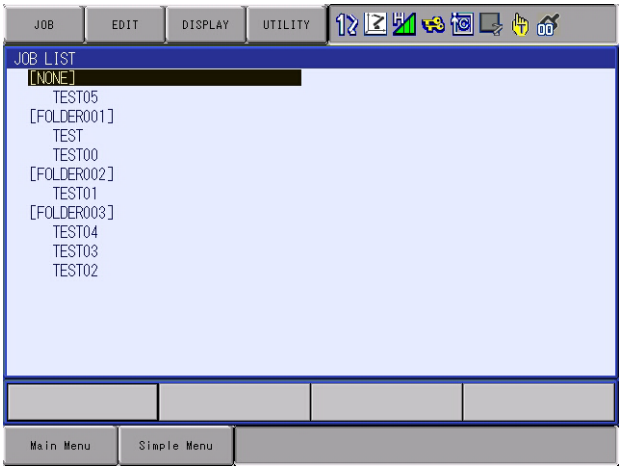


■ **Displaying by date**

1. Select {DISPLAY} → {DATE} in the sub-menu.



– The jobs are displayed in date order for each folder.

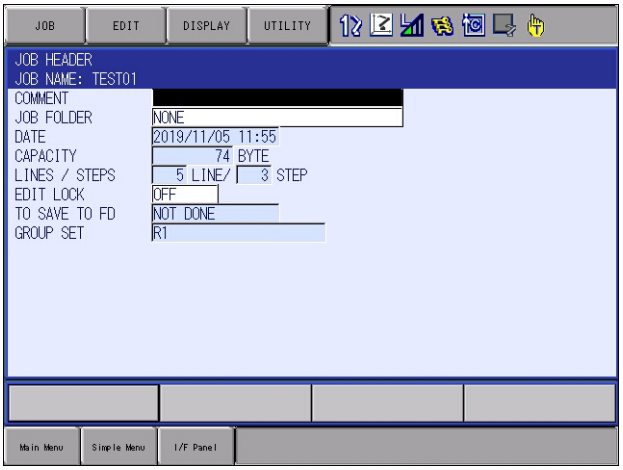


5.6 Setting Edit Lock on Individual Job Units

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 canceled 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.



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).

SUPPLE -MENT

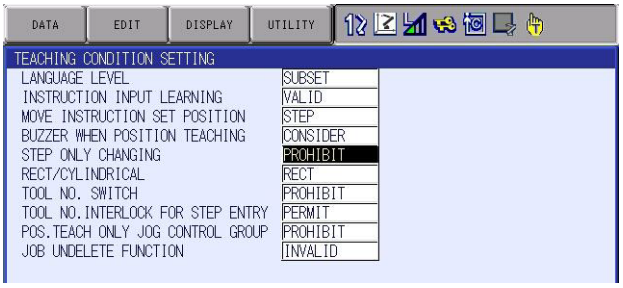
Setting of the edit lock can be changed only when the security mode is set to the management mode or higher.

5.7 Enabling the Modification of Position Data Only

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

> SUPPLE-MENT
>
> The TEACHING CONDITION SETTING window is shown only when the security mode is set to the edit mode or higher.

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



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

6 Convenient Functions

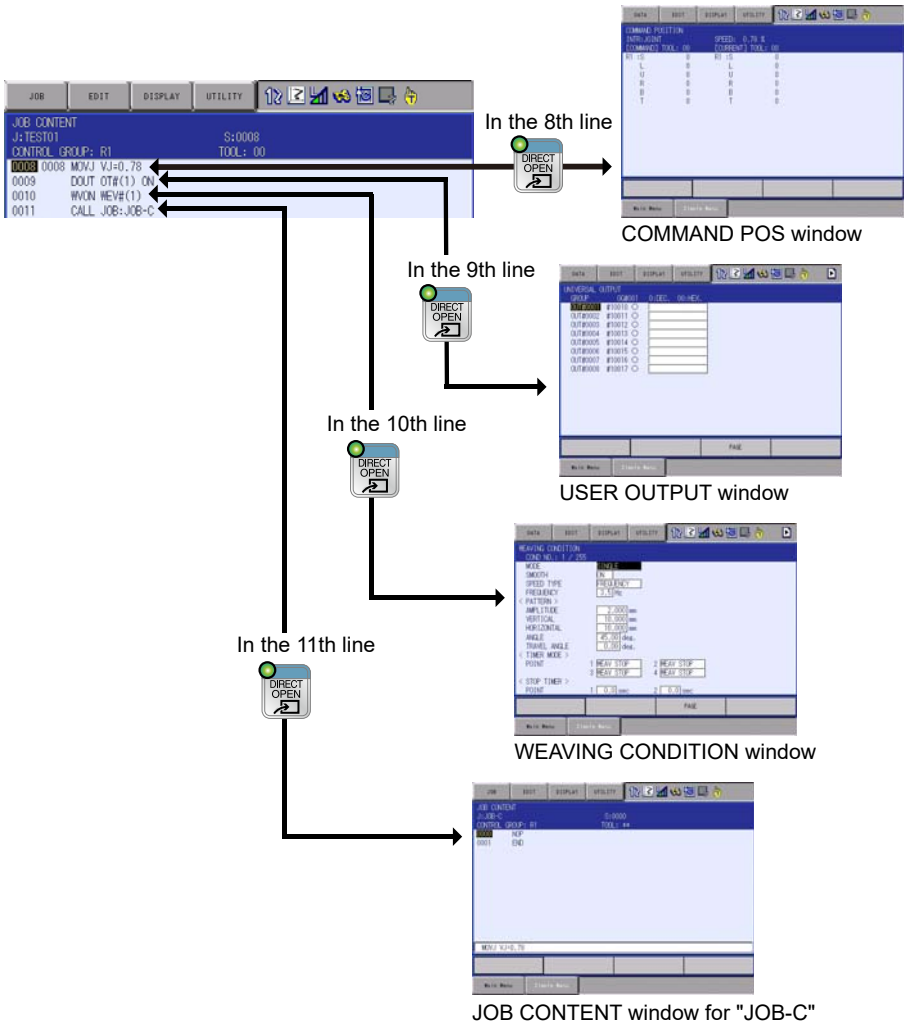
6.1 One-Touch Operation “Direct Open”

6.1.1 Description of Direct Open Function

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 [DIRECT OPEN] 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



6.1.2 Direct Open of the JOB CONTENT Window

1. In the JOB CONTENT window, move the cursor to a job name or a condition file.
2. Press [DIRECT OPEN].

(1) For a job name

– The LED on [DIRECT OPEN] blinks, and the JOB CONTENT window appears.
Direct open can be repeatedly performed in the window opened by the direct-open operation.

– Press [SHIFT] + [DIRECT OPEN] to return to the previous JOB CONTENT window.
When the window is returned to the first JOB CONTENT window, the LED turns OFF.

(2) For a condition file, etc.

– The LED on [DIRECT OPEN] lights up, and the CONDITION FILE window, etc. appears.

– Press [DIRECT OPEN] again to return to the former JOB CONTENT window. The LED turns OFF.



- If another window is selected while the direct open function is effective, the function is automatically canceled and the LED 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.)

6.1.3 Direct Open of the JOB LIST Window

1. In the JOB LIST window, move the cursor to a job name.
2. Press [DIRECT OPEN].

– The LED on [DIRECT OPEN] lights up, and the JOB VIEW window appears.

– Press [DIRECT OPEN] again to return to the JOB LIST window. The LED turns OFF.

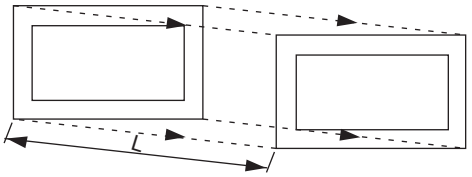


In the JOB VIEW window, jobs cannot be edited.

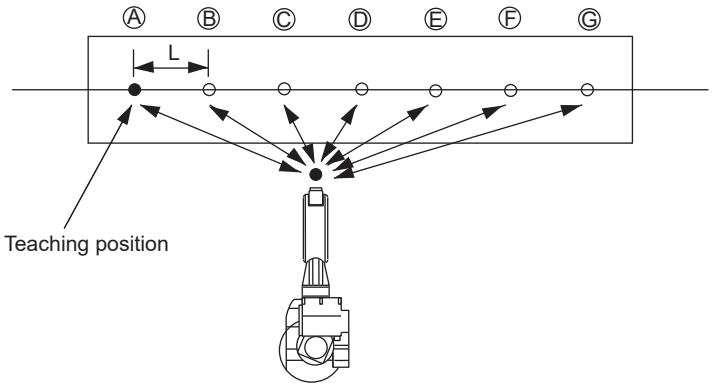
6.2 Parallel Shift Function

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).



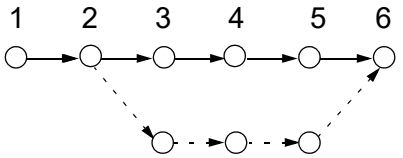
In the example in the figure below, the taught position A is shifted in increments of the distance L (this is actually a three-dimensional XYZ displacement that can be recognized by the robot) in order to enable the operation that was taught at position A to also be performed at positions B through G.



6.2.1.1 Parallel Shift of Step

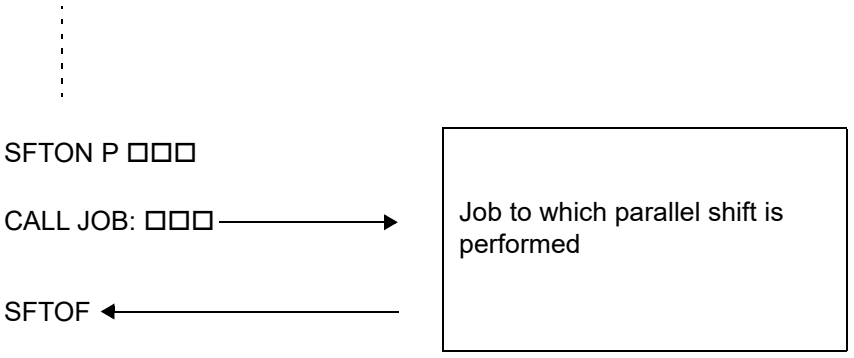
The block from the SFTON to the SFTOF instructions is subject to the shift operation.

Line (Step)	Instruction	
0000	NOP	
0001(001)	MOVJ VJ=50.00	
0002(002)	MOVL V=138	
0003	SFTON P□□□UF# (1)	Shifted block
0004(003)	MOVL V=138	
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

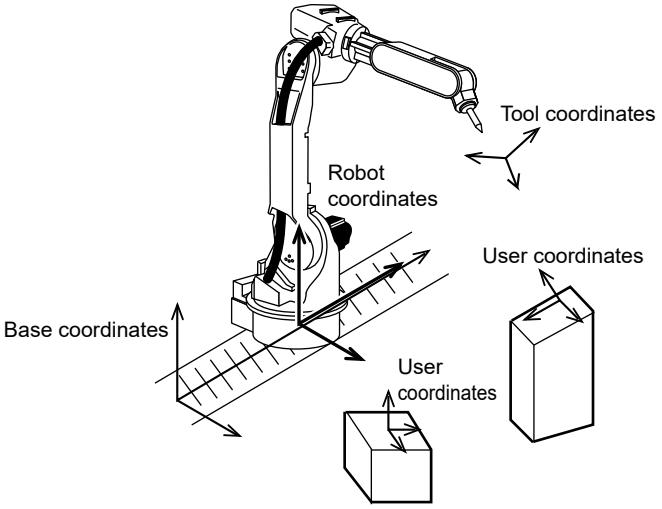
Parallel shift is performed for a job.



6.2.2 Setting the Shift Value

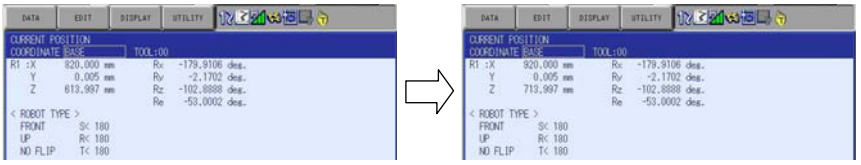
6.2.2.1 Coordinate Systems

The shift amount of parallel shift is denoted by the increments of X, Y, and Z in a coordinate system. Four types of coordinate systems are available: the base coordinates, the robot coordinates, the tool coordinates, and the user coordinates. In a robot system with no servo track, the base coordinates and the robot coordinates are the same.



6.2.2.2 Setting the Shift Value

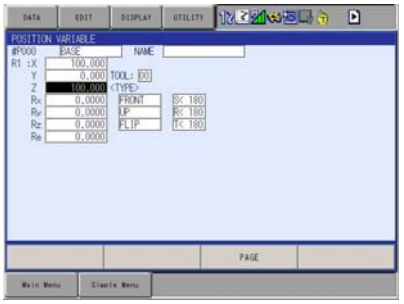
When setting the shift value for the position variables, use the current position (coordinates) of the manipulator in the window



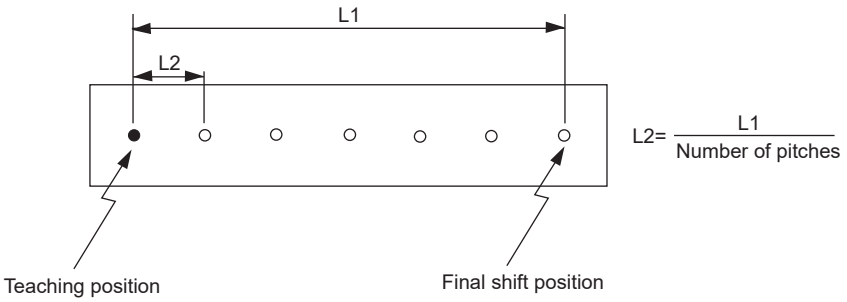
Teaching position

Position to be shifted
(Move the manipulator using the programming pendant.)

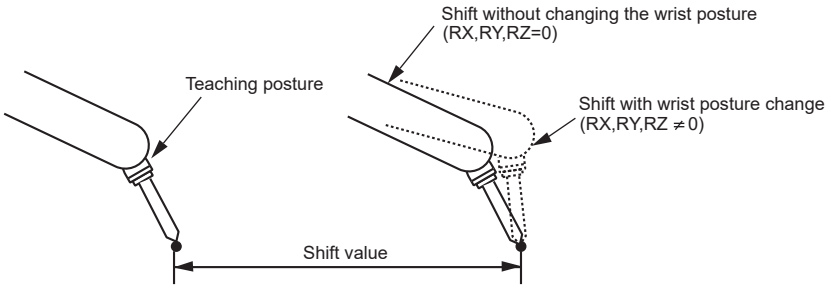
The difference between them is the shift value.



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 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.

SUPPLE -MENT

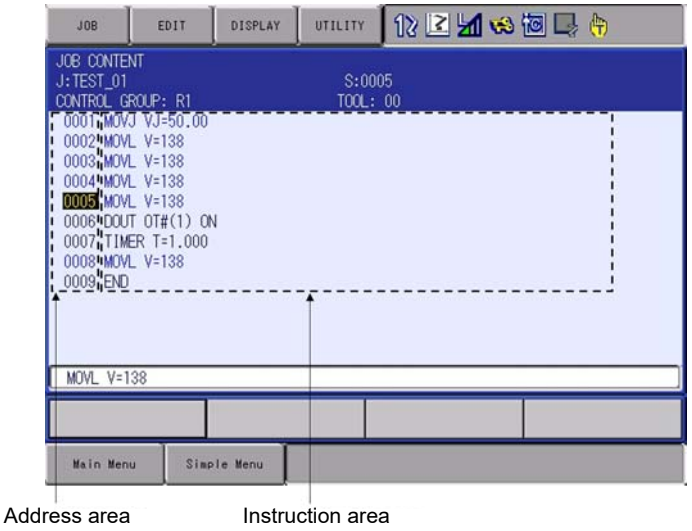
The shift amount of posture displacement (Rx, Ry, Rz) in the Cartesian coordinates is not calculated by the difference of degrees between the components of posture at the shifted position and the components of posture at the taught position.

To calculate the shift amount with the posture displacement values (Rx, Ry, Rz), use the MSHIFT instruction described in *chapter 6.2.3.3 “MSHIFT Instruction”* .

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.

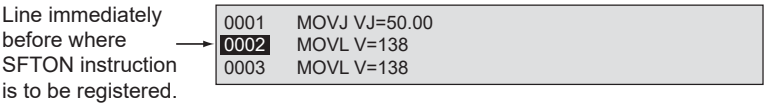


3. Move the cursor to the address area.

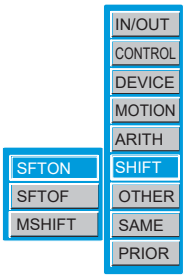
6.2.3.1 SFTON Instruction

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

(1) To change the position variable number, move the cursor to the position variable number and press [SHIFT] + the cursor to increase or decrease the value.



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

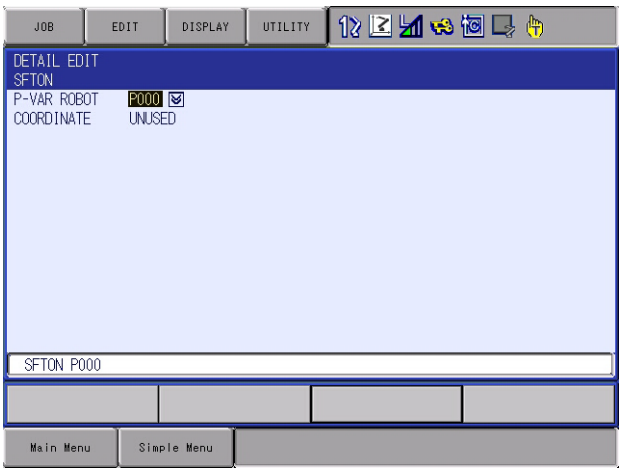


(2) After the number is input, press [ENTER] to modify the number value in the input buffer line.

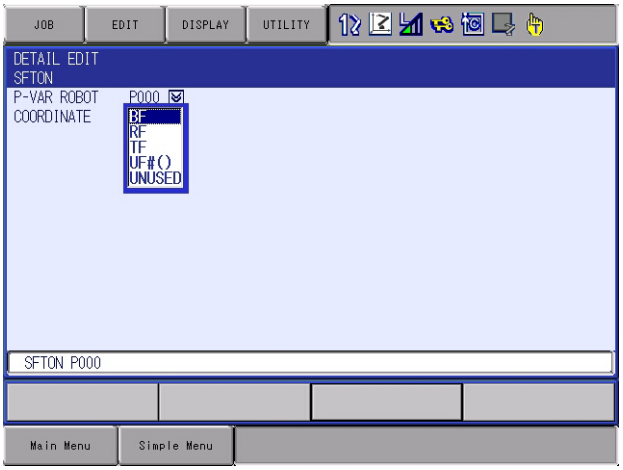
• Adding the coordinate system in which the shift is performed

(1) Move the cursor to the instruction in the input buffer line and press [SELECT]. The DETAIL EDIT window appears.



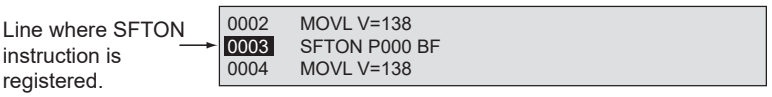


Line up the cursor with “UNUSED” and press [SELECT]. The selection dialog box appears. Line up the cursor with the coordinate system to be added, and press [SELECT].



(2) After the coordinate system addition is completed, press [ENTER]. The DETAIL EDIT window closes and the JOB CONTENT window appears.

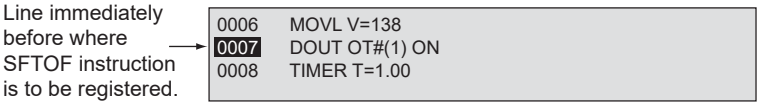
6. Press [INSERT] and then [ENTER].
   – The instruction displayed in the input buffer line is registered.



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.

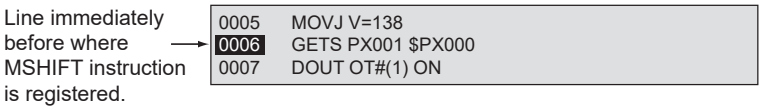


6.2.3.3 MSHIFT Instruction

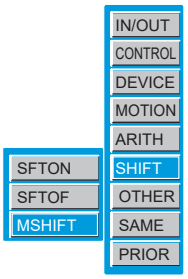
The MSHIFT instruction is used to calculate the shift amount between the reference position and the target position (the shifted position) in the specified coordinates and set the calculated value to the position variable.

By using the MSHIFT instruction, the shift amount with the posture displacement values (Rx, Ry, Rz) in the Cartesian coordinates can be easily calculated.

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.

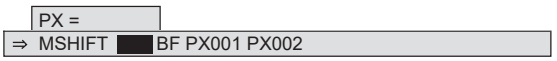
<When Editing Additional Items>

• Adding or modifying additional items

(1) To change the position variable number, move the cursor to the position variable number and press [SHIFT] + the cursor to increase or decrease the value.



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

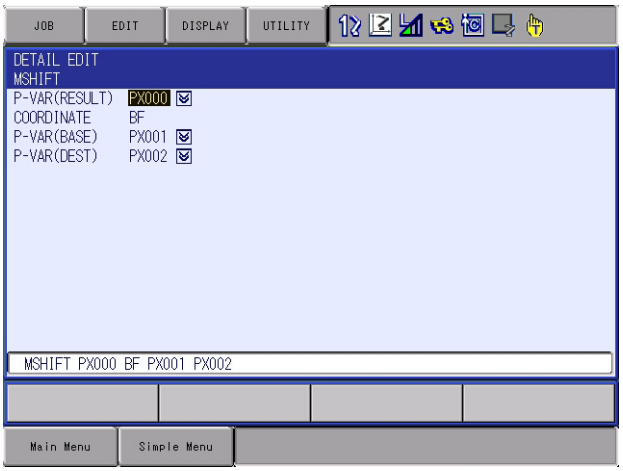


(2) After the number is input, press [ENTER] to modify the number value in the input buffer line.

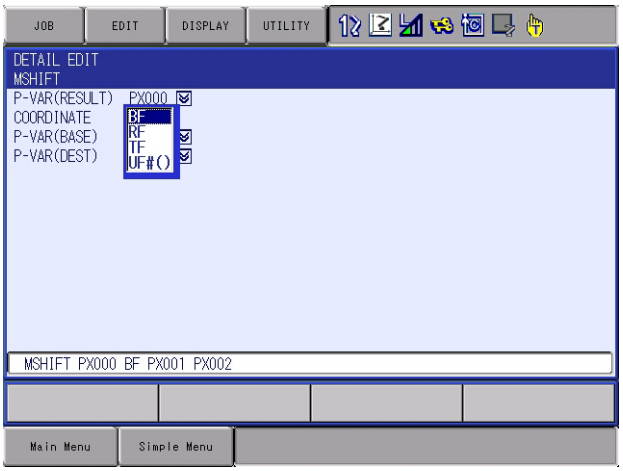
• Changing the coordinate system in which the shift is performed

(1) Move the cursor to the instruction in the input buffer line and press [SELECT]. The DETAIL EDIT window appears.





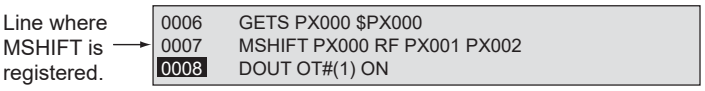
Line up the cursor with “BF” and press [SELECT]. The selection dialog box appears. Line up the cursor with the coordinate system to be changed, and press [SELECT].



(2) 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.



6.2.4 Continuation of the Parallel Shift Function

CAUTION

- If the parallel shift function is canceled because of job editing, etc. after the execution of a parallel shift instruction, start up the job again from the beginning.

Because no parallel shift is performed if the operation is restarted in the middle of the job, the manipulator may interfere with the workpiece or fixture.

If any of the following operations are performed after executing a parallel shift instruction, the shift function is canceled.

- Job editing operation (changing, deleting, adding)
- Job copy, job name change
- Registering a new job, deleting a job, or modifying a selected job

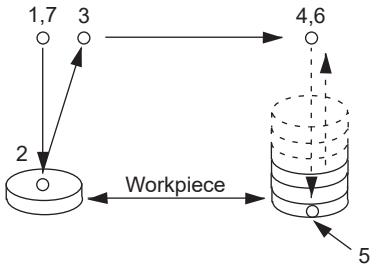
NOTE With any operation other than those listed above, the parallel shift function remains in effect.

6.2.5 Examples of Use

6.2.5.1 Example of Use of Shift Addition/Subtraction

Table 6-1: Workpiece Stacking Operation

Line	Instruction	Description
0000	NOP	
0001	SET B000 0	
0002	SUB P000 P000	Make the first shift value zero.
0003	*A	
0004	MOVJ	Step 1
0005	MOVL	Step 2
0006	'Gripping workpiece	
0007	MOVL	Step 3
0008	MOVL	Step 4
0009	SFTON P000 UF#(1)	Shift start
0010	MOVL	Shift position Step 5
0011	'Releasing workpiece	
0012	SFTOF	Shift end
0013	ADD P000 P001	Add the shift value for the next operation.
0014	MOVL	Step 6
0015	MOVL	Step 7
0016	INC B000	
0017	JUMP *A IF B00<6	
0018	↓	
	SFTON P000 UF#(1)	Since the shift data is retained in memory, the same data can be used (with subtraction instead of addition) to perform a workpiece unloading operation.
	SFTOF	
	SUB P000 P001	
	↓	



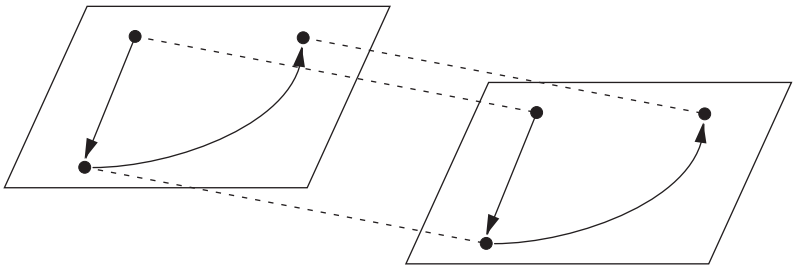
6.2.5.2 Example of Use of MSHIFT Instruction

Line	Instruction	Description
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.

NOTE

Steps Outside the P-point Maximum Envelope

- "/OV" is added to the step when its position exceeds the P-point maximum envelope due to this conversion.
  At this time, if the pulse limit is exceeded, the position after conversion is taught; if the interpolation motion is impossible, the pulse before conversion is taught when the taught position is in pulses, and the Cartesian values after conversion is taught when the taught position is in the Cartesian values.
  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)

NOTICE

- 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 (63 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 for Conversion

Group Combination in Job	**Explanation**		
	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 basis of pulse values regardless of the coordinates.		

Table 6-2: Relationship Between Group Combinations and Coordinates for Conversion

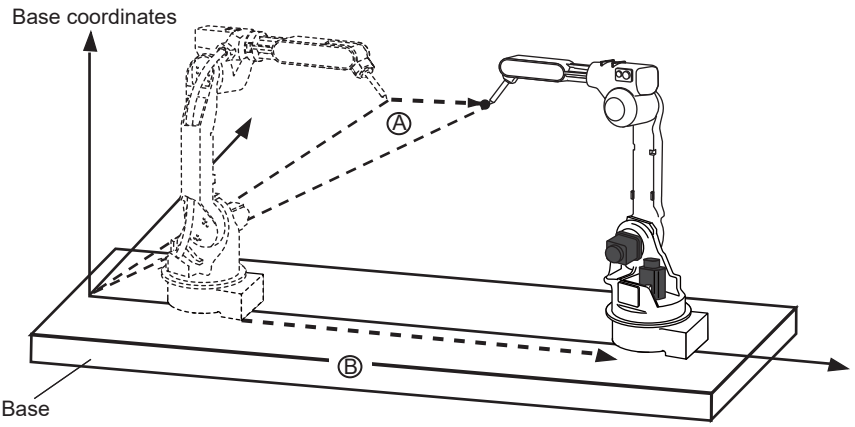
Group Combination in Job	Explanation Usable Coordinate System
R+S	The manipulator is shifted in the selected coordinates. The station axis is shifted on the basis of pulse values regardless of the coordinates. Base coordinates, robot coordinates, tool coordinates, user coordinates, pulse coordinates
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

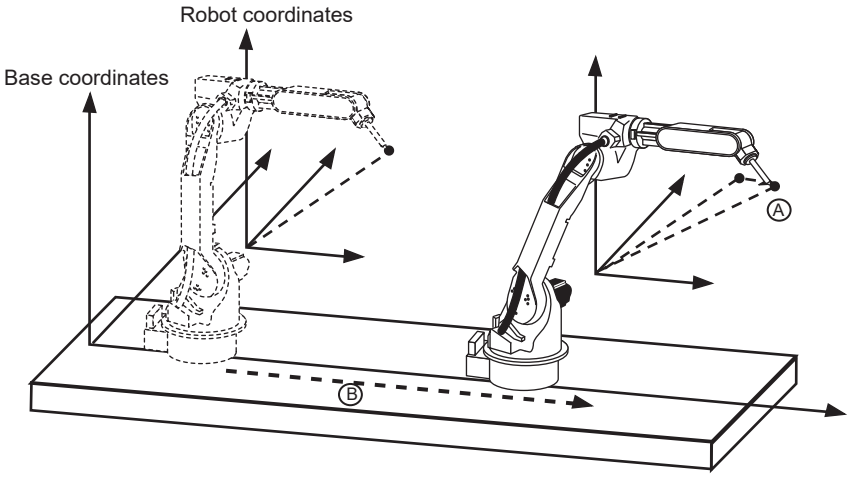
1. Base Coordinates

The base axis is shifted by B and the TCP of the manipulator is shifted by A in the base coordinates.



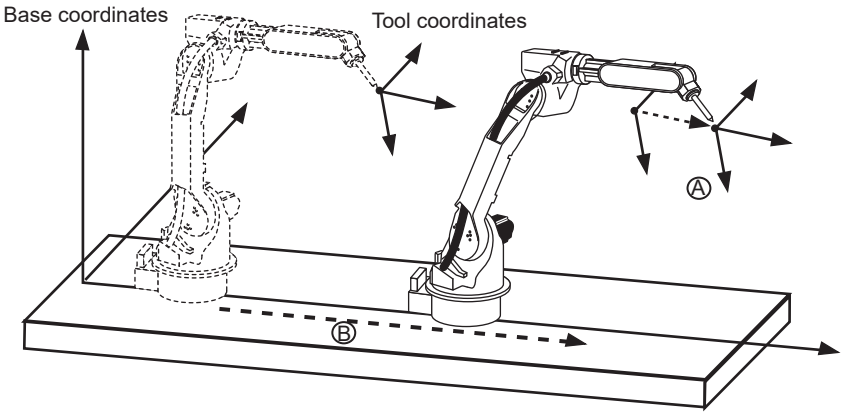
2. Robot Coordinates

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.



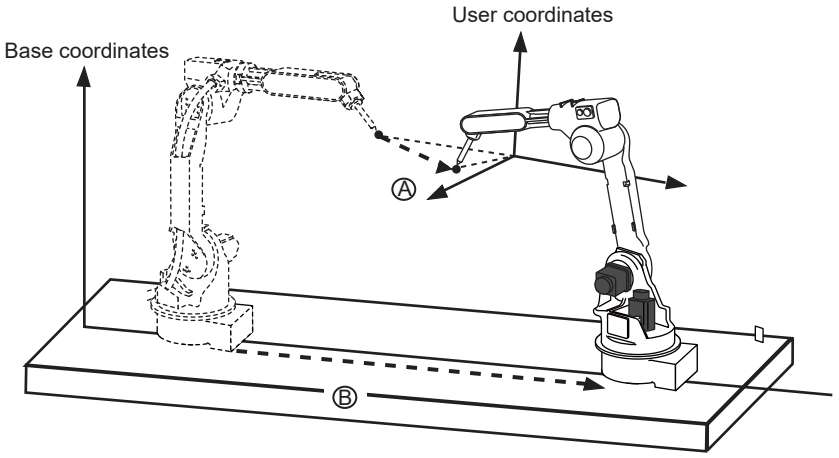
3. Tool Coordinates

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.



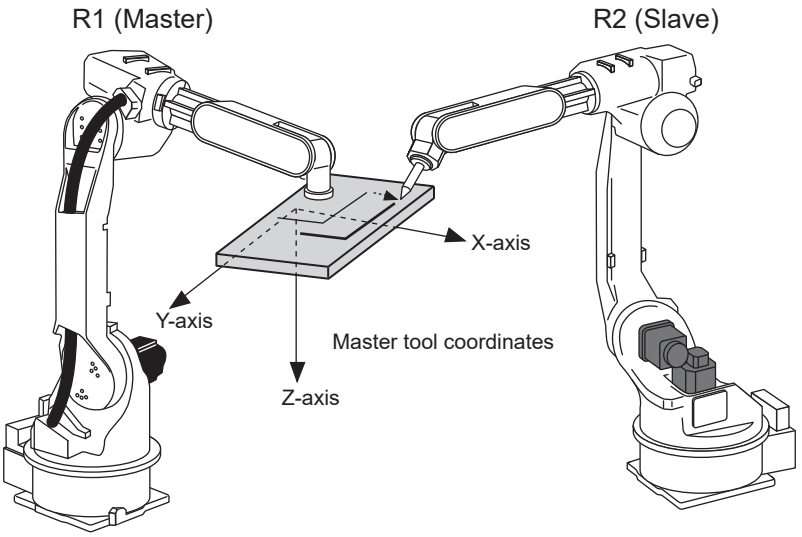
4. User Coordinates

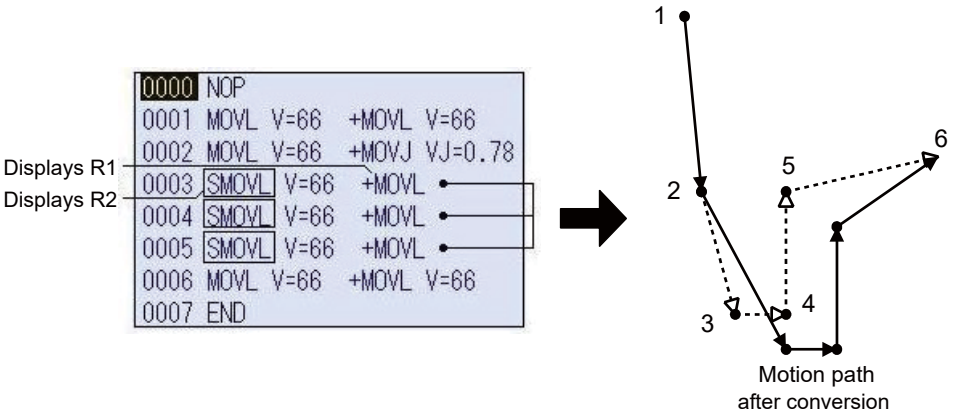
The base axis is shifted by B and the TCP of the manipulator is shifted by A in the user coordinates. These shifts are carried out independently.



■ Converting R*+R* Jobs with Master Tool Coordinates

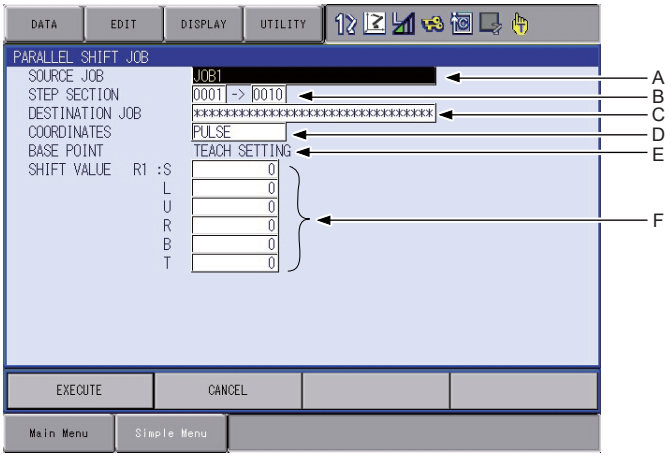
R*+R* coordinated jobs can be subjected to the parallel shift job conversion in the master tool coordinates. Only the steps taken at the “slave” from the standpoint of the SMOV instruction are subject to conversion (i.e. the steps of R2 in the figure below).





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 → 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.

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.

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.

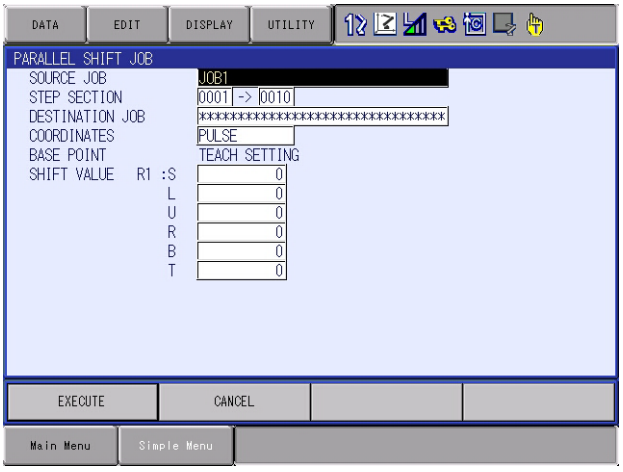
SUPPLE -MENT

The method using position variables by parameter setting is described in *chapter 6.3.4 “Specifying the Shift Value by Position Variables”* other than above two methods.

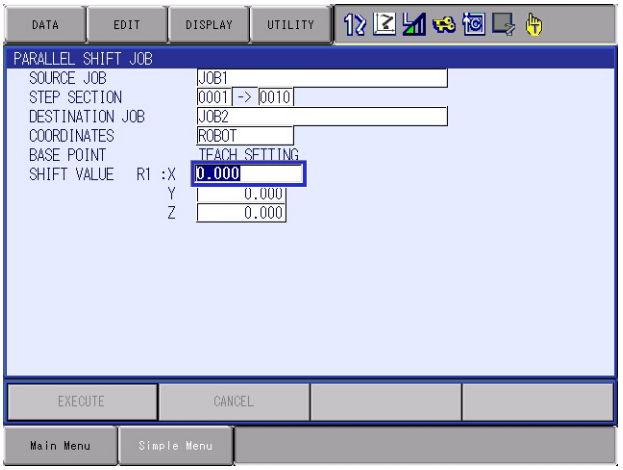
The following are the operation procedures by each setting of shift value for parallel shift job conversion.

■ Numerical Value Input

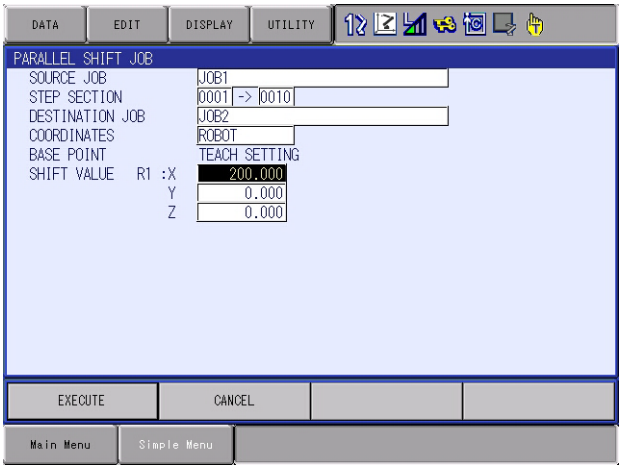
1. Select {JOB} under the main menu.
2. Select {JOB}.
   – The JOB CONTENT window appears.
3. Select {UTILITY} under the pull-down menu.
4. Select {PARALLEL SHIFT JOB}.
   – The PARALLEL SHIFT JOB window appears.



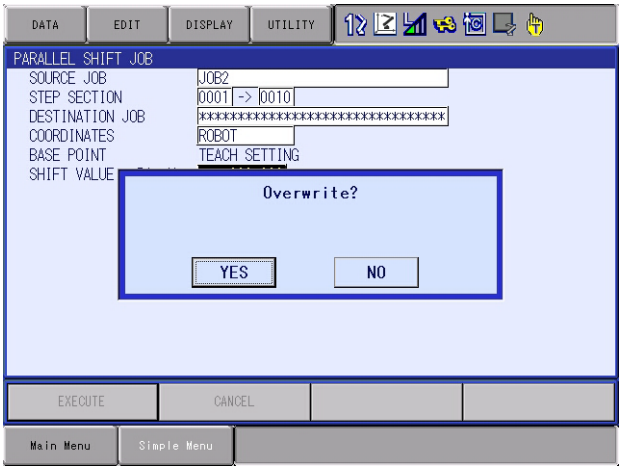
5. Specify the conversion items.
   – Specify each item.
6. Select the shift value to be set.
   – The number can be entered.



7. Type the shift value using [Numeric Keys].
8. Press [ENTER].
   – The shift value is set.



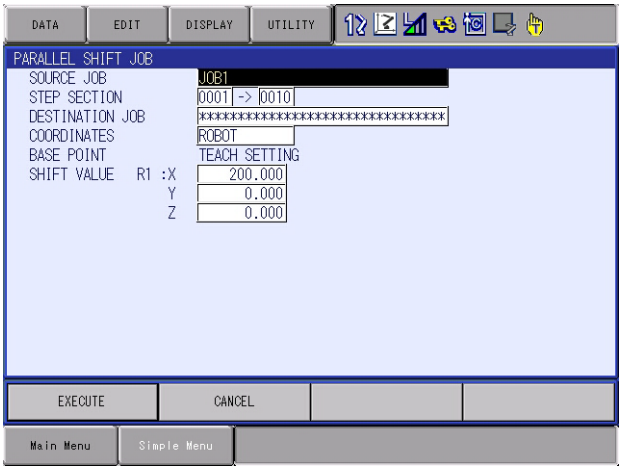
9. Display the PARALLEL SHIFT JOB window. Select “EXECUTE”.
   – The confirmation dialog box appears when the converted job is not specified. Select “YES” then the conversion is executed.
   – The JOB CONTENT window appears when the conversion is completed.
   – When “CANCEL” is selected, the display goes back to the JOB CONTENT window without executing conversion.



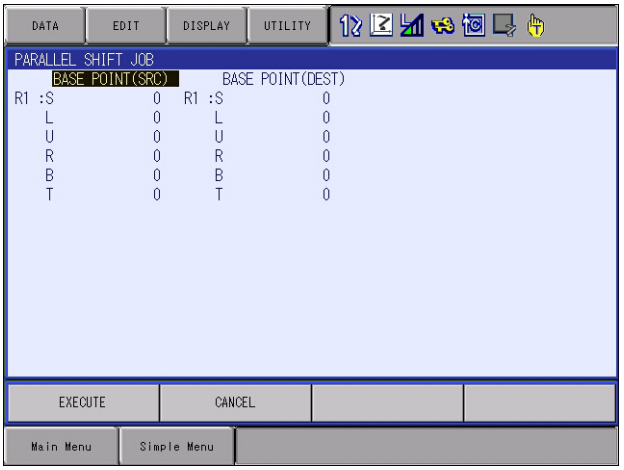
NOTE If an alarm occurs during conversion, conversion is suspended.

■ Calculation by Teaching

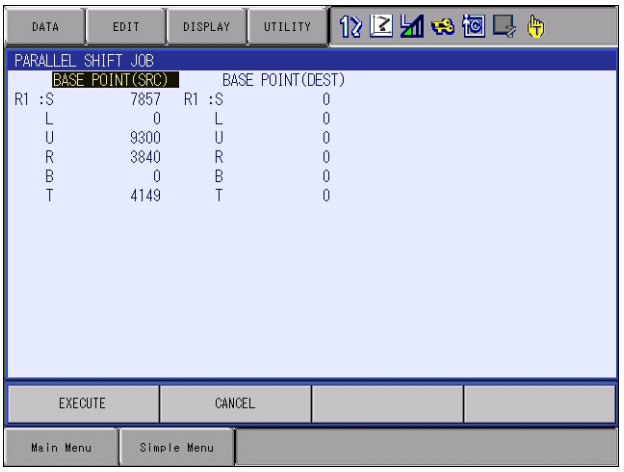
1. Select {JOB} under the main menu.
2. Select {JOB}.
   – The JOB CONTENT window appears.
3. Select {UTILITY} under the pull-down menu.
4. Select {PARALLEL SHIFT JOB}.
   – The PARALLEL SHIFT JOB window appears.



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.

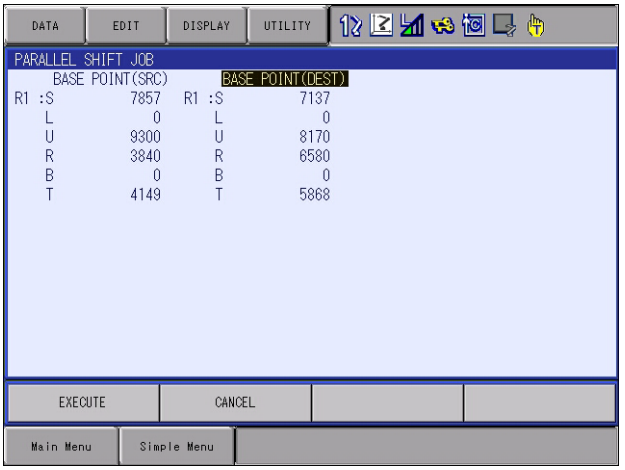


7. Select “BASE POINT(SRC)”.
8. Move the manipulator to the original base point by the [Axis Keys].
9. Press [MODIFY] and [ENTER].
   – The original base point is set.

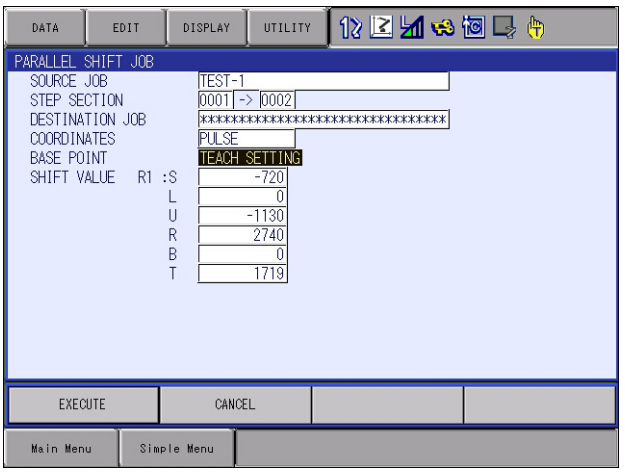


10. Select “BASE POINT(DEST)”.
11. Move the manipulator to the converted base point by the [Axis Keys].

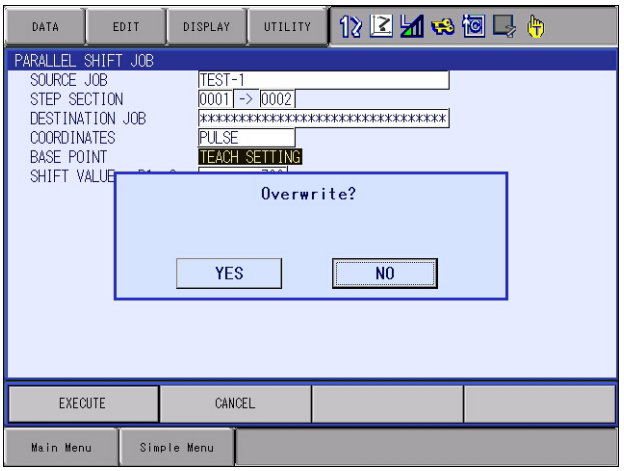
12. Press [MODIFY] and [ENTER].
    – The conversion base point is set.



13. Touch “EXECUTE”.
    – The difference is calculated by the two teaching points and set as a shift value.



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.



NOTE If an alarm occurs during conversion, conversion is suspended.

6.3.4 Specifying the Shift Value by Position Variables

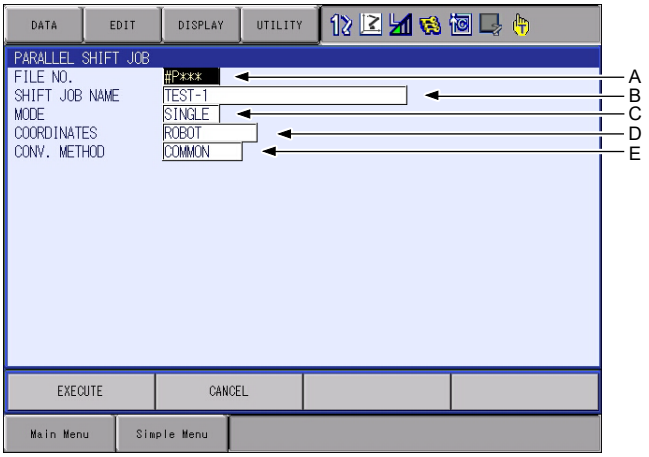
The shift value can be specified using position variables by parameter settings.

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.
When the user coordinates are selected, the input buffer line appears. Input the desired user coordinate number and press [ENTER].

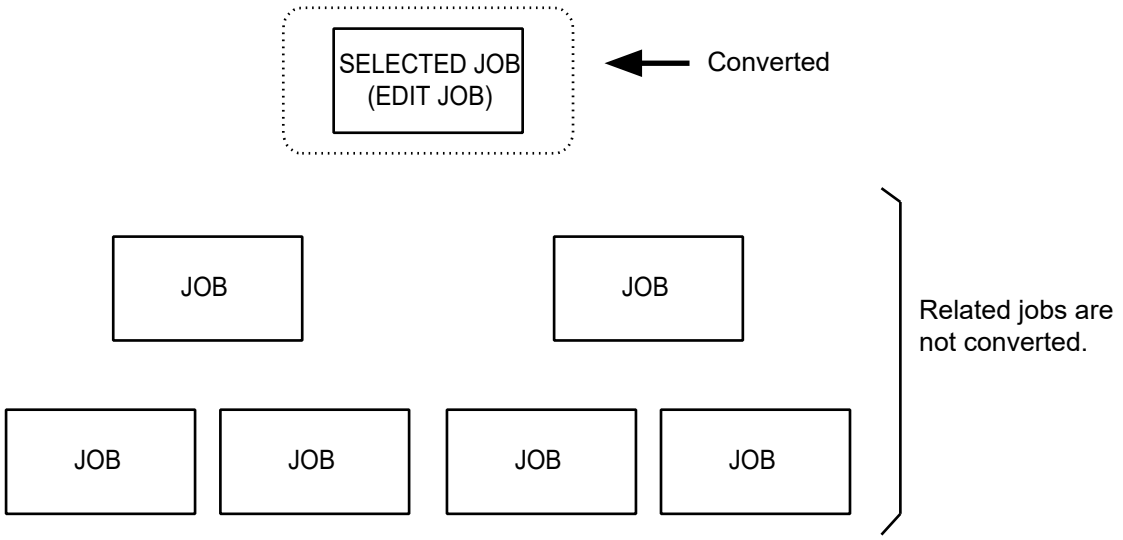
E. CONV. METHOD

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” .

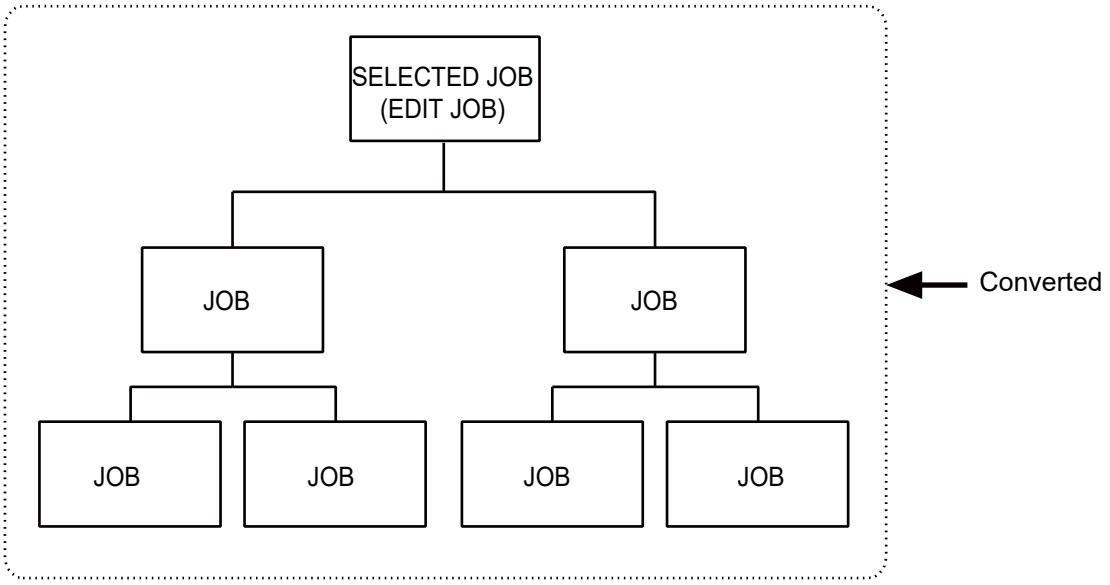
6.3.4.2 Jobs Targeted for Conversion

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.

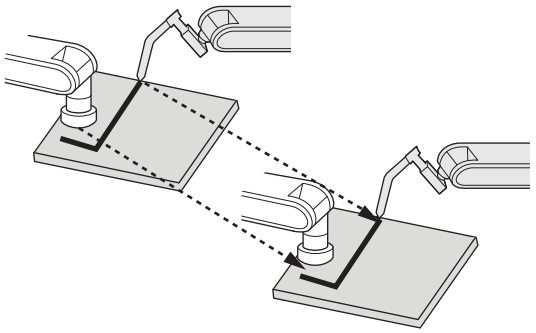


6.3.4.3 Conversion of Coordinated Jobs

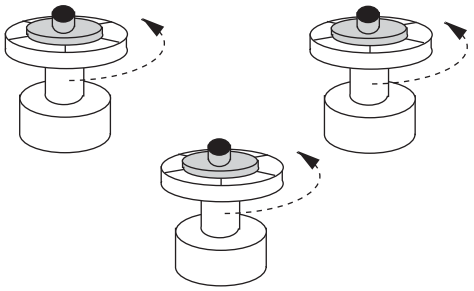
There are two ways to convert a related job such as a coordinated job with two manipulators or the system with multiple stations as described in the following:

- **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



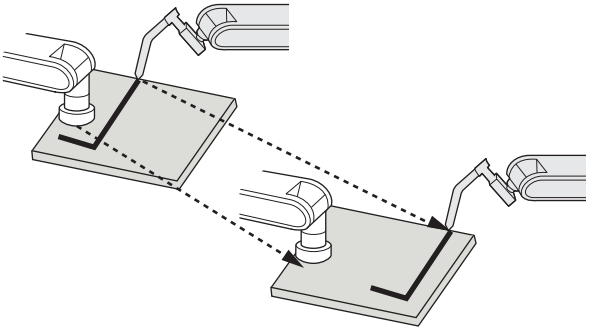
The system with multiple stations



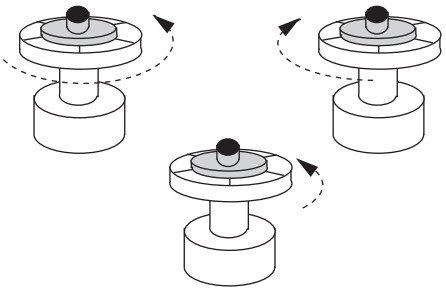
■ **Individual Shift**

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



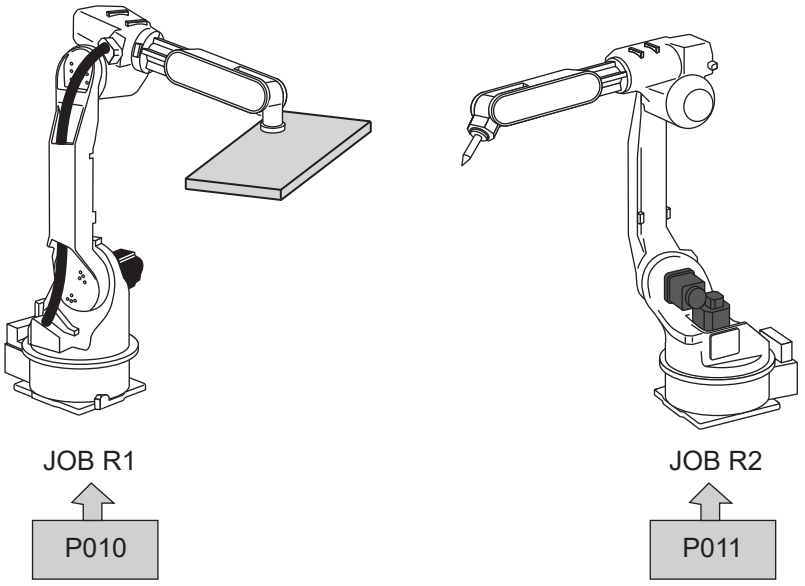
■ **Variables used in an individual shift**

NOTE 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:

Use P010 for R1.

Use P011 for R2.

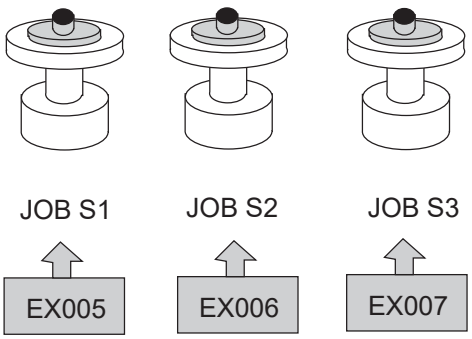


Example 2) When selecting EX005 for multiple jobs with three stations:

Use EX005 for S1.

Use EX006 for S2.

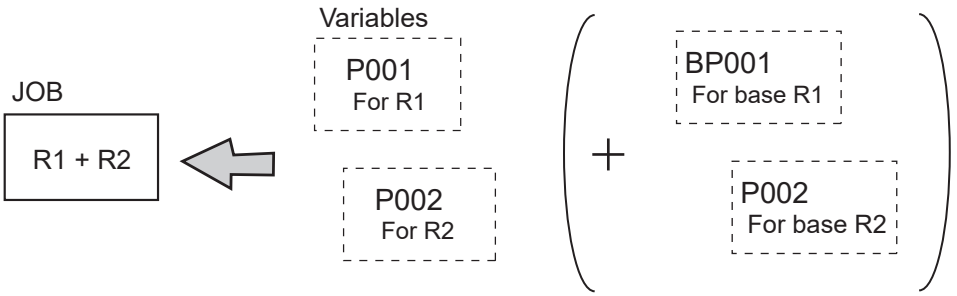
Use EX007 for S3.



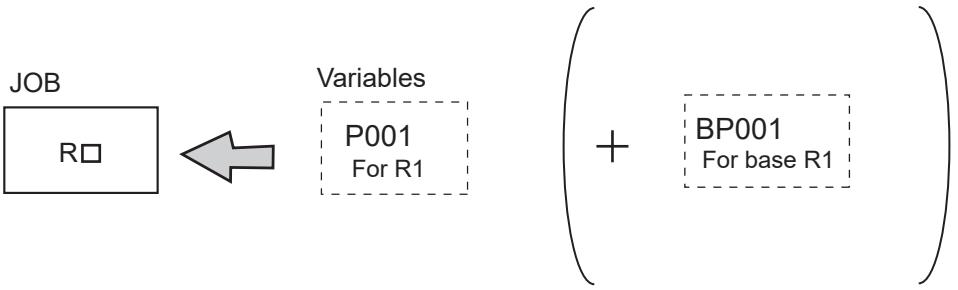
■ **Relation between variables and jobs for conversion in an individual shift**

■ **In the case of independent job conversion:**

• Coordinated job with R1 + R2
Different shift values can be set for each manipulator and base.

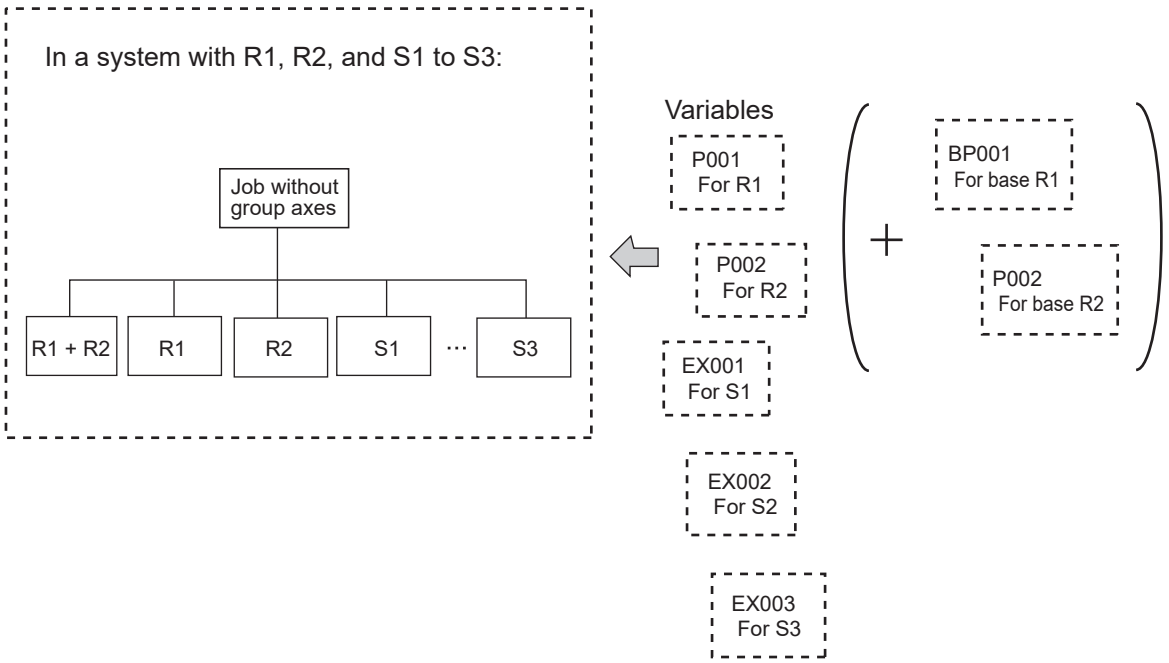


• Job with R☐ (+ S☐)
Use one variable for a job with one manipulator.



■ **In the case of related job conversion:**

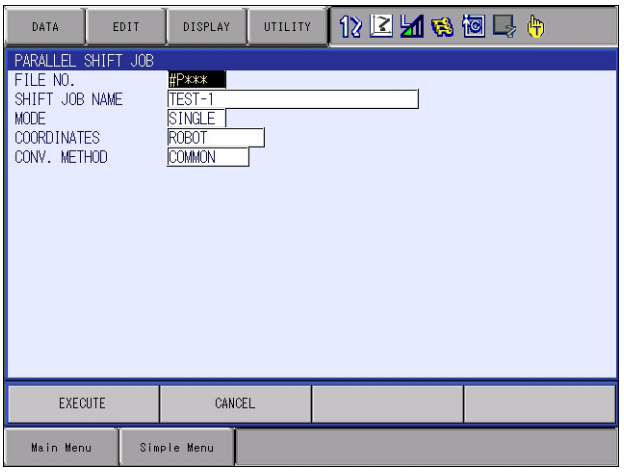
• Different shift values can be set for each manipulator, base, and station.



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”* .
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}.
   – 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.

NOTE

- If an alarm occurs during conversion, conversion is suspended.
- Specify the position variable in advance when using the setting value as a shift value.
- The line to which the Edit Lock function is set or the comment out is performed cannot be changed. (For details, refer to *chapter 3.7.6 “Commenting Out a Line”* and *chapter 3.7.7 “Prohibiting Editing Line-by-Line”* .)

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	Remarks
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%	Play speed VMAX cannot be modified
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:

- S3C1098: Position adjustment range (unit: 0.001 mm)
- 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"* .

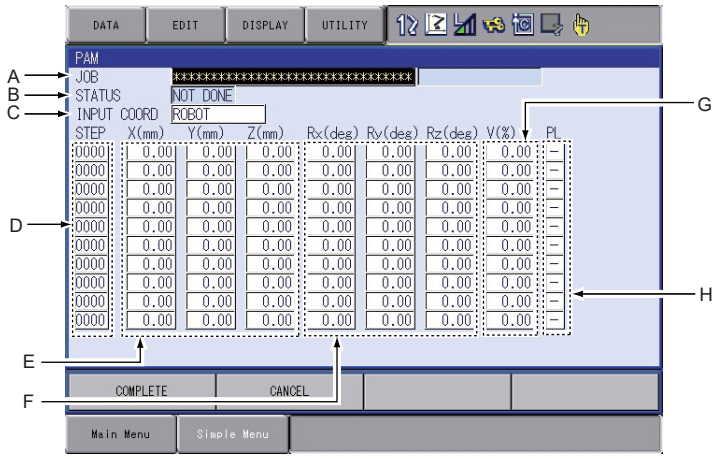
NOTE

- 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.
- When the coordinates for adjustment are user coordinates, an error occurs if teaching has not been performed in the user coordinates.
- 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 where the speed tag VJ, V,VR,VE is not added or the play speed VMAX is specified cause an error.

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 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] 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].



The line to which the Edit Lock function is set or the comment out is performed cannot be changed.

Following errors occur when performing the Edit Lock operation.

1011: EDIT LOCK is set for this line.

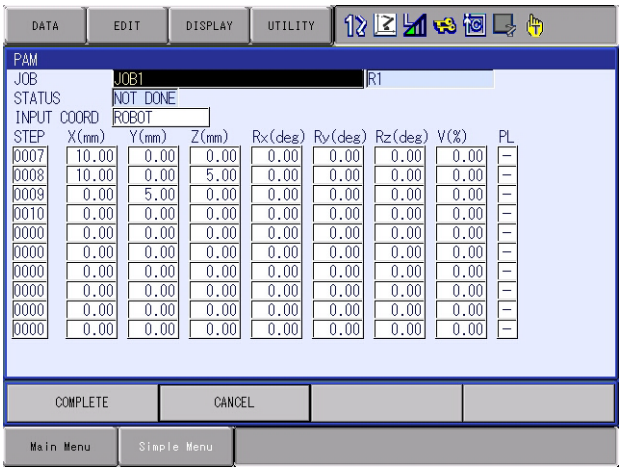
1012: This line is defined as a comment.

(For details, refer to *chapter 3.7.6 “Commenting Out a Line”* and *chapter 3.7.7 “Prohibiting Editing Line-by-Line”* .)

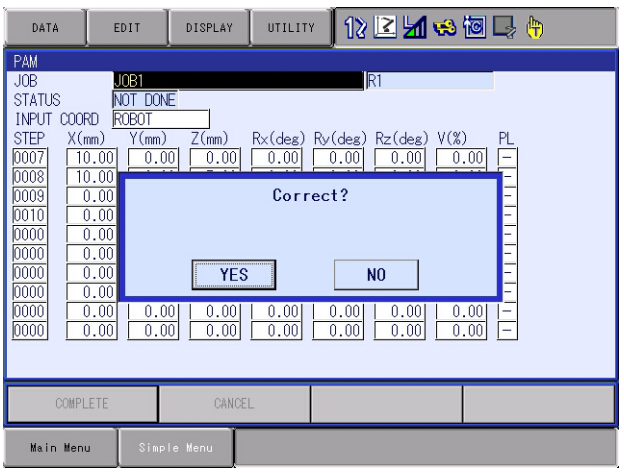
6.4.2.2 Executing the Adjustment

■ **Executing the Adjustment**

1. Touch “COMPLETE” on the screen.
   – The confirmation dialog box appears.



2. Select “YES”.
   – In teach mode, the job adjustment can be immediately executed. In 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 a step which exceeds the software limit or a step for which interpolation is not applicable is found during the job adjustment, an error occurs and only the data of that step cannot be cleared on the window.



■ Canceling the Execution

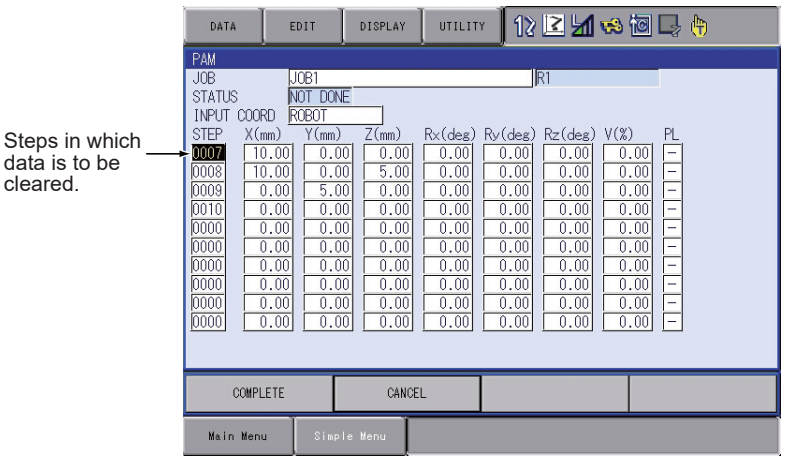
In play mode, during the adjustment wait status, “STOP” is displayed in the PAM window. To cancel the adjustment process, touch “STOP” on the screen. Also, if the following occurs before executing, the process is automatically canceled.

- If the mode is changed
- If an alarm occurs
- If the power is turned OFF

■ 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.

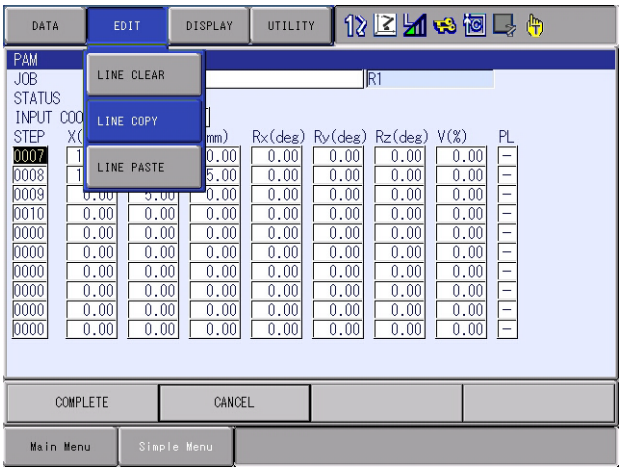


2. Select {EDIT} under the pull-down menu.
3. Select {LINE CLEAR}.
   – The line data is cleared.

■ 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.



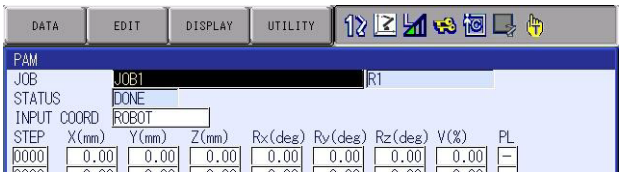
3. Select {LINE COPY}.
4. Move the cursor to the line where the item is to be copied.
5. Select {EDIT} under the menu.
6. Select {LINE PASTE}.
   – The desired data is copied to the line.
   – However, if the line where the data is to be copied does not have a speed value or PL value, it cannot be copied.

■ Canceling the Adjustment

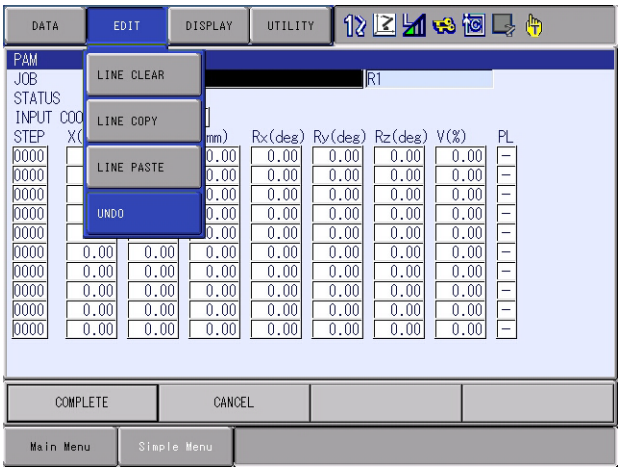
After the position adjustment in the PAM function, the job can be returned to the status before adjustment only during teaching. In this case, follow the procedures below.

Note that the job cannot be undone during playback.

1. Check the status of adjustment.
   – 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.



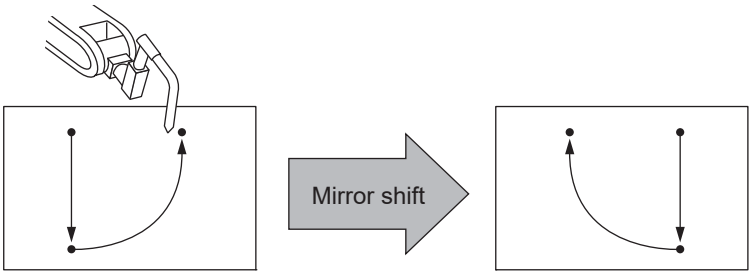
4. Select “YES”
   – The status turns “NOT DONE” and the job is undone when selecting “YES”. The status does not change and the job is not undone when selecting “NO”.

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.

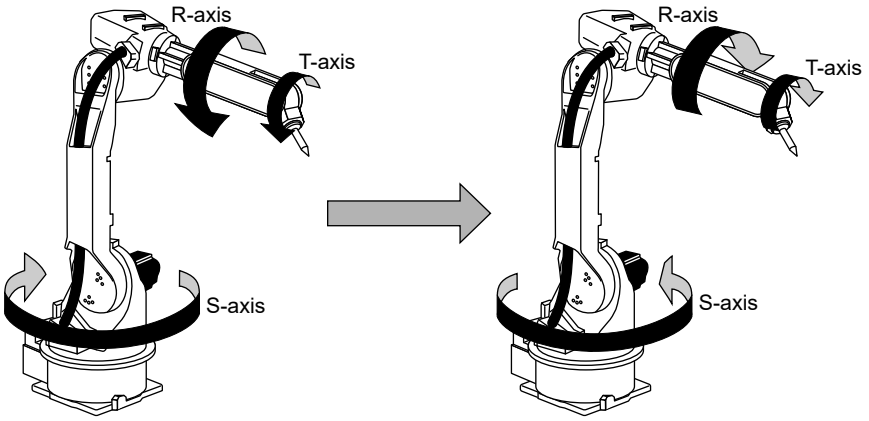


The original path before the mirror shift

The converted path after the mirror shift

6.5.2 Pulse Mirror-Shift Function

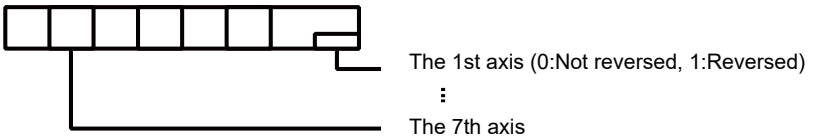
With the pulse mirror-shift function, the mirror shift is performed by reversing the sign (+/-) for the axes which are specified with the parameter in advance.



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.

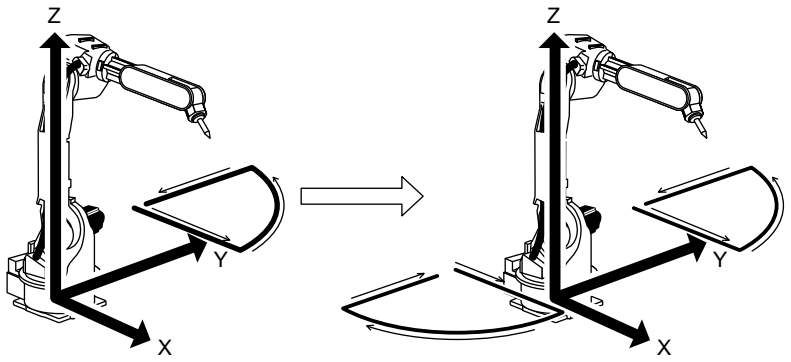
- Robot Axis: Same model
- Base Axis: Same configuration
- Station Axis: Same configuration

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

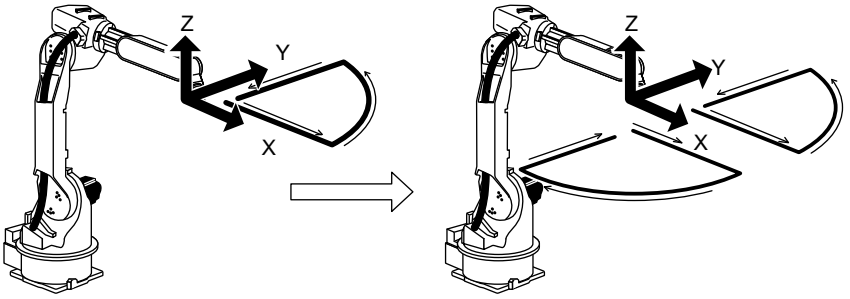
Position variables are not converted by the mirror shift function.

NOTE

- 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.

NOTE

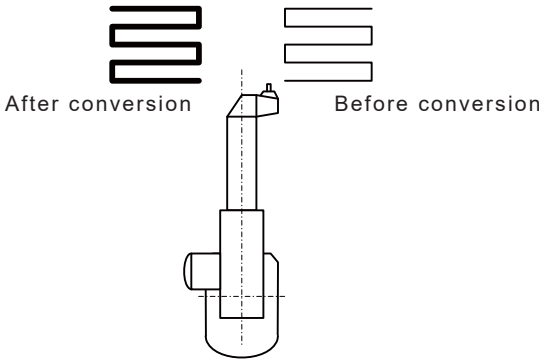
With the user-coordinates mirror shift function, mirror shift conversion for the station axis is performed by reversing the sign for the axes specified with the parameter S1CxG065 “Mirror Shift Sign Reversing Axis Specification”.

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.

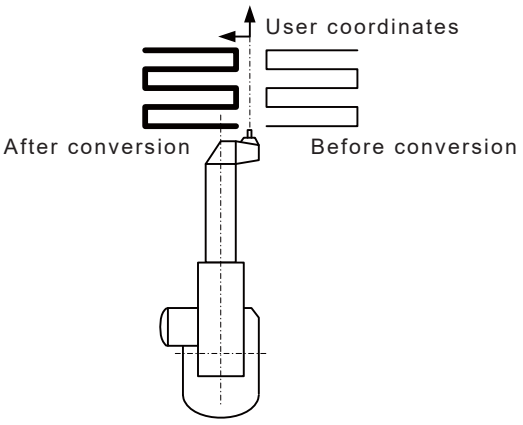
(1) Using the Robot-coordinates Mirror-shift Function
When the robot-coordinates mirror-shift function is performed, the mirror shift is performed on the X-Z coordinate of the robot coordinates. The path of the converted job is as follows:

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



NOTE

"/OV" is added to the step when its position exceeds the P-point maximum envelope due to the conversion. For the step to which "/OV" is added, if the pulse limit is exceeded, the position after conversion is taught; if the interpolation motion is impossible, the pulse before conversion is taught when the taught position is in pulses, and the Cartesian values after conversion is taught when the taught position is in the Cartesian values.

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}.

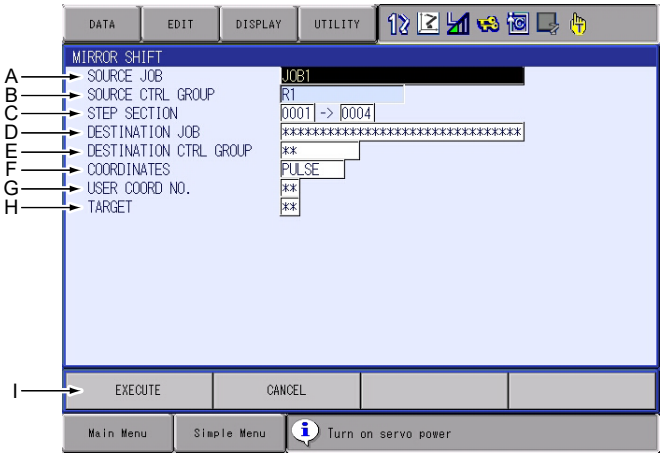
■ **For Another Job**

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.
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.

G. USER COORD NO.

Specifies the user coordinates number when “USER” is selected in “F. COORDINATES”.
This item cannot be set when “PULSE” or “ROBOT” is selected in “F. COORDINATES”.

H. TARGET

Specifies the coordinate where conversion is to be done when “ROBOT” or “USER” is selected in “F. COORDINATES”. “XY”, “XZ”, or “YZ” can be selected. Always specify “XZ” for “ROBOT”.

I. EXECUTE

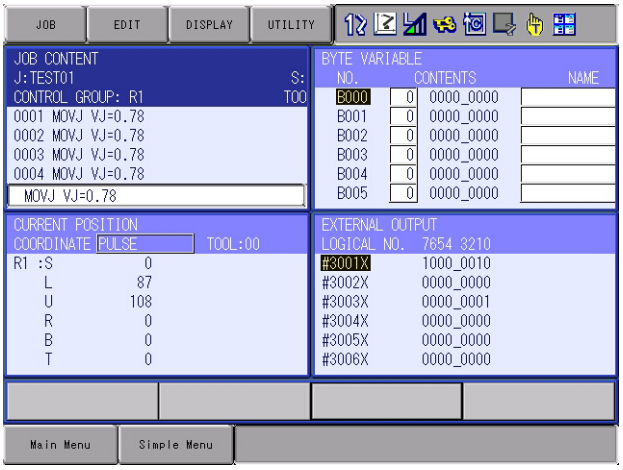
Mirror shift conversion is executed when pressing {EXECUTE} or [ENTER]. A job is created with the name of conversion source job when a job after conversion is not entered.

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)

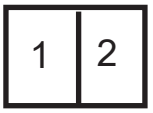
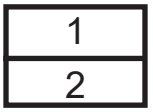
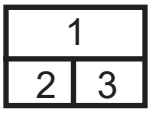
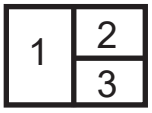
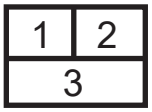
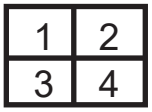
	Number of the window	Dividing Pattern
1	1 window	
2	2 windows	
3	2 windows	
4	3 windows	

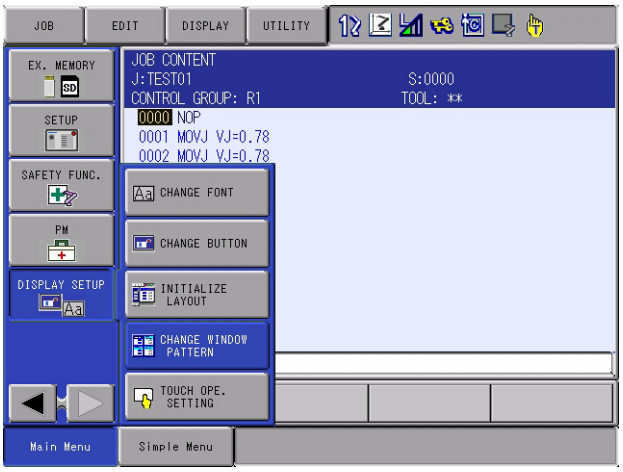
Table 6-3: Display the dividing Pattern (Sheet 2 of 2)

	Number of the window	Dividing Pattern
5	3 windows	
6	3 windows	
7	4 windows	

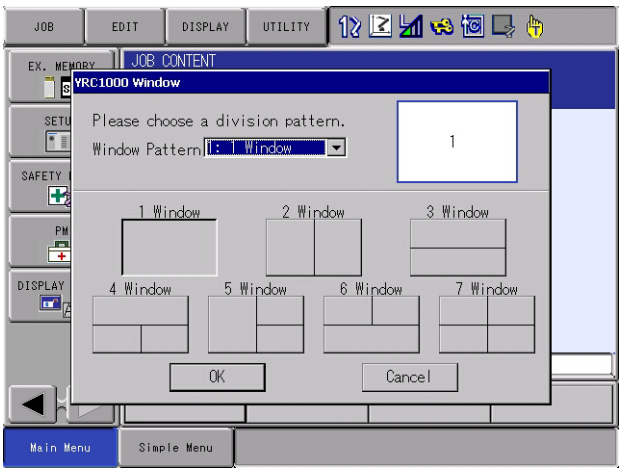
6.6.2.1 Calling Up and Operating Methods of the Display Dividing Pattern Setting Window

Call up the dividing pattern setting window.

1. Select {DISPLAY SETUP} - {CHANGE WINDOW PATTERN} under the main menu.

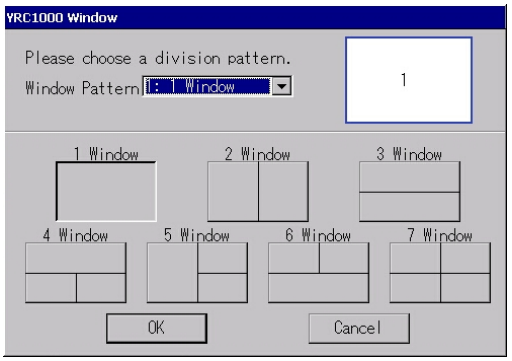


2. Dividing pattern setting window appears in the center of the display.

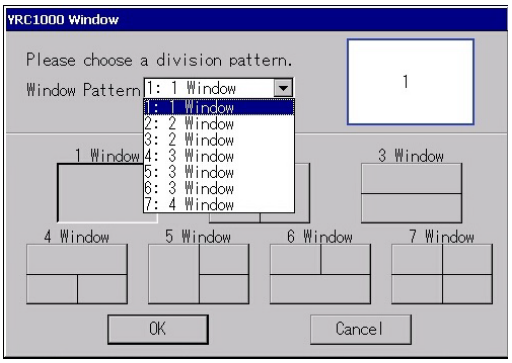


In the dividing pattern setting window, set the dividing pattern of the general-purpose display area.

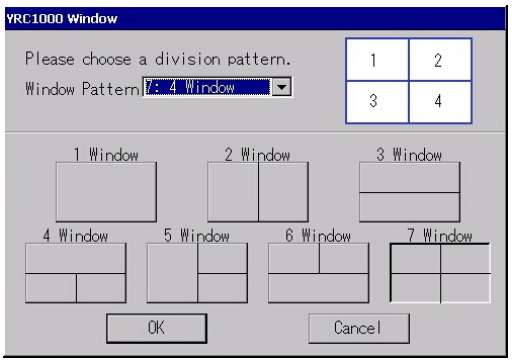
1. Key operation 1:
   When “Window Pattern” is focused in the window, the option of the dividing pattern shifts as cursor moves upper or lower.
   – Choose the desired dividing patter from the “Window Pattern”.



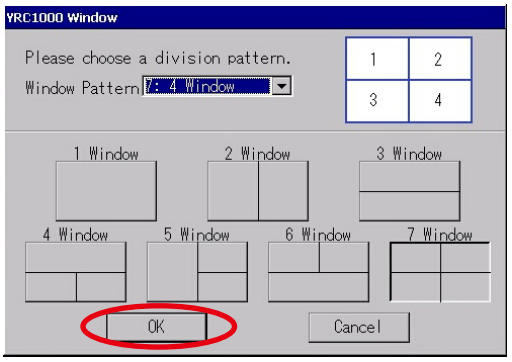
2. Key operation 2:
   Press [SELECT] when “Window Pattern” is focused. The list of the dividing patterns appears. The list closes and a pattern is set after choosing the desired pattern and press [SELECT].



3. Touching operation:
   The desired pattern can be chosen by touching a pattern in the window.
   – Choose a pattern from the dividing pattern buttons.

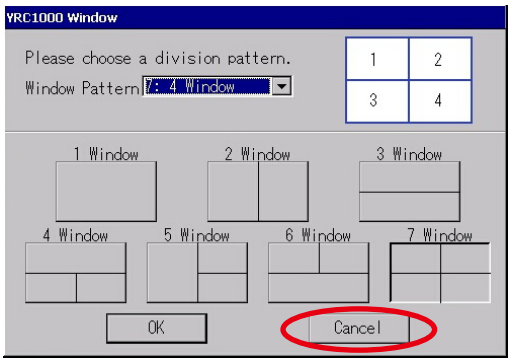


4. Touch [OK] button or move the cursor to it and press [SELECT].
   – The dividing pattern setting window closes and the chosen pattern (chosen with the procedure either 1, 2 or 3) appears.



Cancel the setting

1. Touch [CANCEL] button or move the cursor to it and press [SELECT].
   – Dividing pattern setting window closes. The dividing pattern in the general-purpose display area doesn't change.



SUPPLE -MENT

The cursor moves by pressing [AREA] in the dividing pattern setting window.

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.

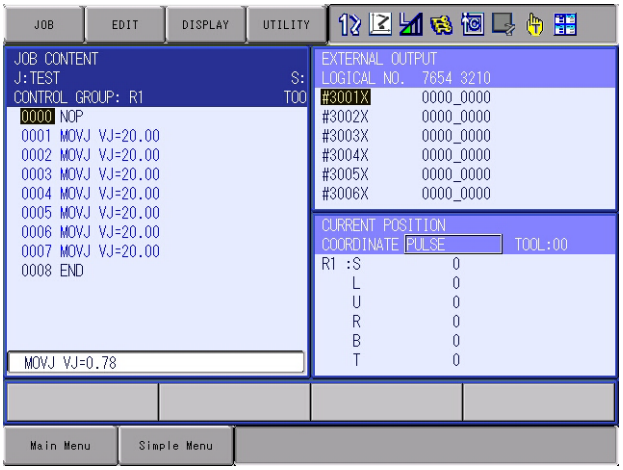
On the other hand, a single active window can be displayed with pressing [SHIFT] + [MULTI] operation.
This is called single window mode.

Pressing [SHIFT] + [MULTI] 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.



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.

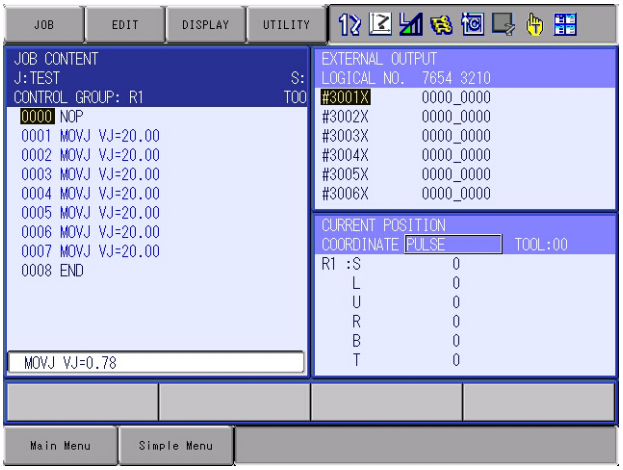
- The input buffer in the JOB window is displayed only when the window is active.
- No auxiliary window appears.

6.6.4 Operation of Multi Window

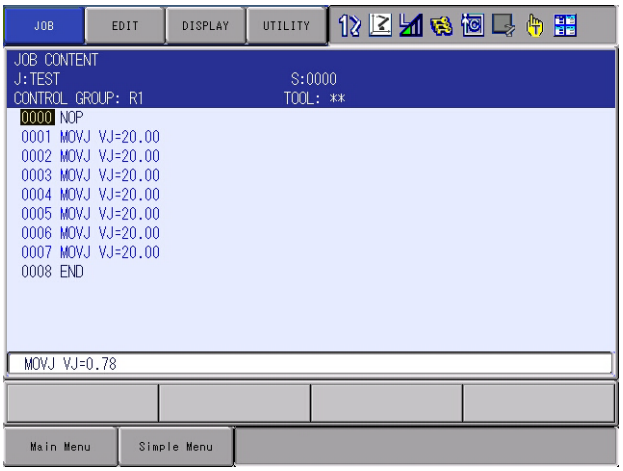
6.6.4.1 Switching of Multi Window Mode and Single Window Mode

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.

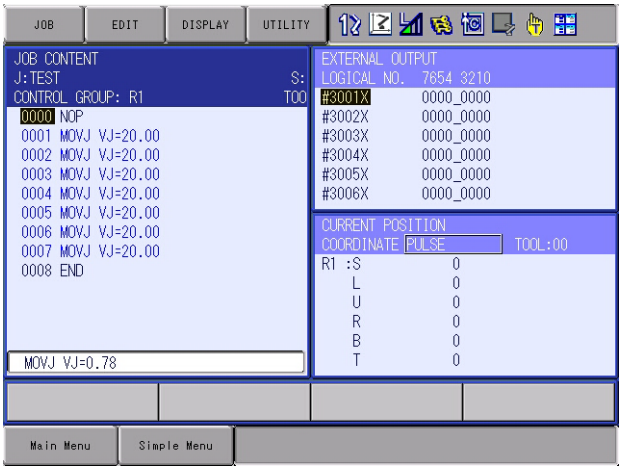
1. Set the mode of the general-purpose displaying area to multi window mode.



2. Press [SHIFT]+[MULTI].
   – Active window is displayed under single window mode in the general-purpose window displaying area.



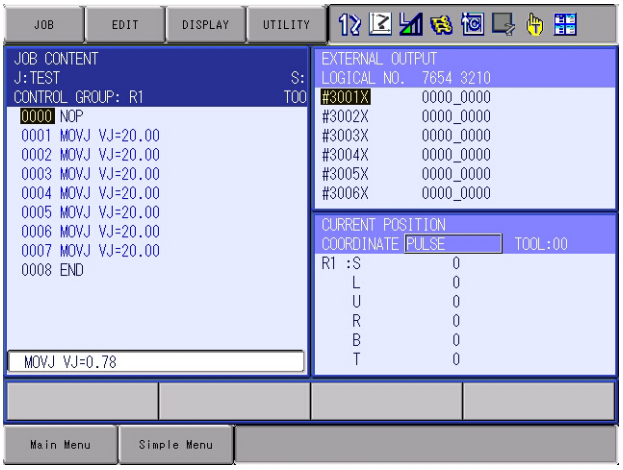
3. Press [SHIFT]+[MULTI] under the condition of the step 2.
   – The general-purpose display area changes to already set pattern in multi window mode.



6.6.4.2 Switching of Active Window

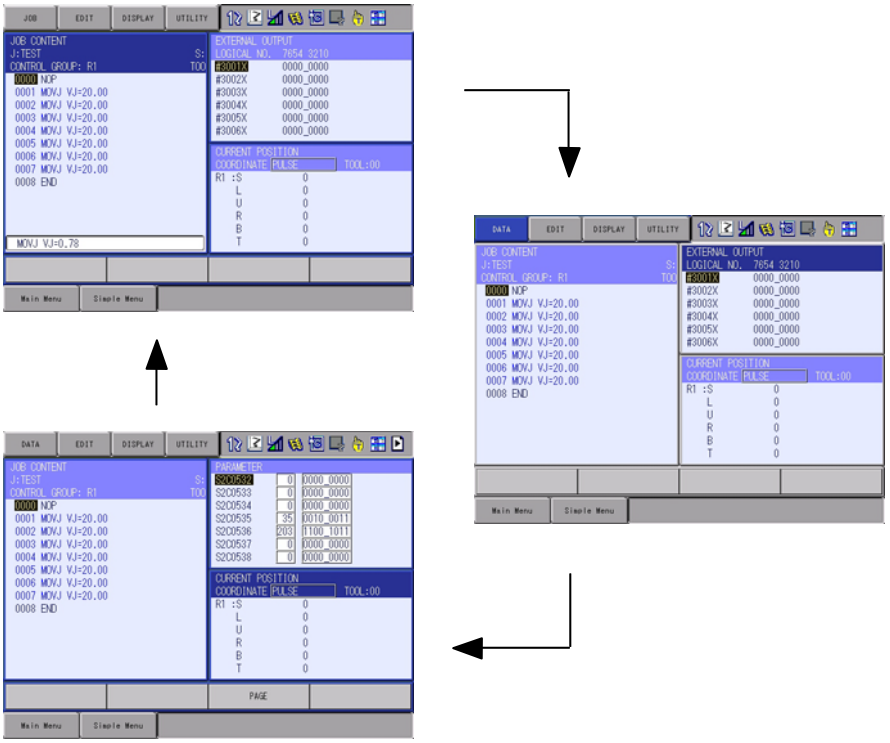
Switch the active window in the multi window displaying mode.

1. Set the mode of the general-purpose displaying area to multi window mode.



2. Key Operation:
   Press [MULTI].

   – 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"* .
   (1→2→3→4→1·····)

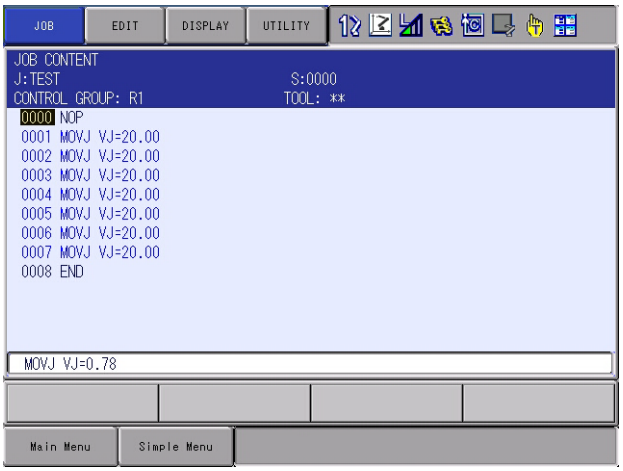


3. Touching Operation:
   Touch the window to be active.

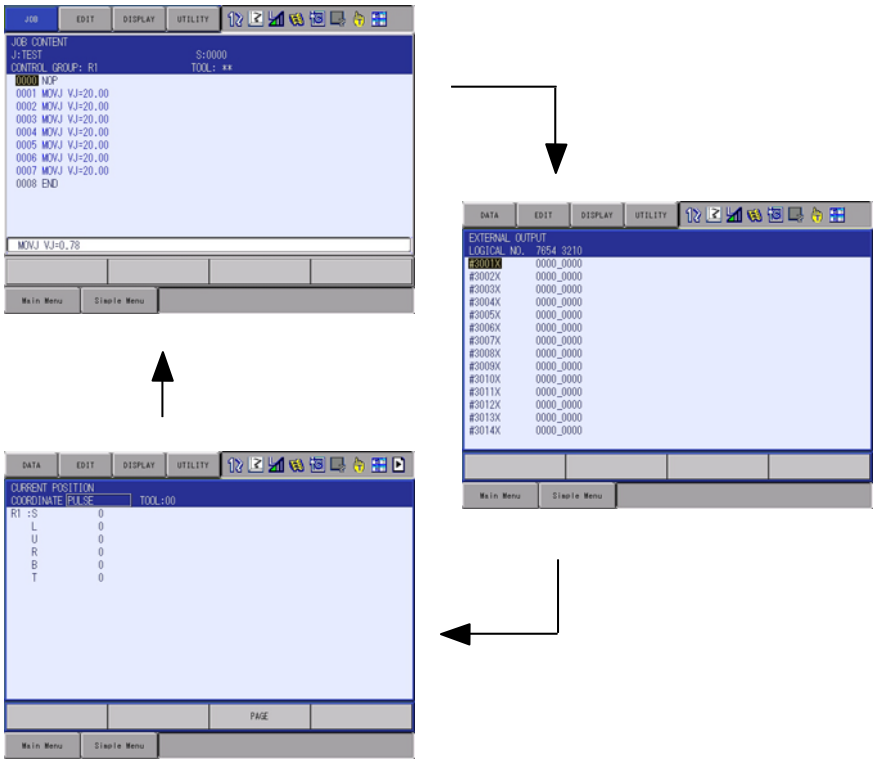
   – The touched window becomes active.

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 [MULTI].
   – The following windows are displayed in the order mentioned in *chapter 6.6.2 "Setting the Dividing Pattern of the General-Purpose Display Area"*. (1→2→3→4→1·····)



NOTE

During the period before menu is selected when alarm occurred, the active window cannot be switched if alarm window is displayed, direct open is ON or a window is displayed by key allocation operation.

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] operation or touching operation when switching the active window is notified to the user.

SUPPLE -MENT

The change of the control group for axis operation due to other than [MULTI] operation or touching operation; due to the switch of the window by selecting main menu, is not notified to the user.

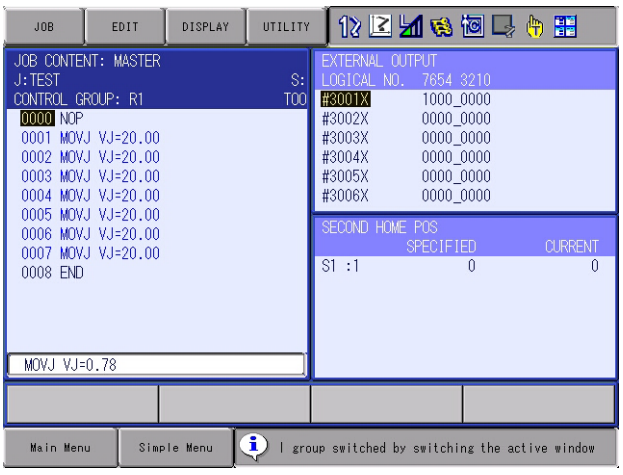
6.6.5.1 S2C540 “Choosing Method of Notifying the Change of Axis Operation Control Group When Switching the Active Window”

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.



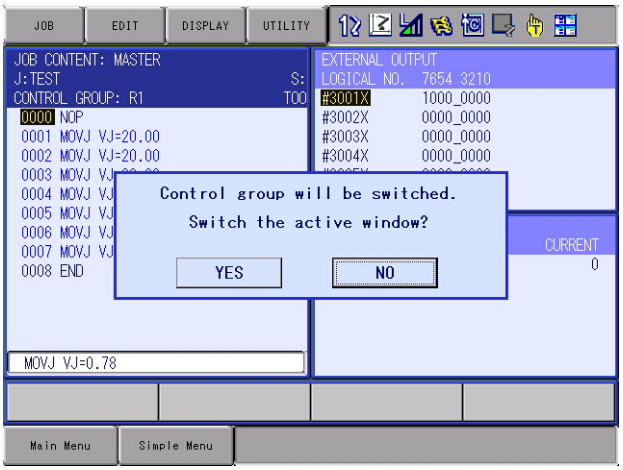
• Setting Value:1

– 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

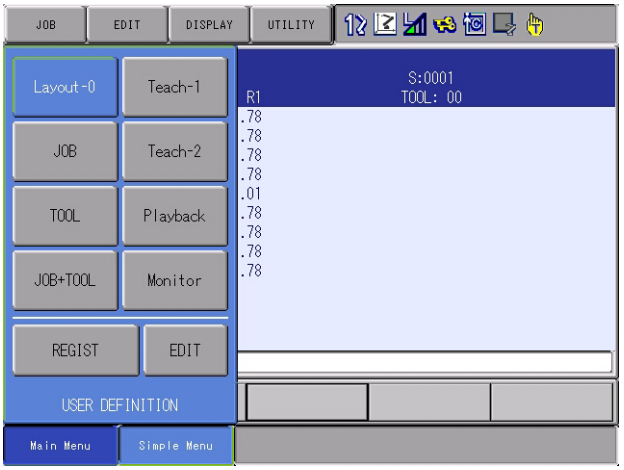
– Do not notify the control group change.

6.7 Simple Menu Function

6.7.1 Simple Menu

This function enables users to create “USER DEFINITION” menu by registering the layouts (screen dividing patterns and screen to be displayed) on the general-purpose display area.

Eight layout patterns can be registered to the user definition menu at maximum.
The registered layout patterns can be easily called up with the buttons of simple menu.

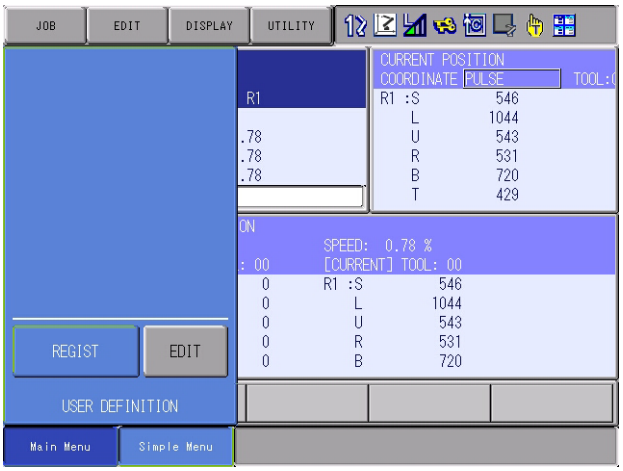


6.7.2 Registering the Layout Patterns to User Definition Menu

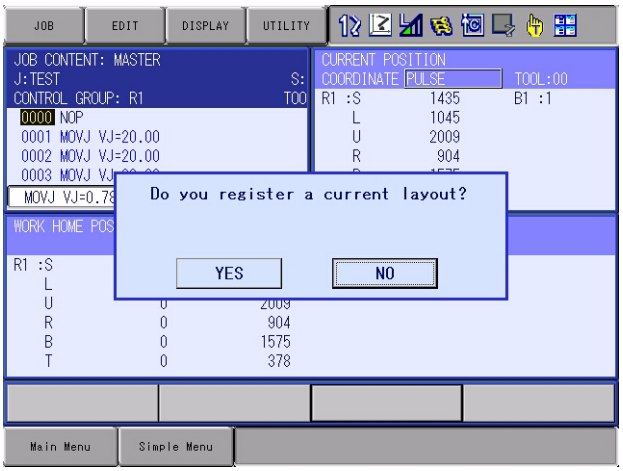
6.7.2.1 Register with {REGIST} Button

Register the layout patterns by using {RESIST} button which is in “USER DEFINITION” menu.

1. Press [SIMPLE MENU] or select {Simple Menu} button on the display while the layout pattern to be registered is on the general-purpose display area.
   – “USER DEFINITION” menu appears.



2. Press {REGIST} button.
   – “USER DEFINITION” menu closes.
   – The message “Do you register a current layout?” appears in the confirmation dialog box.

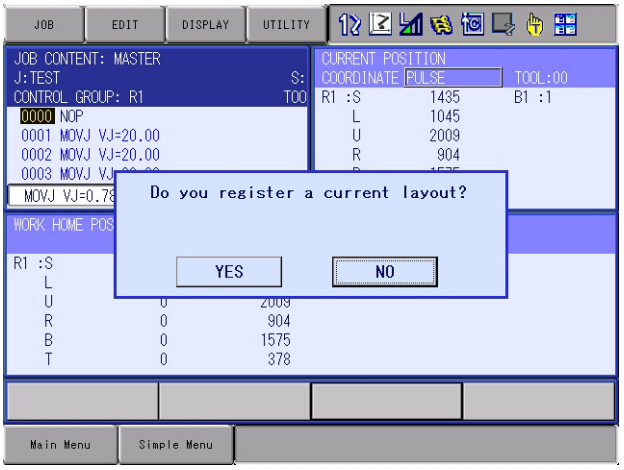


3. Select “YES”.
   – The layout is registered and the dialog box closes.
   If “NO” is selected, the layout will not be registered.

6.7.2.2 Register by Key Operation

Use the programming pendant keys to register the layout patterns to “USER DEFINITION” menu.

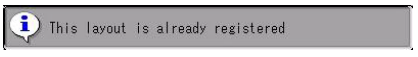
1. Press [SHIFT] + [SIMPLE MENU] while the layout pattern to be registered is on the general-purpose display area.
   – The message “Do you register a current layout?” appears in the confirmation dialog box.



2. Select “YES”.
   – The layout is registered and the dialog box closes.
   If “NO” is selected, the layout will not be registered.

6.7.2.3 Conditions to Register the Layout

There are some cases that the layout patterns cannot be registered to “USER DEFINITION” menu. Followings are the conditions and the messages that the layout is refused to register.

	Condition	**Message**
1	when the layout is already registered.	This layout is already registered. 
2	when eight layouts are already registered.	There is not an undefined domain. 
3	When the registering layout includes the window which cannot be started up in the the main menu.	The screen which I cannot register is included [W1W2W3W4]  (The number W1 to W4 indicates the windows which are actually displayed on the general-purpose display area, however, the highlighted numbered window cannot be registered. *For the layout of 1 to 4,refer to *table 6-3 “Display the dividing Pattern”* .
4	When a single window is displayed under the multi window mode.	Cannot register at current operation mode. 

SUPPLE -MENT

The screens which cannot be started up in the the main menu are impossible to register.
Also, the layout of the screens that are called up from {EXTERNAL MOMERY DEVICE} or ladder editor (optional function) cannot be registered.

6.7.2.4 The Displayed Layout Name

After a layout pattern is registered to “USER DEFINITION” menu, it is named in accordance with the status of the general-purpose display area when the layout pattern is created.
Refer to the followings for the details.

	Status of general-purpose display area	**Name registered to “USER DEFINITION” Menu**
1	Single window mode	(Same as the sub menu in main menu)
2	Multi window mode	Layout -n (“n” should be a number from 0 to 7)

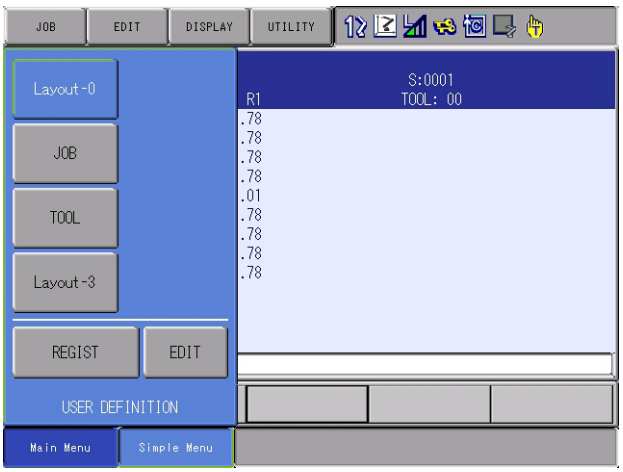
It is possible to change the name even after the name is registered. Refer to *chapter 6.7.4.3 “Changing the Name of Registered Layout Name”* .

6.7.3 Calling Up of the Registered Layout

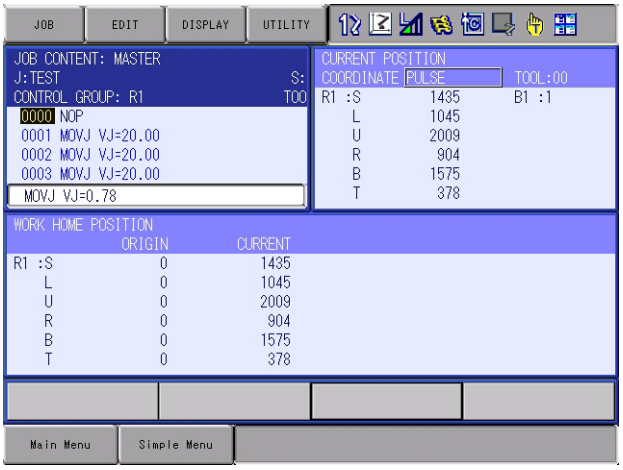
6.7.3.1 Calling up

Call up the registered layout with the following procedures.

1. Press [SIMPLE MENU] or select {Simple Menu} button at the lower-left on the display.
   – “USER DEFINITION” menu appears.

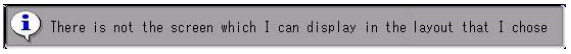


2. Select and press a button on “USER DEFINITION” menu to display a layout to be called up.
   – “USER DEFINITION” menu closes.
   – The selected layout appears on the general-purpose display area.



6.7.3.2 Conditions When Calling Up the Layout

There are some cases where the layout cannot be called up depending on the conditions when calling up.
Followings are the conditions and the messages that the layout is refused to be called up.

	Condition	**Message**
1	When all the registered layout windows cannot be displayed due to security mode or its purpose of use.	There are no windows to display within the chosen layout. 

When undisplayed screen is included in the layout to be called up due to above mentioned reasons, the message, “Please selected a Main Menu” appears to the said screen.

6.7.4 Editing USER DEFINITION Menu

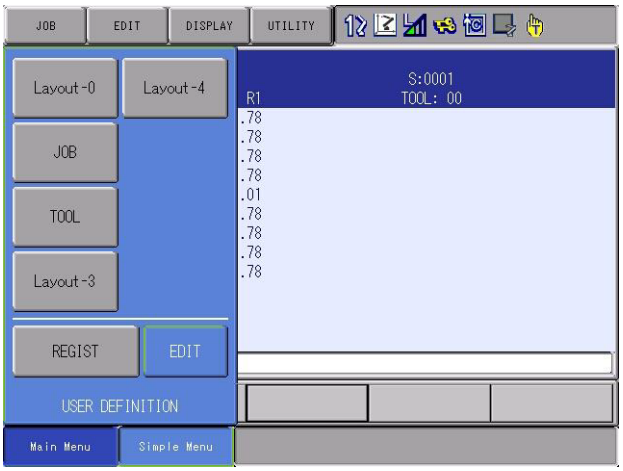
Editing procedures of “changing the registered name” and “deleting the registered item” are possible to the items registered to the USER DEFINITION MENU window.

Those editions are executed on the USER DEFINITION MENU window. Displaying of the USER DEFINITION MENU window is possible in the operation mode or more and editing of this menu is possible in the editing mode or more.

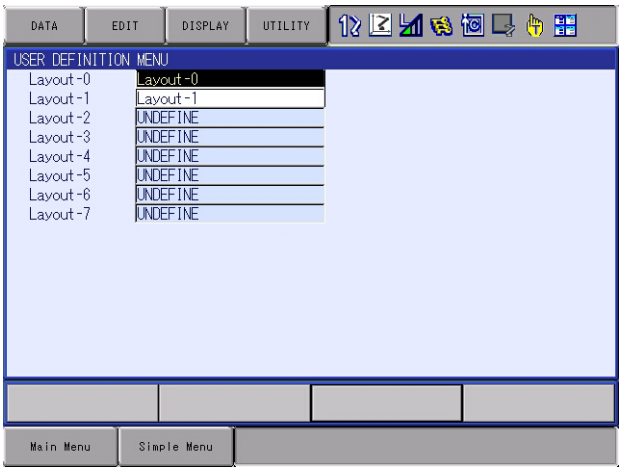
6.7.4.1 Displaying USER DEFINITION MENU Window by Using EDIT Button

Displays the USER DEFINITION MENU window by using {EDIT}.

1. Press [SIMPLE MENU] or select {Simple Menu} button at the lower-left on the display.
   – The USER DEFINITION menu appears.



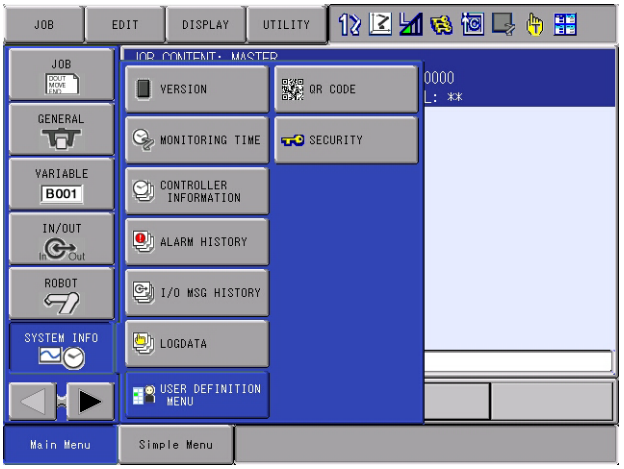
2. Press {EDIT}.
   – The USER DEFINITION menu closes.
   – The USER DEFINITION MENU window appears on the active window in the general-purpose display area.



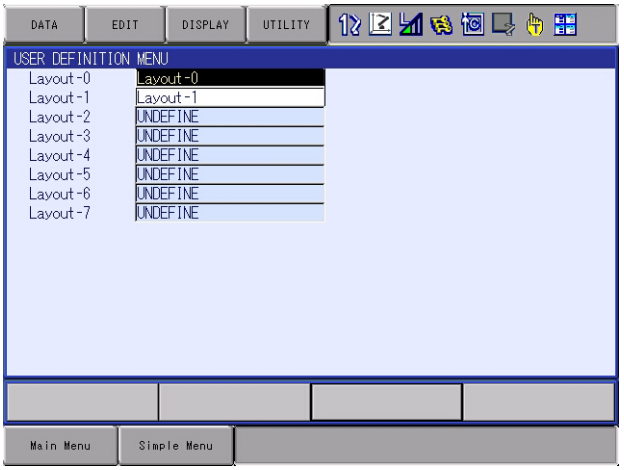
6.7.4.2 Displaying USER DEFINITION MENU Window under Main Menu

Displays the USER DEFINITION MENU window under the main menu.

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



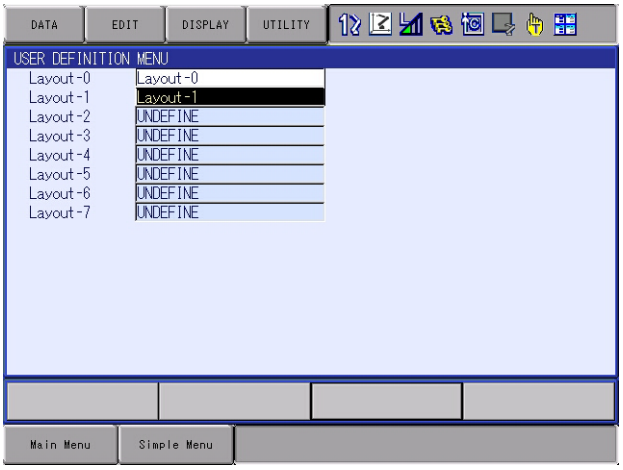
2. Select {USER DEFINITION}.
   – The USER DEFINITION MENU window appears on the active window in the general-purpose display area.



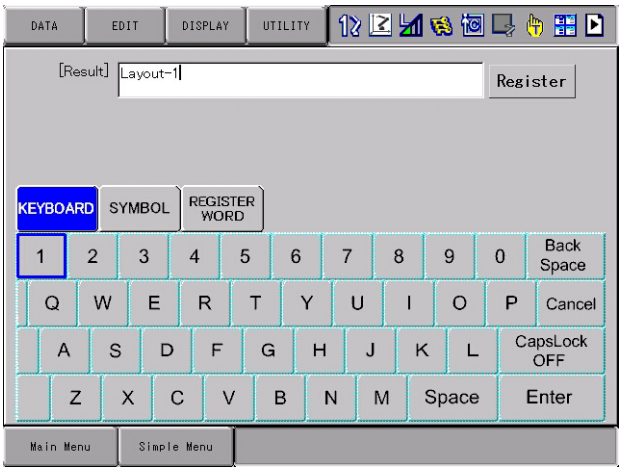
6.7.4.3 Changing the Name of Registered Layout Name

The registered layout names can be changed.

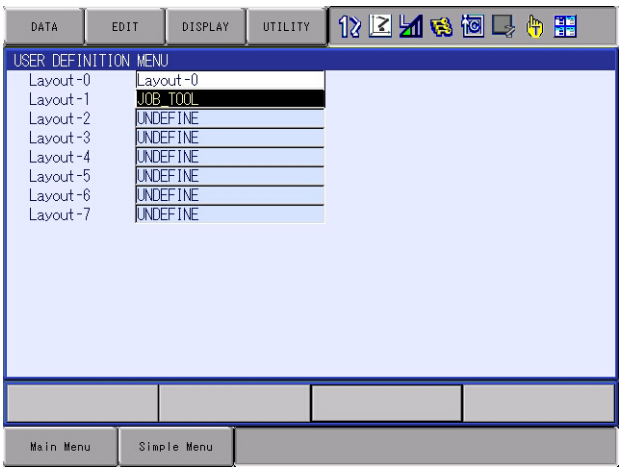
1. Display the USER DEFINITION MENU window.



2. Move the cursor to the layout name to be changed and press [SELECT].
   – The software key pad for inputting letters appears.



3. Input the layout name, and then press [ENTER] or {ENTER}.
   – The software key pad closes.
   – The name changes.



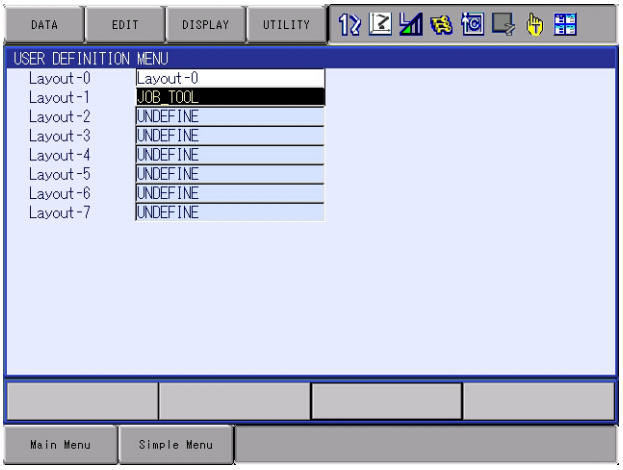
Note that if the software key pad is completed by [CANCEL] or {CANCEL}, the name editing operation is also canceled.

SUPPLE -MENT When the bilingual function is valid, name in each language can be set.

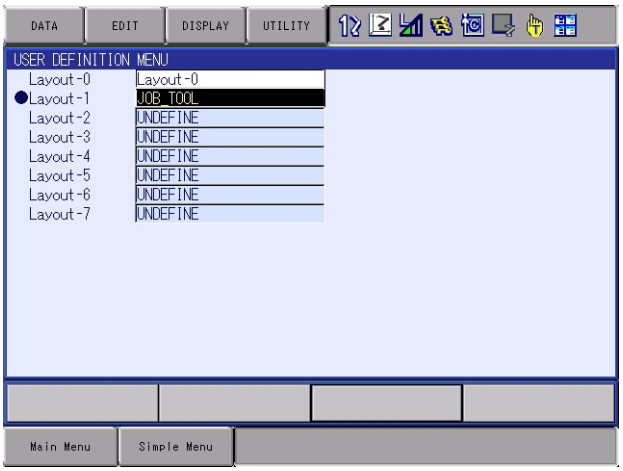
6.7.4.4 Deleting the Layout

The layout registered to the USER DEFINITION menu can be deleted.

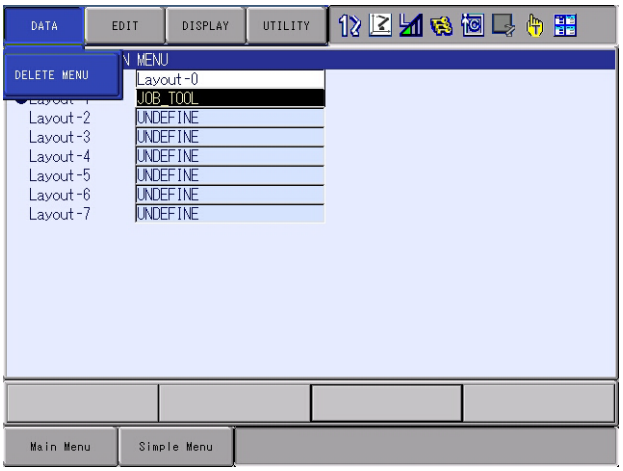
1. Display the USER DEFINITION MENU window.



2. Move the cursor to the layout to be deleted and press [SHIFT] + [SELECT]. (multiple selection possible)
   – "●" mark is indicated at the head of the selected line.

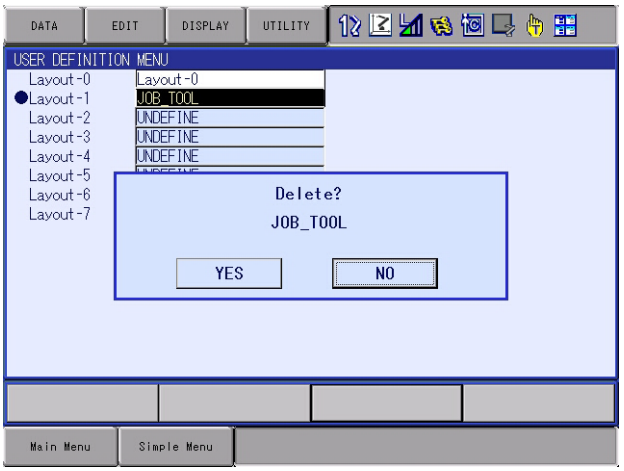


3. Select {DATA} in the menu.
   – A pull down menu appears.



4. Select {DELETE MENU}.

   – The confirmation dialog box with a message “Delete? Layout -4 (layout name)” appears to the line marked with “●”.



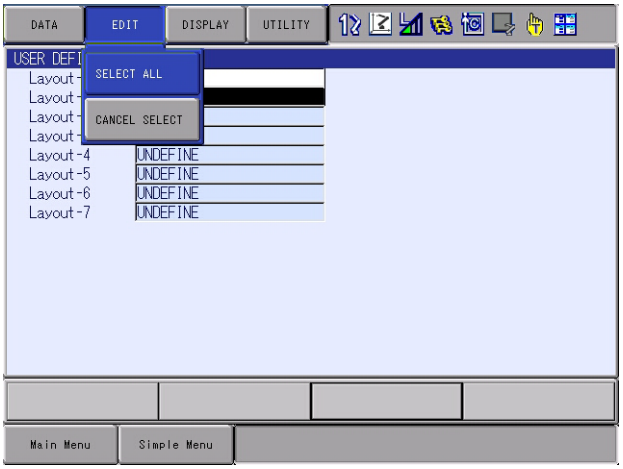
5. Select “YES” in the dialog box.

   – The marked layout is deleted.
   * The layout will not be deleted if “NO” in the dialog box is selected.

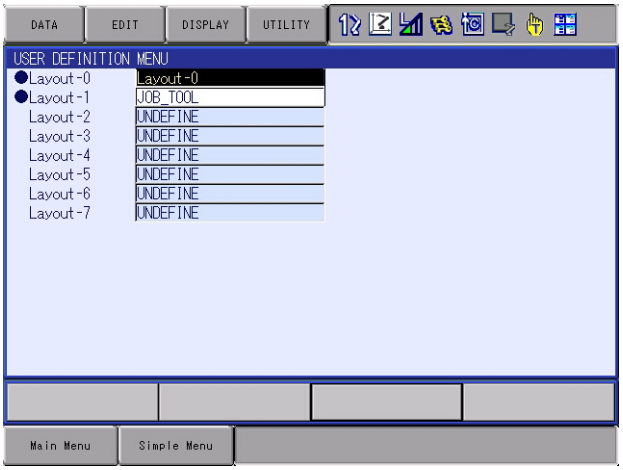
6.7.4.5 Deleting All Layouts

All layouts registered to the USER DEFINITION menu can be deleted at a time.

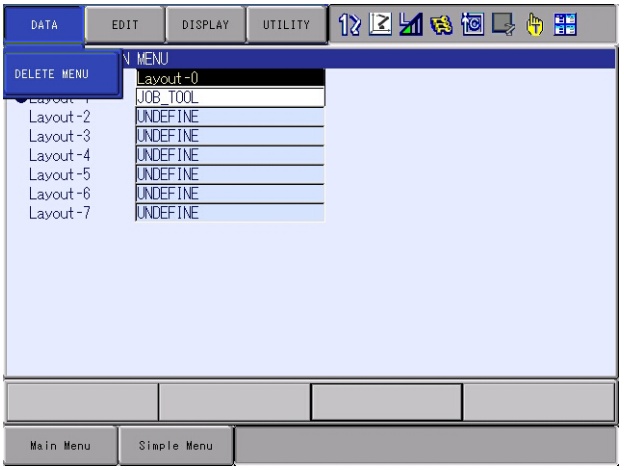
1. Display the USER DEFINITION MENU window.
2. Select {EDIT} in the menu.
   – A pull down menu appears.



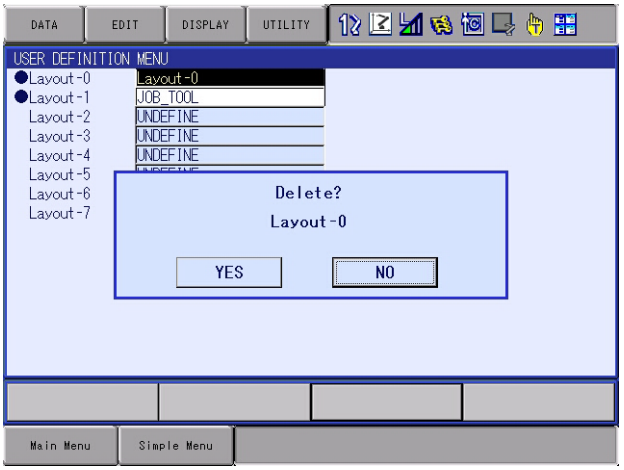
3. Select {SELECT ALL}.
   – "●" mark is indicated at the head of all the registered layouts.



4. Select {DATA} in the menu.
   – A pull down menu appears.



5. Select {DELETE MENU}.
   – The confirmation dialog box with a message “Delete? Layout -0 (layout name)” appears to the lines marked with “●”.



6. Select “YES” in the dialog box.
   – The marked layouts are deleted.
   * The layout will not be deleted if “NO” in the dialog box is selected.

SUPPLE-MENT

To hide “●” mark, move the cursor to the line with “●” mark, and press [SHIFT] + [SELECT].
To clear all the selected items and hide all “●” marks, select {EDIT} → {CANCEL SELECT} under the pull down menu.

6.7.5 Save/Load of the User Definition Menu Data (to External Memory Device)

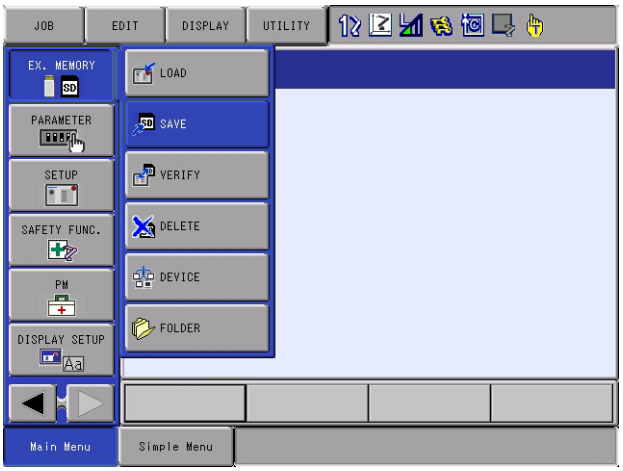
The data registered to the USER DEFINITION menu (user menu data) can be saved to and loaded from the external memory device.

In this case, the name of the file is “USERMENU.DAT”.

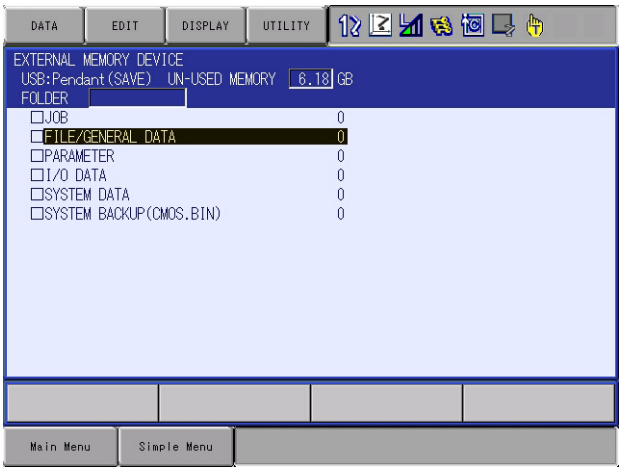
6.7.5.1 Saving the Data

User menu data can be saved at the security level of operation mode or more.

1. Select {EX. MEMORY} under the main menu.
   – {EX. MEMORY} sub menu appears.

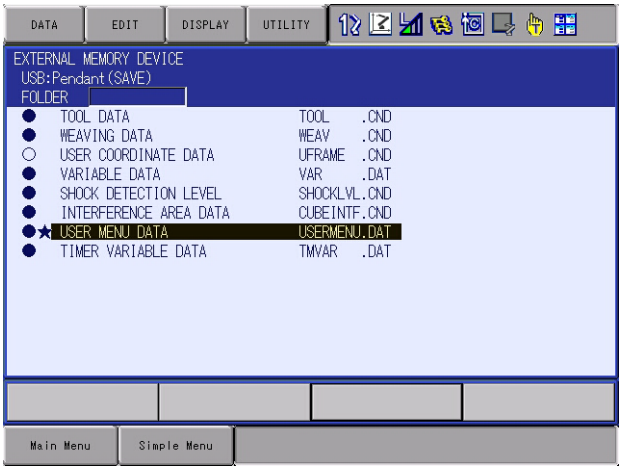


2. Select {SAVE}.
   – {SAVE} window of external memory device appears.

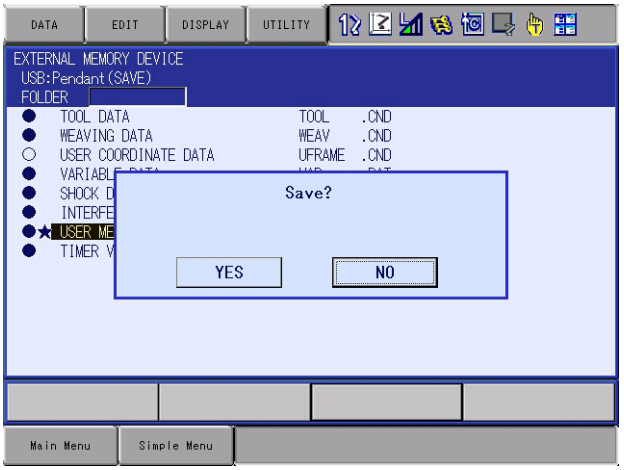


3. Select “FILE/GENERAL DATA”.
   – The FILE/GENERAL DATA window of an external memory device appears.

4. Select “USER MENU DATA”.
   – “★” mark is indicated at the head of “USER MENU DATA”.



5. Press [ENTER].
   – The confirmation dialog box with a message “SAVE” appears.

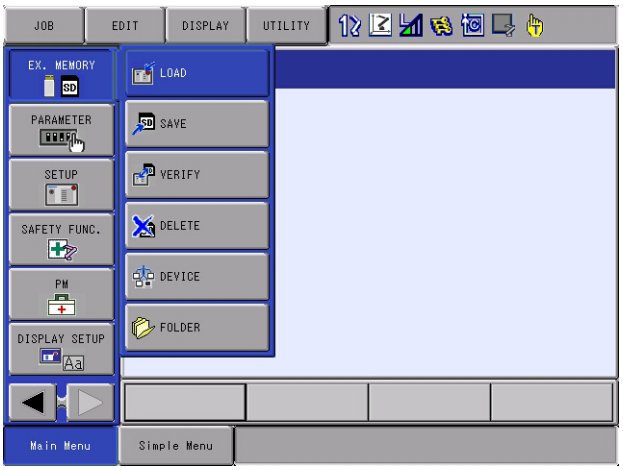


6. Select “YES” in the dialog box.
   – “USER MENU DATA” is saved.
   “USER MENU DATA” will not be saved if “NO” in the dialog box is selected.

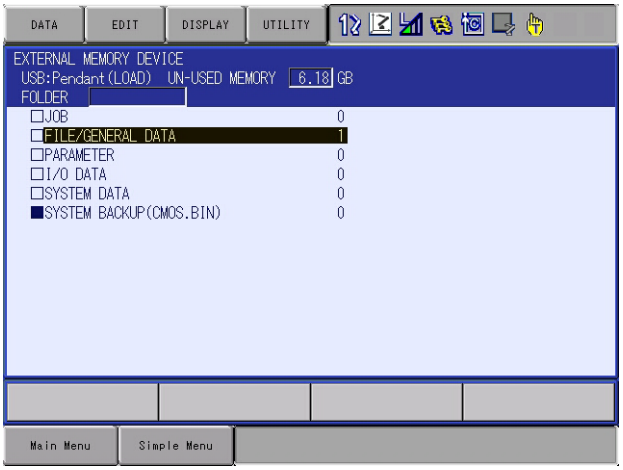
6.7.5.2 Loading the Data

User menu data can be loaded at the security level of editing mode or more.

1. Select {EX. MEMORY} under the main menu.
   – {EX. MEMORY} sub menu appears.

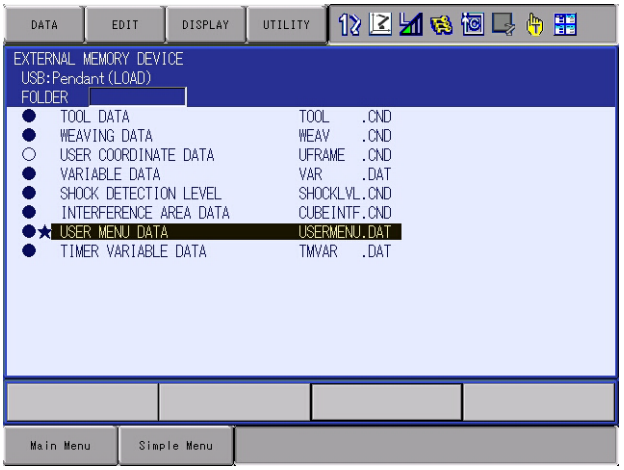


2. Select {LOAD}.
   – The LOAD window of an external memory device appears.

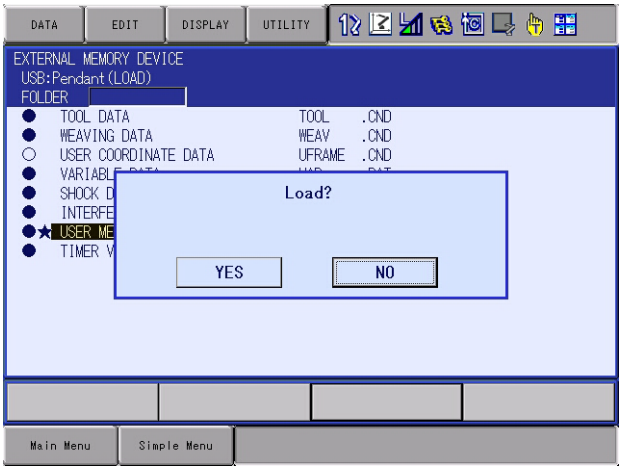


3. Select “FILE/GENERAL DATA”.
   – The FILE/GENERAL DATA window of an external memory device appears.

4. Select “USER MENU DATA”.
   – “★” mark is indicated at the head of “USER MENU DATA”.



5. Press [ENTER].
   – The confirmation dialog box with a message “LOAD?” appears.



6. Select “YES” in the dialog box.
   – “USER MENU DATA” is loaded.
   “USER MENU DATA” will not be loaded if “NO” in the dialog box is selected.

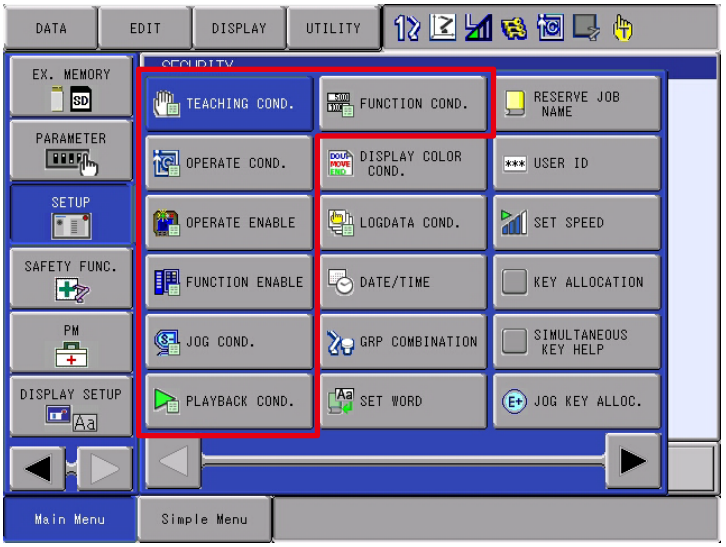
6.8 Parameter Setting Function

6.8.1 Parameter Setting Function

Among the parameters explained in *chapter 8 "Parameter"* , frequently used parameters' settings can be changed from the exclusive windows. Those windows are sorted out depending on the parameters' function as shown below.

- TEACHING CONDITION SETTING
  Teaching-relevant parameters are displayed.
- OPERATE CONDITION SETTING
  Mode switching/power-relevant parameters are displayed.
- OPERATE ENABLE SETTING
  ON/OFF of the manipulator-relevant parameters are displayed.
- FUNCTION ENABLE SETTING
  Enable/unable of optional function-relevant parameters settings are displayed.
- JOG CONDITION SETTING
  Operation of the jog-relevant parameters are displayed.
- PLAYBACK CONDITION SETTING
  Playback operation-relevant parameters are displayed.
- FUNCTIONAL CONDITION SETTING
  Execution of each function-relevant parameters are displayed.

Select above mentioned menu from {SETUP} window under the main menu.

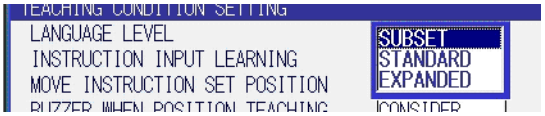


Move the cursor to select a menu, then the settings of the desired parameters can be changed by one of the following three methods according to its content.

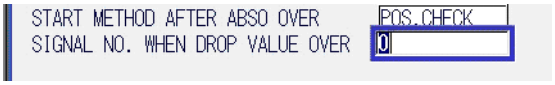
- When there are two options.
  The options alternate every time [SELECT] is pressed.



- When there are three or more options.
  A dialog box with the options appears. Select one to change the settings.

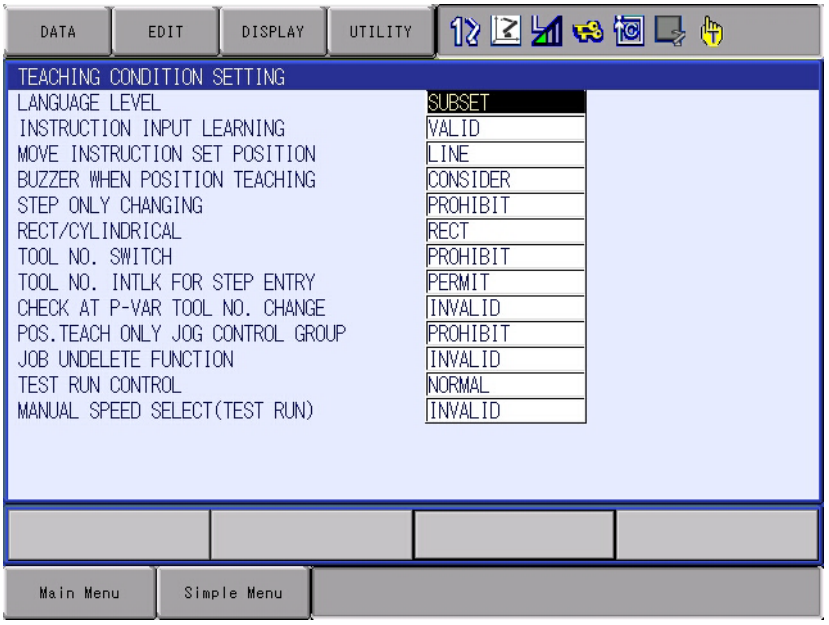


- When it requires to input a value.
  Input a value using [Numeric Keys] and press [ENTER] to change the settings.



6.8.2 Teaching Condition Setting

Select {SETUP} → {TEACHING CONDITION SETTING} to display the following window.



- LANGUAGE LEVEL (S2C211)
  Refer to *chapter 8.3.0.13 "S2C211: LANGUAGE LEVEL"* .

Setting	Parameter value
SUBSET	0
STANDARD	1
EXPANDED	2

- INSTRUCTION INPUT LEARNING (S2C214)
  Refer to *chapter 8.3.0.14 "S2C214: INSTRUCTION INPUT LEARNING FUNCTION"* .

Setting	Parameter value
VALID	0
INVALID	1

- MOVE INSTRUCTION SET POSITION (S2C206)
  Refer to *chapter 8.3.0.8 "S2C206: ADDITIONAL STEP POSITION"* .

Setting	Parameter value
STEP	0
LINE	1

- BUZZER WHEN POSITION TEACHING (S2C433)
  Refer to *chapter 8.3.0.43 "S2C433: POSITION TEACHING BUZZER"* .

Setting	Parameter value
CONSIDER	0
NOT CONSIDER	1

• STEP ONLY CHANGING (S2C203)
Refer to *chapter 8.3.0.6 "S2C203: CHANGING STEP ONLY"* .

Setting	Parameter value
PERMIT	0
PROHIBIT	1

• RECT/CYL INDRICAL (S2C196)
Refer to *chapter 8.3.0.2 "S2C196: SELECTION OF Cartesian/ CYLINDRICAL"* .

Setting	Parameter value
CYL.	0
RECT	1

• TOOL NO. SWITCH (S2C431)
Refer to *chapter 8.3.0.42 "S2C431: TOOL NO. SWITCHING"* .

Setting	Parameter value
PROHIBIT	0
PERMIT	1

• TOOL NO. INTERLOCK FOR STEP ENTRY(S2C234 d0 bit)
Refer to *chapter 8.3.0.29 "S2C234: STEP REGISTRATION AT TOOL NO. CHANGE"* .

Setting	Bit status
PERMIT	0
PROHIBIT	1

• TOOL NO. MODIFICATION CHECK BY POSITION VARIABLE (S2C234 d1 bit)
Refer to *chapter 8.3.0.29 "S2C234: STEP REGISTRATION AT TOOL NO. CHANGE"* .

Setting	Bit status
VALID	0
INVALID	1

• POS. TEACH ONLY JOG CONTROL GROUP (S2C320)
Refer to *chapter 8.2.0.15 "S2C320: CONTROLLED GROUP JOB TEACHING POSITION CHANGE"* .

Setting	Parameter value
PROHIBIT	0
PERMIT	1

• JOB UNDELETE FUNCTION (S2C413)
Refer to *chapter 8.3.0.40 "S2C413: JOB UNDELETE FUNCTION"* .

Setting	Parameter value
INVALID	0
VALID	1

• INDEPENDENT: MOTION OF NEXT/TEST(S2C231)
Refer to *chapter 8.6.0.3 "S2C231: OPERATION METHOD AT FWD/BWD OPERATION OR TEST RUN BY INDEPENDENT CONTROL"* .
This appears only when the independent control is valid.

Setting	Parameter value
SINGLE	0
ALL	1

• BWD OPERATION NO GROUP AXIS (S2C688 d0 bit)

• BWD OPERATION CONCURRENT JOB (S2C688 d1 bit)
Refer to *chapter 8.6.0.10 "S2C688: EXECUTION OF "BWD" OPERATION"* .
This appears only when the independent control is valid.

Setting	Bit status
PERMIT	0
PROHIBIT	1

• STATION TWIN (S2C434)
Refer to *chapter 8.3.0.44 "S2C434: JOB LINKING DESIGNATION (When Twin Synchronous Function Used)"* .
This appears only when the STATION TWIN SYNCHRONOUS JOB is valid.

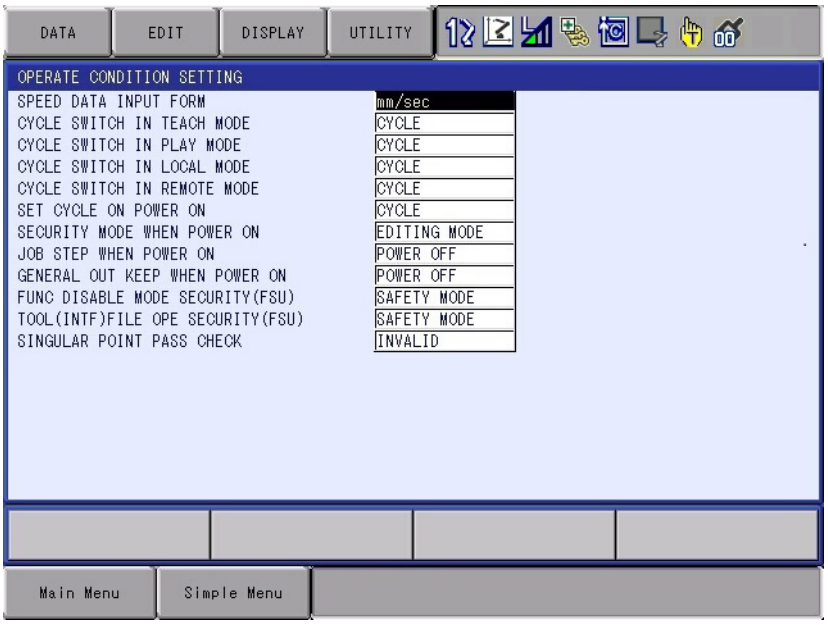
Setting	Parameter Value
INVALID	0
VALID	1

• TEST RUN OPERATION (S2C896)

Setting	Parameter value
NORMAL	0
HIGH-PRECISION	1

6.8.3 Operation Condition Setting

Select {SETUP} → {OPERATE CONDITION SETTING} to display the following window.



- SPEED DATA INPUT FORM (S2C221)
  Refer to *chapter 8.3.0.21 "S2C221: SPEED DATA INPUT FORM"* .

Setting	Parameter value
MM/SEC	0
CM/MIN	1
INCH/MIN	2
MM/MIN	3

- CYCLE SWITCH IN TEACH MODE (S2C313)
  Refer to *chapter 8.3.0.33 "S2C313: TEACH MODE FIRST CYCLE MODE"* .

Setting	Parameter value
STEP	0
1 CYCLE	1
AUTO	2
NONE	3

- CYCLE SWITCH IN PLAY MODE (S2C314)
  Refer to *chapter 8.3.0.34 "S2C314: PLAY MODE FIRST CYCLE MODE"* .

Setting	Parameter value
STEP	0
1 CYCLE	1
AUTO	2
NONE	3

• CYCLE SWITCH IN LOCAL MODE (S2C294)
Refer to *chapter 8.3.0.31 "S2C294: LOCAL FIRST CYCLE MODE"* .

Setting	Parameter value
STEP	0
1 CYCLE	1
AUTO	2
NONE	3

• CYCLE SWITCH IN REMOTE MODE (S2C293)
Refer to *chapter 8.3.0.30 "S2C293: REMOTE FIRST CYCLE MODE"* .

Setting	Parameter value
STEP	0
1 CYCLE	1
AUTO	2
NONE	3

• SET CYCLE ON POWER ON (S2C312)
Refer to *chapter 8.3.0.32 "S2C312: POWER ON FIRST CYCLE MODE"* .

Setting	Parameter value
STEP	0
1 CYCLE	1
AUTO	2
NONE	3

• SECURITY MODE WHEN POWER ON (S2C195)
Refer to *chapter 8.3.0.1 "S2C195: SECURITY MODE WHEN CONTROL POWER SUPPLY IS TURNED ON"* .

Setting	Parameter value
OPERATION MODE	0
EDIT MODE	1
MANAGEMENT MODE	2

• JOB STEP WHEN POWER ON (S2C215)
Refer to *chapter 8.3.0.15 "S2C215: ADDRESS SETTING WHEN CONTROL POWER IS TURNED ON"* .

Setting	Parameter value
POWER OFF	0
INITIAL	1

• GENERAL-PURPOSE OUT KEEP WHEN POWER ON (S2C235)
Refer to *chapter 8.5.0.1 “S2C235: USER OUTPUT RELAY WHEN CONTROL POWER IS ON”* .

Setting	Parameter value
POWER OFF	0
INITIAL	1

• DISABLE MODE OPERATION (FUNCTIONAL SAFETY) (S2C1201)
This appears only when the security mode is set to the safety mode under one of the following conditions:
  • Axis range limit function is enabled
  • Robot range limit function is enabled
  • Tool angle monitor function is enabled
  • Functional safety and tool change monitor function are enabled

Setting	Parameter value
SAFETY MODE	0
EDIT MODE	1
MANAGEMENT MODE	2

• TOOL (INTERFERENCE) FILE OPERATION (FUNCTIONAL SAFETY) (S2C1235)
This appears only when the functional safety is enabled and the security mode is set to the safety mode.

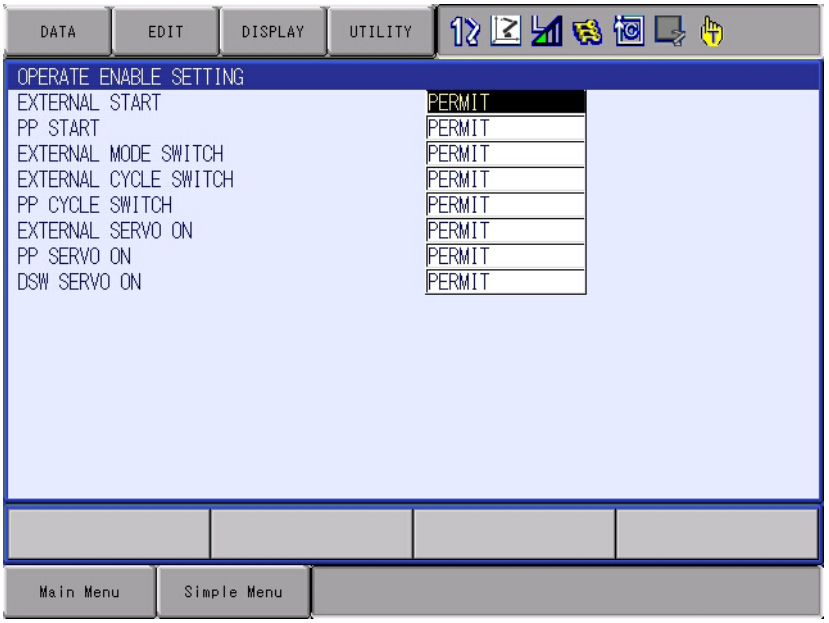
Setting	Parameter value
SAFETY MODE	0
EDIT MODE	1
MANAGEMENT MODE	2

• SINGULAR POINT PASS CHECK (S2C892 d1 bit)
This appears only when the singular point pass check function is enabled.

Setting	Bit status
INVALID	0
VALID	1

6.8.4 Operate Enable Setting

Select {SETUP} → {OPERATE ENABLE SETTING} to display the following window.



• EXTERNAL START (S2C219)
Refer to *chapter 8.3.0.19 "S2C219: EXTERNAL START"* .

Setting	Parameter value
PERMIT	0
PROHIBIT	1

• PP START (S2C220)
Refer to *chapter 8.3.0.20 "S2C220: PROGRAMMING PENDANT START"* .

Setting	Parameter value
PERMIT	0
PROHIBIT	1

• EXTERNAL MODE SWITCH (S2C225)
Refer to *chapter 8.3.0.24 "S2C225: EXTERNAL MODE SWITCH"* .

Setting	Parameter value
PERMIT	0
PROHIBIT	1

• EXTERNAL CYCLE SWITCH (S2C227)
Refer to *chapter 8.3.0.25 "S2C227: EXTERNAL CYCLE SWITCHING"* .

Setting	Parameter value
PERMIT	0
PROHIBIT	1

• PP CYCLE SWITCH (S2C228)
Refer to *chapter 8.3.0.26 “S2C228: PROGRAMMING PENDANT CYCLE SWITCHING”* .

Setting	Parameter value
PERMIT	0
PROHIBIT	1

• EXTERNAL SERVO ON (S2C229 d0 bit)

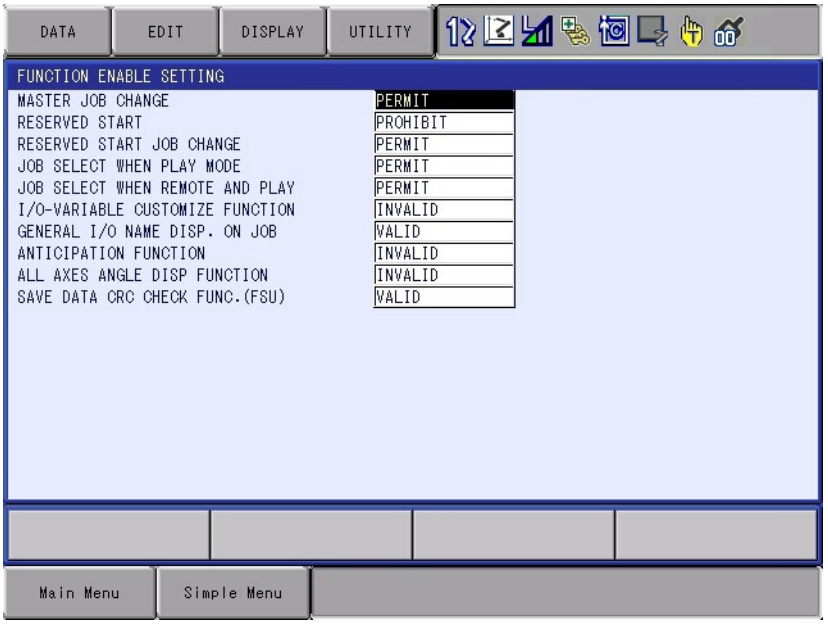
• PP SERVO ON (S2C229 d1 bit)

• DSW SERVO ON (S2C229 d2 bit)
Refer to *chapter 8.3.0.27 “S2C229: SERVO ON FROM EXTERNAL PP PROHIBITION”* .

Setting	Bit Status
PERMIT	0
PROHIBIT	1

6.8.5 Function Enable Setting

Select {SETUP} → {FUNCTION ENABLE SETTING} to display the following window.



• MASTER JOB CHANGE (S2C207)
Refer to *chapter 8.3.0.9 "S2C207: MASTER JOB CHANGING OPERATION"* .

Setting	Parameter value
PERMIT	0
PROHIBIT	1

• RESERVED START (S2C222)
Refer to *chapter 8.3.0.22 "S2C222: RESERVED START"* .

Setting	Parameter value
PERMIT	0
PROHIBIT	1

• RESERVED START JOB CHANGE (S2C209)
Refer to *chapter 8.3.0.11 "S2C209: RESERVED WORK JOB CHANGING OPERATION"* .

Setting	Parameter value
PERMIT	0
PROHIBIT	1

• JOB SELECTION IN PLAY MODE (S2C552).

Setting	Parameter value
PERMIT	0
PROHIBIT	1

• JOB SELECTION IN PLAY MODE WITH REMOTE (S2C224)
Refer to *chapter 8.3.0.23 "S2C224: JOB SELECTION AT REMOTE FUNCTION (PLAY MODE)"* .

Setting	Parameter value
PERMIT	0
PROHIBIT	1

• I/O VARIABLE CUSTOMIZE FUNCTION (S2C397)
Refer to *chapter 8.3.0.38 "S2C397: I/O VARIABLE CUSTOMIZE FUNCTION"* .

Setting	Parameter value
INVALID	0
VALID	1

• GENERAL-PURPOSE I/O NAME DISP. ON JOB (S2C544)
Refer to *chapter 8.3.0.46 "S2C544: I/O NAME DISPLAY FUNCTION FOR JOB"* .

Setting	Parameter value
INVALID	0
VALID	1

• ANTICIPATION FUNCTION (S2C646)
Refer to *chapter 8.8.0.1 "S2C646: ANTICIPATOR FUNCTION"* .

Setting	Parameter value
INVALID	0
VALID	1

• ALL AXES ANGLE DISP FUNCTION (S2C684 d0 bit)
Refer to *chapter 8.3.0.47 "S2C684:ALL AXES ANGLE DISPLAY FUNCTION"* .

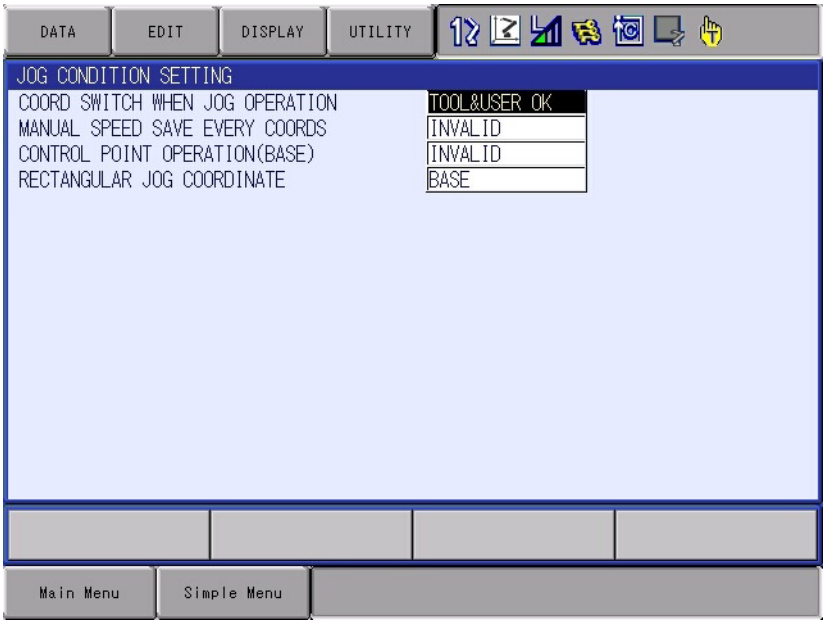
Setting	Bit status
INVALID	0
VALID	1

• SAVE DATA CRC CONFIRM FUNCTION (FUNCTIONAL SAFETY) (S2C1202)
This appears only when the functional safety is enabled and the security mode is set to the safety mode.

Setting	Parameter value
VALID	0
INVALID	1

6.8.6 Jog Condition Setting

Select {SETUP} → {JOG CONDITION SETTING} to display the following window.



• COORDS SWITCH WHEN JOG OPERATION (S2C197)
Refer to *chapter 8.3.0.3 "S2C197: COORDINATE SWITCHING PROHIBITED"* .

Setting	Parameter value
TOOL & USER OK	0
TOOL NG	1
USER NG	2
TOOL & USER NG	3

• MANUAL SPEED SAVE EVERY COORDS (S2C204)
Refer to *chapter 8.3.0.7 "S2C204: MANUAL SPEED STORING FOR EACH COORDINATE"* .

Setting	Parameter value
INVALID	0
VALID	1

• MOTION ABOUT TCP IN BASE COORDS (S2C713)
Refer to *chapter 8.3.0.48 "S2C713: CONTROL POINT OPERATION SETTING ON THE SERVO TRACK"* .
This appears only when the robot system includes a base axis.

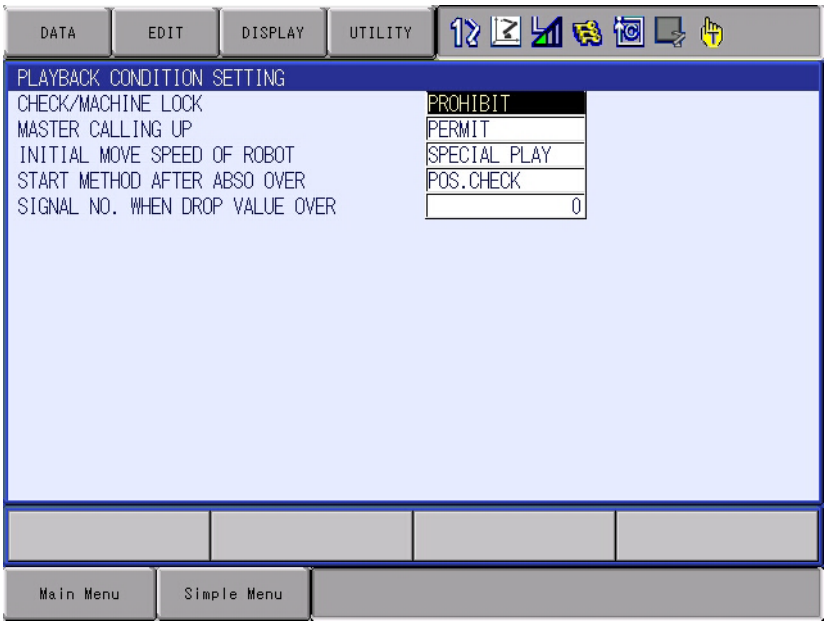
Setting	Parameter value
INVALID	0
VALID	1

• Cartesian JOG COORDS (S2C724)
This appears only when the robot system includes two or more manipulators.

Setting	Parameter value
BASE COORDS	0
ROBOT COORDS	1

6.8.7 Playback Condition Setting

Select {SETUP} → {PLAYBACK CONDITION SETTING} to display the following window.



• CHECK/MACHINE LOCK (S2C208)
Refer to *chapter 8.3.0.10 "S2C208: CHECK AND MACHINE-LOCK KEY OPERATION IN PLAY MODE"* .

Setting	Parameter value
PERMIT	0
PROHIBIT	1

• MASTER CALLING UP (S2C210)
Refer to *chapter 8.3.0.12 "S2C210: MASTER OR SUBMASTER CALL OPERATION IN PLAY MODE"* .

Setting	Parameter value
PERMIT	0
PROHIBIT	1

• INITIAL MOVE SPEED OF ROBOT (S2C217)
Refer to *chapter 8.3.0.17 "S2C217: INITIAL OPERATION OF MANIPULATOR"* .

Setting	Parameter value
SPECIAL PLAY	0
LOW SPEED AFTER EDIT	1

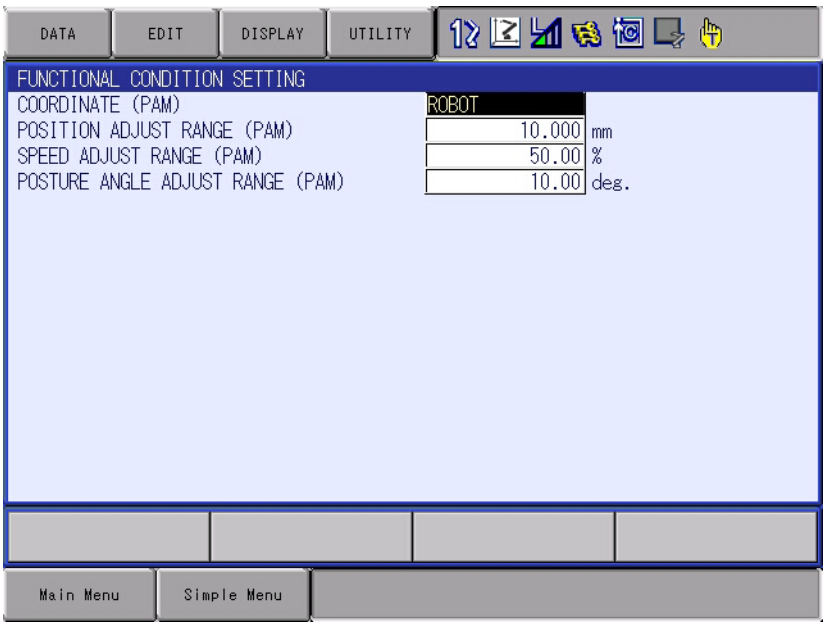
• START METHOD AFTER ABSO OVER (S2C316)
Refer to *chapter 8.3.0.35 "S2C316: START CONDITION AFTER ALARM-4107 ("OUT OF RANGE (ABSO DATA)")"* .

Setting	Parameter value
POS. CHECK	0
LOW SPEED	1

• SIGNAL NO. WHEN DROP VALUE OVER (S2C240)
Refer to *chapter 8.5.0.7 "S4C240: USER OUTPUT NO. WHEN MANIPULATOR DROP ALLOWABLE RANGE ERROR OCCURS"* .

6.8.8 Functional Condition Setting

Select {SETUP} → {FUNCTIONAL CONDITION SETTING} to display the following window.



- COORDINATE (PAM) (S2C1100)
  Refer to *chapter 8.2.0.24 "S3C1098 to S3C1102: POSITION CORRECTING FUNCTION DURING PLAYBACK"* .

Setting	Parameter value
BASE	0
ROBOT	1
TOOL	2
USER #1	3
:	
USER #63	65

- POSITION ADJUST RANGE (PAM) (S2C1098)
- SPEED ADJUST RANGE (PAM) (S2C1099)
- POSTURE ANGLE ADJUST RANGE (PAM) (S2C1102)
  Refer to *chapter 8.2.0.24 "S3C1098 to S3C1102: POSITION CORRECTING FUNCTION DURING PLAYBACK"* .

6.9 Jog Key Allocation

6.9.1 Jog Key Allocation Function

This function enables to operate external axis without switching control groups by using operation keys of 7th-axis (E+, E-) and 8th-axis (8+,8-) on the programing pendant after setting any external axis to them.

NOTICE

- Operation of external axis by using the allocated operation keys of 7th axis and 8th axis are valid only when operating a robot.
  In the case where operating external axes, operate them by using keys from the key for 1st axis.
  Furthermore, when the robot is equipped with 7th and 8th axes, keys on the pendant are used to operate existing axes on a priority basis.
  For example, when the robot is equipped with 7 axes, E-axis will move even if the external axis operation is allocated to 7th axis (E+, E-) operational key.

NOTE

This function can operate other control group than displayed in the upper part of the programming pendant (Status display area or the LED of [ROBOT] or [EX.AXIS]).

Also, the simultaneous operation of the robot and the external axes is possible by pressing several axis operational keys at a time. Please be careful to the axes movements when pressing them.

6.9.2 Jog Key Allocation Setting

6.9.2.1 Allocation of the Jog Key

NOTICE

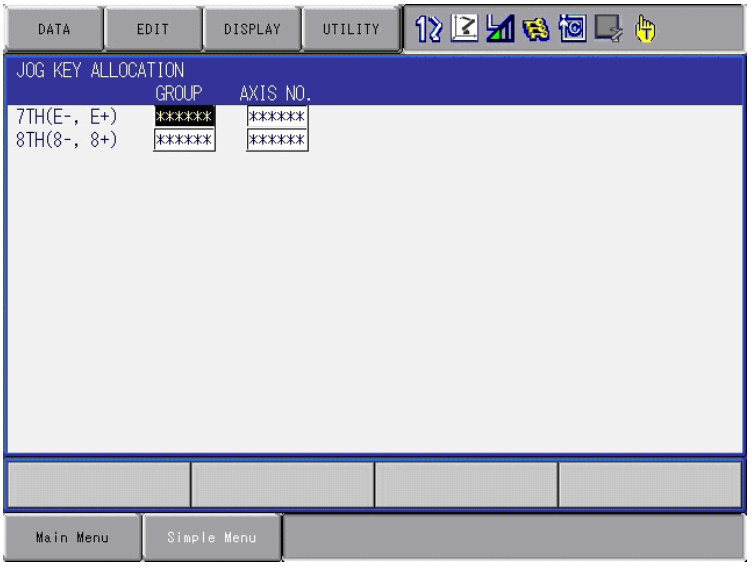
- Allocation of the jog keys is valid only in the management mode while only confirmation of allocated axes is valid in the operation mode and edit mode.

NOTE

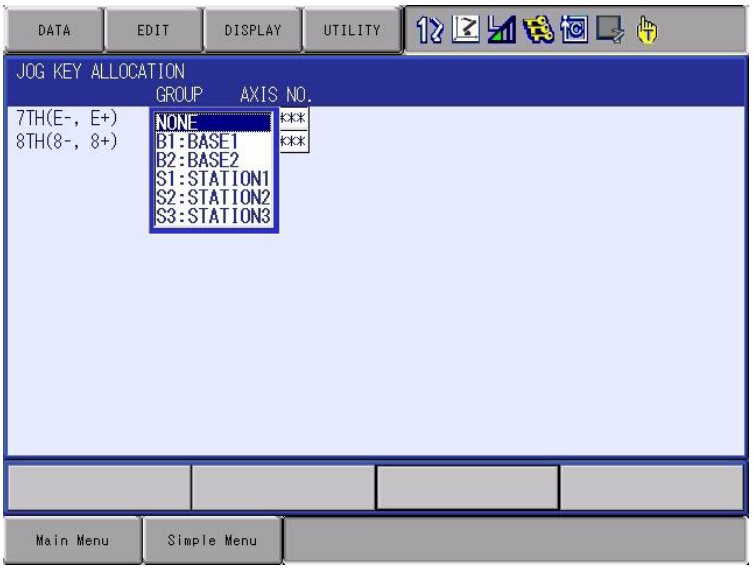
The setup conditions are saved in the following parameters. Even if the same numbered external axes are allocated to a key (example:S1 for the 1st axis), the value of the parameter to be saved varies depending on the composition of the control group of the system. In this consequence, when loading the parameter file (ALL.PRM or AC.PRM), please make sure to confirm the allocating status before executing the function.

Parameters for saving the setup conditions of jog key allocation
S2C739 7th axis
S2C740 8th axis

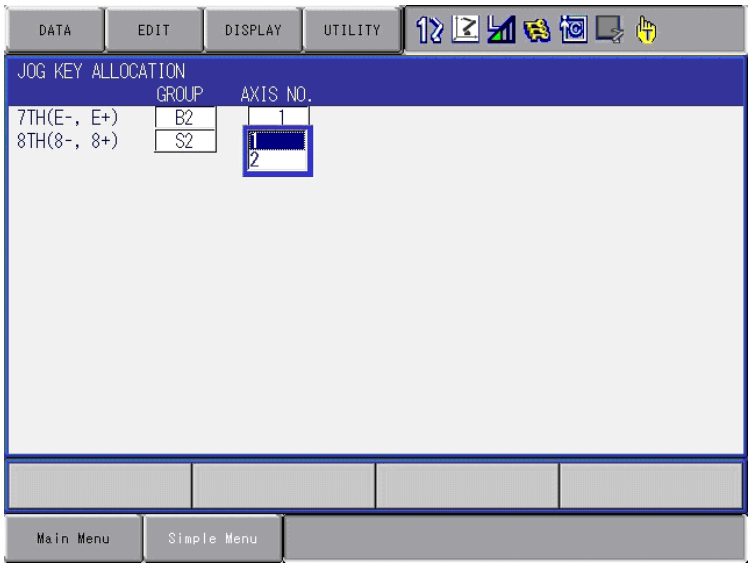
1. Select {SETUP} under the main menu.
2. Select {JOG KEY ALLOCATION}.
   – Jog key allocation window appears.



3. Move the cursor to “GROUP” and press down [SELECT].
   – The list of allocatable external axes appears.



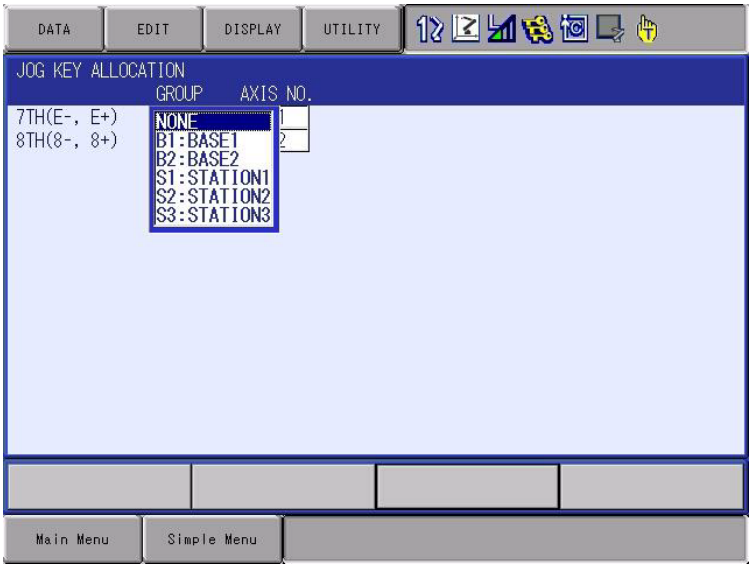
4. Select an external axis to be allocated.
   – The selected external axis is indicated in “GROUP” and “1” is indicated in “AXIS NO”.
5. (In the cases where the external axis is composed of more than two axes and the axis from the 2nd-axis are operated)
   Move the cursor to “AXIS NO”. and press down [SELECT].
   – The list of selected external axes appears.



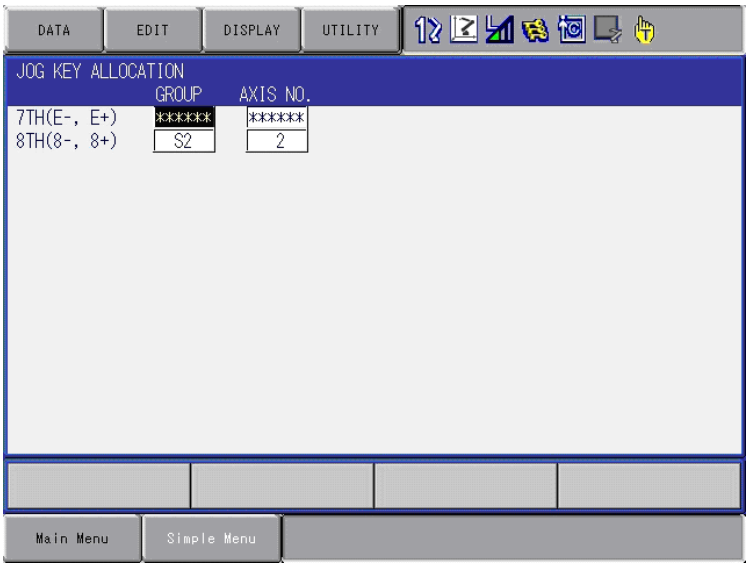
6. Select a desired axis number.
   – The selected axis is indicated in “AXIS NO”.

6.9.2.2 Cancellation of Jog Key Allocation

1. Select {SETUP} under the main menu.
2. Select {JOG KEY ALLOCATION}.
   – Jog key allocation window appears.
3. Move the cursor to “GROUP” and press [SELECT].
   – The list of allocatable external axes appears.



4. Select “NONE”.
   – “******” is indicated in “GROUP” and “AXIS NO”.



6.9.2.3 Operating Method of Allocated External Axis

NOTICE

- When the same external axis (same group and axis number) is allocated to 7th and 8th [Axis Keys], it won't move even both keys are pressed individually. In the case like this, the message "Check the setting of JOG KEY ALLOCATION (7th and 8th)" is indicated to alarm that the same external axis is allocated to two different keys. Please cancel the allocation setting or allocate another external axis to either of the key.

1. Press [ROBOT].
   – A mark of robot is indicated at the left side of the status area on the programming pendant, and this expresses that the robot is selected to be the object of operation.
   Also, the LED of [ROBOT] lights.
2. Press 7th (E+,E-) axis or 8th (8+,8-) axis operation key.
   – The allocated external axes moves if there are no 7th and 8th axes and the allocation setting was done properly.

6.10 Energy Saving Function

6.10.1 Energy Saving Function

Energy saving function is a function to save power by halting the power to the robot after applying brake to the motor when robot's all axes won't move for a designated period of time while servo is turned ON in play mode. The initial designated period of time is 10 minutes.

This energy saving function is valid when all the following condition met.

1. Energy saving function is valid.
2. The system input signal (the signal to prohibit on energy saving mode #40580) is turned OFF.

Followings are the status of the robot while this function is valid.

1. The message "On energy saving mode" is indicated on the programming pendant.
2. The servo is turned ON.
3. The jobs under execution are continuously executed.
4. The system output signal (ENERGY SAVING:SOUT#0576(#50727))to indicate that it is in energy saving status is turned ON while other signals won't change.

NOTICE

- This function is canceled in the following cases:
  - When the programming pendant mode is switched to teach mode.
  - When the system input signal of external servo OFF(1,2,3) is input.
  - When the axis, which belongs to the subject control group of the executing job, is about to move while energy saving function is valid.
  - In the cases where emergency stop or servo OFF is executed when alarming.



This function will not be canceled if the system input signal (the signal to prohibit energy saving #40580) is turned ON. This signal merely prohibits to shift the status to energy saving status.

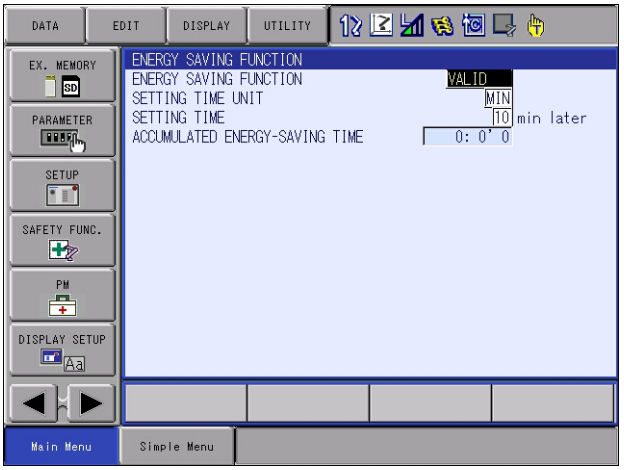
6.10.2 Method of Setting Energy Saving Function

6.10.2.1 Enable/Disable Energy Saving Function

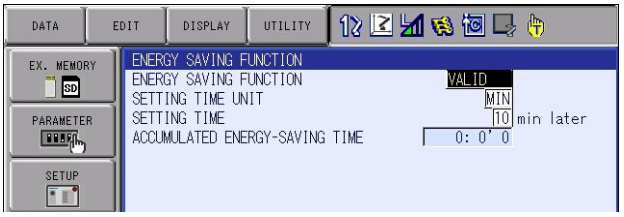
NOTICE

- The energy saving function can be enabled/disabled only in the management mode. In the operation mode or in the edit mode, only confirmation of this function is available.

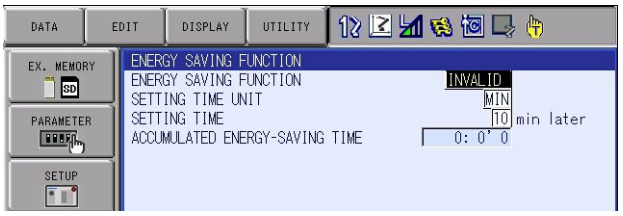
1. Select {SETUP} under the main menu.
2. Select {ENERGY SAVING FUNCTION}.
   – The ENERGY SAVING FUNCTION window appears.



3. Move the cursor to “ENERGY SAVING FUNCTION” and press [SELECT].
   – Valid and invalid alternates at each press of [SELECT].[1)]

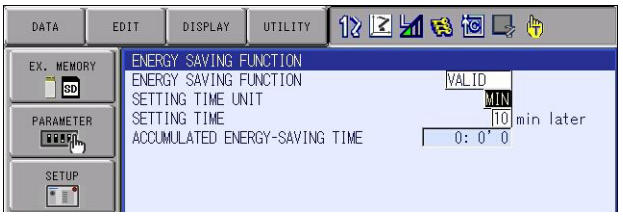


↑
Pressing [SELECT]
↓

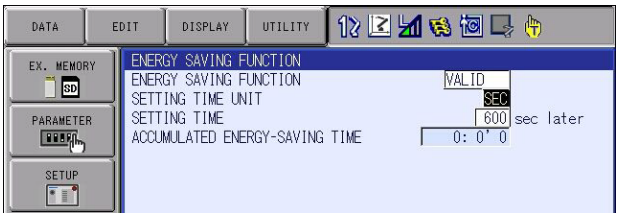


1 Some types cannot set the energy saving function to “INVALID”.

4. Move the cursor to {SETTING TIME UNIT} and press [SELECT].
   – The unit of energy saving setting time alternates at each press of [SELECT].[1)]



↑
Pressing [SELECT]
↓

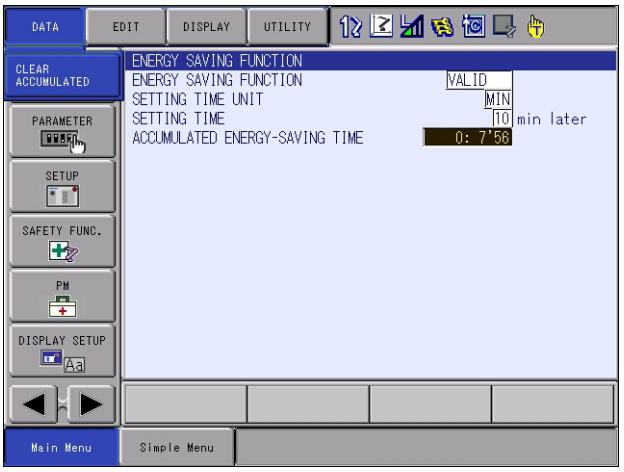


5. Move the cursor to {SETTING TIME} and press [SELECT].
   – Input the time to start energy saving after the robot is stopped into {SETTING TIME} section.
   The initial value is set to 10 (min) and the range of the inputting value is from 1 to 60 (for specifying minutes) or 1 to 3600 (for specifying seconds).[1)]

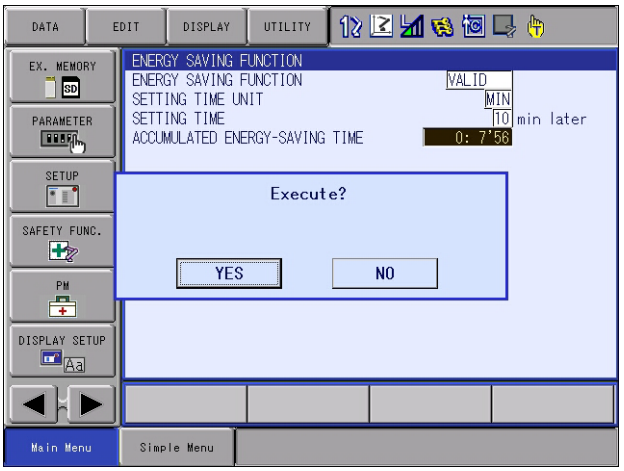
1 Switching the unit of energy saving setting time is available for the software version YBS1.05-00 or later.

6.10.2.2 Accumulated Energy Saving Time Clearance

1. Select {SETUP} under the main menu.
2. Select {ENERGY SAVING FUNCTION}.
   – Energy saving function window appears.
3. Move the cursor to {ACCUMULTED ENERGY-SAVING TIME}.
4. Move the cursor to {DATA} and press [SELECT].
   – {CLEAR ACCUMULTED} appears in the pull-down menu.



5. Select {CLEAR ACCUMULTED}
   – The confirmation dialog box appears.

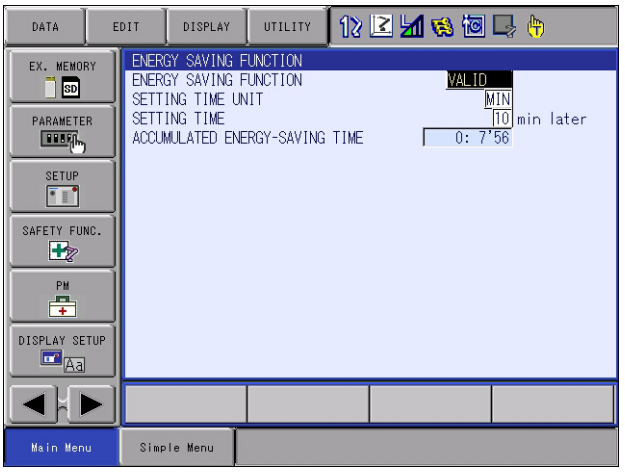


6. Select “YES” on the dialog box.
   – The accumulated energy-saving time is cleared.

6.10.3 Energy Saving Status Confirmation Method

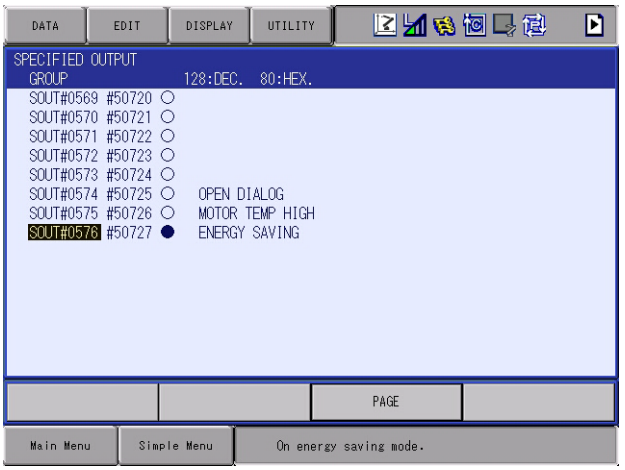
6.10.3.1 Confirmation by the Accumulated Energy-Saving Time

1. Select {SETUP} under the main menu.
2. Select {ENERGY SAVING FUNCTION}.
   – The ENERGY SAVING FUNCTION window appears.
   The accumulated energy-saving time is being counted up while the status is in the energy saving mode.



6.10.3.2 Confirmation by System Signal Output

1. Select {IN/OUT} under the main menu.
2. Select {SPECIFIC OUTPUT}.
   – The SPECIFIED OUTPUT window appears.
3. Press the [PAGE] or [SELECT] to display SOUT#0576 (#50727).
   – The system output status during the energy saving status is indicated.
   This signal is turned ON while in the energy saving mode.



   – This signal is turned OFF after the energy saving mode is released.

6.11 Instruction Display Color Setting Function

6.11.1 Setting the Instruction Display Color on the Job Window

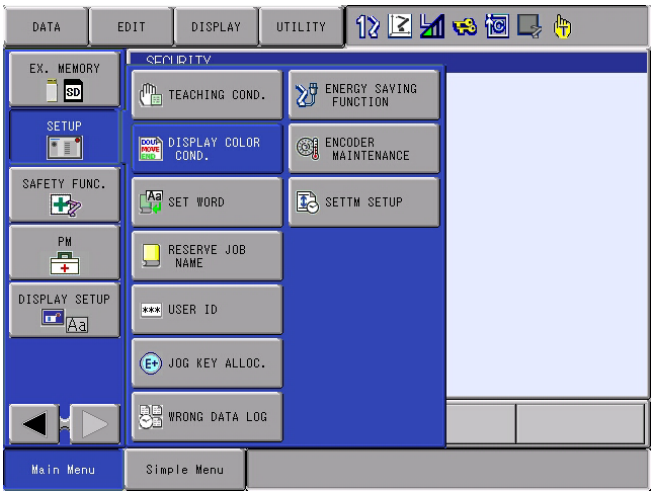
By using this function, each instruction can be displayed in each different color on the job window.

Display colors can be specified for the following instructions:

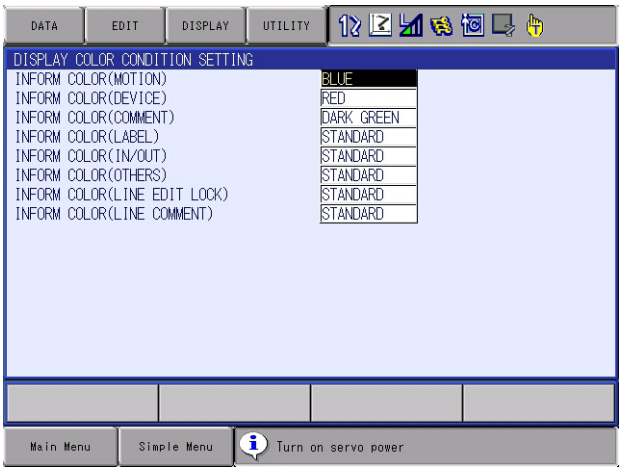
- Move instruction
- Work instruction
- Comment instruction
- Label instruction
- Macro instruction (when the macro function is enabled)
- I/O instruction
- Instruction to which LINE EDIT LOCK is specified
- Instruction to which LINE COMMENT is specified
- All the instructions other than listed above

The color of each instruction in the job window can be set on the DISPLAY COLOR CONDITION SETTING window.

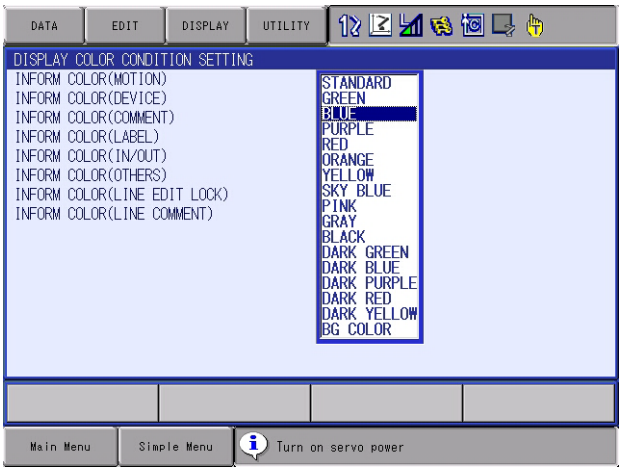
1. Select {SETUP} under the main menu.



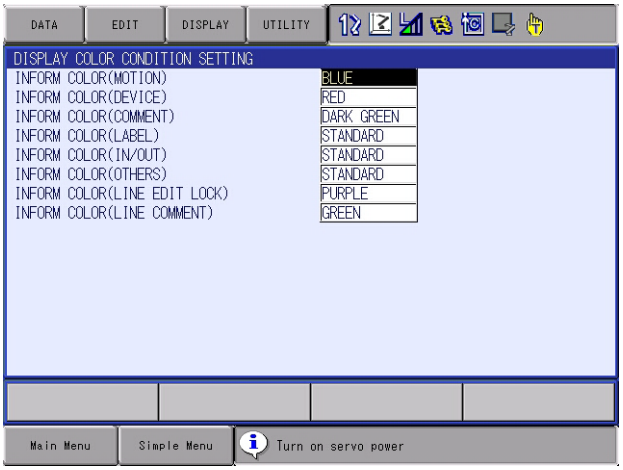
2. Select {DISPLAY COLOR COND.}.
   – The DISPLAY COLOR CONDITION SETTING window appears.



3. Move the cursor to an instruction and press [SELECT].
   – The list of available colors for the instruction is displayed.



4. Select a color.
   – The selected color is set for the instruction.



5. Select the JOB window.
   – The instruction is displayed in the selected color on the job window.



6.12 Present Manipulator Position Output Function

6.12.1 Function for Outputting Present Cartesian Position of Manipulator to Register

6.12.1.1 Outline

The present Cartesian position of the manipulator (values in the base coordinates) is output to the specified registers.

6.12.1.2 Parameters

The following parameters specify the details of the function and output register numbers.

S1CxG	Description
208	Enables/Disables the function for outputting the present Cartesian position (in the base coordinates) to registers. (command value) 0: disable 1: enable
209	Specifies the output size to the register. 0: output in 2 bytes 1: output in 4 bytes
210	Cartesian position (command value) X register number of output destination
211	Cartesian position (command value) Y register number of output destination
212	Cartesian position (command value) Z register number of output destination
213	Cartesian position (command value) Rx register number of output destination
214	Cartesian position (command value) Ry register number of output destination
215	Cartesian position (command value) Rz register number of output destination
216	Cartesian position (command value) Re register number of output destination
217	Enables/Disables the function for outputting the present Cartesian position (in the base coordinates) to registers. (FB value) 0: disable 1: enable
218	Specifies the output size to the register. 0: output in 2 bytes 1: output in 4 bytes
219	Cartesian position (FB value) X register number of output destination
220	Cartesian position (FB value) Y register number of output destination
221	Cartesian position (FB value) Z register number of output destination
222	Cartesian position (FB value) Rx register number of output destination
223	Cartesian position (FB value) Ry register number of output destination
224	Cartesian position (FB value) Rz register number of output destination
224	Cartesian position (FB value) Re register number of output destination

<Example 1>

S1C1G	Setting value
208	1
209	0
210	10
211	11
212	12
213	13
214	14
215	15
216	16

When the parameters are set as shown in the above table, the present position is output to the registers as follows:

M010 = Manipulator's present Cartesian position (command value) X [unit: mm]
M011 = Manipulator's present Cartesian position (command value) Y [unit: mm]
M012 = Manipulator's present Cartesian position (command value) Z [unit: mm]
M013 = Manipulator's present Cartesian position (command value) Rx [unit: deg]
M014 = Manipulator's present Cartesian position (command value) Ry [unit: deg]
M015 = Manipulator's present Cartesian position (command value) Rz [unit: deg]
M016 = Manipulator's present Cartesian position (command value) Re [unit: deg]

<Example 2>

S1C1G	Setting value
217	1
218	1
219	10
220	12
221	14
222	16
223	18
224	20
225	22

When the parameters are set as shown in the above table, the present position is output to the registers as follows:

M010 = Lower 2 bytes of the manipulator's present Cartesian position (FB value) X [unit: µm]
M011 = Upper 2 bytes of the manipulator's present Cartesian position (FB value) X [unit: µm]
M012 = Lower 2 bytes of the manipulator's present Cartesian position (FB value) Y [unit: µm]
M013 = Upper 2 bytes of the manipulator's present Cartesian position (FB value) Y [unit: µm]
M014 = Lower 2 bytes of the manipulator's present Cartesian position (FB value) Z [unit: µm]
M015 = Upper 2 bytes of the manipulator's present Cartesian position (FB value) Z [unit: µm]
M016 = Lower 2 bytes of the manipulator's present Cartesian position (FB value) Rx [unit: 0.001 deg]
M017 = Upper 2 bytes of the manipulator's present Cartesian position (FB value) Rx [unit: 0.001 deg]

M018 =	Lower 2 bytes of the	manipulator's present Cartesian position (FB value)	Ry	[unit: 0.001 deg]
M019 =	Upper 2 bytes of the	manipulator's present Cartesian position (FB value)	Ry	[unit: 0.001 deg]
M020 =	Lower 2 bytes of the	manipulator's present Cartesian position (FB value)	Rz	[unit: 0.001 deg]
M021 =	Upper 2 bytes of the	manipulator's present Cartesian position (FB value)	Rz	[unit: 0.001 deg]
M022 =	Lower 2 bytes of the	manipulator's present Cartesian position (FB value)	Re	[unit: 0.001 deg]
M023 =	Upper 2 bytes of the	manipulator's present Cartesian position (FB value)	Re	[unit: 0.001 deg]

NOTE

- When this function for command values is enabled (S1CxG208=1), be sure to set the register number of output destination for each coordinate value (S1CxG210 to 216).
- When this function for FB values is enabled (S1CxG217=1), be sure to set the register number of output destination for each coordinate value (S1CxG219 to 225).
- When the output size to the register is set to 2 bytes (S1CxG209=0 or S1CxG218=0), the unit for X, Y, Z coordinate values is "mm", and the unit for Rx, Ry, Rz, Re coordinate values is "deg". If the coordinate value exceeds 2 bytes, only the lower 2 bytes will be output.
- When the output size to the register is set to 4 bytes (S1CxG209=1 or S1CxG218=1), the unit for X, Y, Z coordinate values is "μmm", and the unit for Rx, Ry, Rz, Re coordinate values is "0.0001 deg".
- When the output size to the register is set to 4 bytes (S1CxG209=1 or S1CxG218=1), the upper bytes of the coordinate value will be output to the next number of the specified register number. Before performing setting, check the usage status of the registers.

6.12.2 Function for Outputting Present Pulse Position to Register

6.12.2.1 Outline

The present position of the robot axis, the base axis, or the station axis in pulses is output to the specified registers.

6.12.2.2 Parameters

The following parameters specify the details of the function and output register numbers.

S1CxG	Description
202	Specifies the axis to apply the function 1 for outputting the present position in pulses to registers. (command value) The axis is specified in bits. Bit OFF: disable Bit ON: enable
203	Specifies the axis to apply the function 1 for outputting the present position in pulses to registers. (FB value) The axis is specified in bits. Bit OFF: disable Bit ON: enable
204	Specifies the output size to the register. Bit OFF: output in 2 bytes Bit ON: output in 4 bytes
205	Specifies the axis to apply the function 2 for outputting the present position in pulses to registers. (command value) The axis is specified in bits. Bit OFF: disable Bit ON: enable
206	Specifies the axis to apply the function 2 for outputting the present position in pulses to registers. (FB value) The axis is specified in bits. Bit OFF: disable Bit ON: enable
207	Specifies the output size to the register. Bit OFF: output in 2 bytes Bit ON: output in 4 bytes
1090 to 1097	Function 1 register number of output destination
1100 to 1107	Function 1 resolution setting
1110 to 1117	Function 1 offset value setting
1120 to 1127	Function 2 register number of output destination
1130 to 1137	Function 2 resolution setting
1140 to 1147	Function 2 offset value setting

2-byte output specification:

- (specified M register) = (pulse (command or FB)) / (resolution) + (offset value) [unit: pulse]

NOTE When the output size to the register is set to 2 bytes (no axis specified in S1CxG204 or S1CxG207), the pulse value in the size of 2 bytes will be output to the specified register number. If the size exceeds 2 bytes, only the lower 2 bytes will be output.

4-byte output specification:

- (specified M register) = Lower 2 bytes of {(pulse (command or FB)) / (resolution) + (offset value)} [unit: pulse]
- (specified M register + 1) = Upper 2 bytes of {(pulse (command or FB)) / (resolution) + (offset value)} [unit: pulse]

NOTE When the output size to the register is set to 4 bytes (an axis specified in S1CxG204 or S1CxG207), the lower 2 bytes will be output to the specified register number, and the upper 2 bytes will be output to the next number of the specified register number. Before performing setting, check the usage status of the registers.

<Example 1>

S1C1G	Setting value
202	63
203	0
204	0
1090	10
1091	11
1092	12
1093	13
1094	14
1095	15

When the parameters are set as shown in the above table, the present position is output to the registers as follows:

M010	= Present pulse position (command value)	S (1st axis)	[unit: pulse]
M011	= Present pulse position (command value)	L (2nd axis)	[unit: pulse]
M012	= Present pulse position (command value)	U (3rd axis)	[unit: pulse]
M013	= Present pulse position (command value)	R (4th axis)	[unit: pulse]
M014	= Present pulse position (command value)	B (5th axis)	[unit: pulse]
M015	= Present pulse position (command value)	T (6th axis)	[unit: pulse]

<Example 2>

S1C1G	Setting value
202	0
203	63
204	63
1090	10
1091	12
1092	14
1093	16
1094	18
1095	20

When the parameters are set as shown in the above table, the present position is output to the registers as follows:

M010	= Lower 2 bytes of the	Present pulse position (FB value)	S (1st axis)	[unit: pulse]
M011	= Upper 2 bytes of the	Present pulse position (FB value)	S (1st axis)	[unit: pulse]
M012	= Lower 2 bytes of the	Present pulse position (FB value)	L (2nd axis)	[unit: pulse]
M013	= Upper 2 bytes of the	Present pulse position (FB value)	L (2nd axis)	[unit: pulse]
M014	= Lower 2 bytes of the	Present pulse position (FB value)	U (3rd axis)	[unit: pulse]
M015	= Upper 2 bytes of the	Present pulse position (FB value)	U (3rd axis)	[unit: pulse]
M016	= Lower 2 bytes of the	Present pulse position (FB value)	R (4th axis)	[unit: pulse]
M017	= Upper 2 bytes of the	Present pulse position (FB value)	R (4th axis)	[unit: pulse]
M018	= Lower 2 bytes of the	Present pulse position (FB value)	B (5th axis)	[unit: pulse]
M019	= Upper 2 bytes of the	Present pulse position (FB value)	B (5th axis)	[unit: pulse]
M020	= Lower 2 bytes of the	Present pulse position (FB value)	T (6th axis)	[unit: pulse]
M021	= Upper 2 bytes of the	Present pulse position (FB value)	T (6th axis)	[unit: pulse]

NOTE

- If the pulse is a negative value, the pulse will be output to the register in 2's complement notation.
- Even in one control group, "command value" or "FB value" can be specified differently for each axis. However, if "command value" and "FB value" are specified for the same axis, the value "0" will be output to the register.
- If "0" is set as the resolution setting parameter (S1CxG1110 to 1117, S1CxG1130 to 1137), it will be treated as "1" when output to the register is performed.
- If "0" is set as the register number of output destination (S1CxG1090 to 1097, S1CxG1120 to 1127), the present pulse position will not be output to the register. Thus, no value can be output to the register number M000. Also, if the same register number of output destination is used more than twice, the former data will be overwritten by the latter data.

6.12.3 Function for Outputting TCP Speed to Register

6.12.3.1 Outline

The TCP (tool center point) speed of the manipulator is output to the specified registers.

6.12.3.2 Parameters

The following parameters specify the details of the function and output register numbers.

S1CxG	Description
330	Enables/Disables the function for outputting the TCP speed to registers. (command value) 0: no output to register 1: output in 2 bytes [unit: mm/sec] 2: output in 4 bytes [unit: µm/sec]
331	TCP speed (command value) register number of output destination
332	Enables/Disables the function for outputting the TCP speed to registers. (FB value) 0: no output to register 1: output in 2 bytes [unit: mm/sec] 2: output in 4 bytes [unit: µm/sec]
333	TCP speed (FB value) register number of output destination

<Example 1>

S1C1G	Setting value
330	1
331	10
332	2
333	11

When the parameters are set as shown in the above table, the speed is output to the registers as follows:

M010 =	TCP speed (command value)	[unit: mm/sec]
M011 =	Lower 2 bytes of the TCP speed (FB value)	[unit: µm/sec]
M012 =	Upper 2 bytes of the TCP speed (FB value)	[unit: µm/sec]

NOTE

- When the output size to the register is set to 2 bytes (“1” is set in S1CxG330 or S1CxG332), the TCP speed in the size of 2 bytes will be output to the specified register number. If the size exceeds 2 bytes, only the lower 2 bytes will be output.
- When the output size to the register is set to 4 bytes (“2” is set in S1CxG330 or S1CxG332), the lower 2 bytes will be output to the specified register number, and the upper 2 bytes will be output to the next number of the specified register number. Before performing setting, check the usage status of the registers.
- If “0” is set as the register number of output destination (S1CxG331 or S1CxG333), the present TCP speed will not be output to the register. Thus, no value can be output to the register number M000. Also, if the same register number of output destination is used more than twice, the former data will be overwritten by the latter data.

6.12.4 Function for Outputting Each Axis Speed to Register

6.12.4.1 Outline

The speed of each axis of the robot axis, the base axis, and the station axis is output to the specified registers.

6.12.4.2 Parameters

The following parameters specify the details of the function and output register numbers.

S1CxG	Description
334	Enables/Disables the function for outputting each axis speed to registers. (command value) 0: no output to register 1: output in 2 bytes [unit: deg/sec (mm/sec for a linear motion axis)] 2: output in 4 bytes [unit: 0.0001 deg/sec (μm/sec for a linear motion axis)]
335	Enables/Disables the function for outputting each axis speed to registers. (FB value) 0: no output to register 1: output in 2 bytes [unit: deg/sec (mm/sec for a linear motion axis)] 2: output in 4 bytes [unit: 0.0001 deg/sec (μm/sec for a linear motion axis)]
1270 to 1277	Each axis speed (command value) register number of output destination
1280 to 1287	Each axis speed (FB value) register number of output destination

<Example 1>

S1C1G	Setting value
334	1
335	0
1270	10
1271	11
1272	12
1273	13
1274	14
1275	15

When the parameters are set as shown in the above table, the speed is output to the registers as follows:

M010	= Each axis speed (command value)	S (1st axis)	[unit: deg/sec]
M011	= Each axis speed (command value)	L (2nd axis)	[unit: deg/sec]
M012	= Each axis speed (command value)	U (3rd axis)	[unit: deg/sec]
M013	= Each axis speed (command value)	R (4th axis)	[unit: deg/sec]
M014	= Each axis speed (command value)	B (5th axis)	[unit: deg/sec]
M015	= Each axis speed (command value)	T (6th axis)	[unit: deg/sec]

<Example 2>

S1C1G	Setting value
334	0
335	2
1280	10
1281	12
1282	14
1283	16
1284	18
1285	20

When the parameters are set as shown in the above table, the speed is output to the registers as follows:

M010	= Lower 2 bytes of the	Each axis speed (FB value)	S (1st axis)	[unit: 0.0001 deg/sec]
M011	= Upper 2 bytes of the	Each axis speed (FB value)	S (1st axis)	[unit: 0.0001 deg/sec]
M012	= Lower 2 bytes of the	Each axis speed (FB value)	L (2nd axis)	[unit: 0.0001 deg/sec]
M013	= Upper 2 bytes of the	Each axis speed (FB value)	L (2nd axis)	[unit: 0.0001 deg/sec]
M014	= Lower 2 bytes of the	Each axis speed (FB value)	U (3rd axis)	[unit: 0.0001 deg/sec]
M015	= Upper 2 bytes of the	Each axis speed (FB value)	U (3rd axis)	[unit: 0.0001 deg/sec]
M016	= Lower 2 bytes of the	Each axis speed (FB value)	R (4th axis)	[unit: 0.0001 deg/sec]
M017	= Upper 2 bytes of the	Each axis speed (FB value)	R (4th axis)	[unit: 0.0001 deg/sec]
M018	= Lower 2 bytes of the	Each axis speed (FB value)	B (5th axis)	[unit: 0.0001 deg/sec]
M019	= Upper 2 bytes of the	Each axis speed (FB value)	B (5th axis)	[unit: 0.0001 deg/sec]
M020	= Lower 2 bytes of the	Each axis speed (FB value)	T (6th axis)	[unit: 0.0001 deg/sec]
M021	= Upper 2 bytes of the	Each axis speed (FB value)	T (6th axis)	[unit: 0.0001 deg/sec]

NOTE

- When the output size to the register is set to 2 bytes (“1” is set in S1CxG334 or S1CxG335), the axis speed in the size of 2 bytes will be output to the specified register number. If the size exceeds 2 bytes, only the lower 2 bytes will be output.
- When the output size to the register is set to 4 bytes (“2” is set in S1CxG334 or S1CxG335), the lower 2 bytes will be output to the specified register number, and the upper 2 bytes will be output to the next number of the specified register number. Before performing setting, check the usage status of the registers.
- If “0” is set as the register number of output destination (S1CxG1270 to 1277, S1CxG1280 to 1287), the present axis speed will not be output to the register. Thus, no value can be output to the register number M000. Also, if the same register number of output destination is used more than twice, the former data will be overwritten by the latter data.

6.12.5 Function for Outputting Each Axis Position to Register

6.12.5.1 Outline

The position of each axis of the robot axis, the base axis, and the station axis is output to the specified registers.

6.12.5.2 Parameters

The following parameters specify the details of the function and output register numbers.

S1CxG	Description
336	Enables/Disables the function for outputting each axis position to registers. (command value) 0: no output to register 1: output in 2 bytes [unit: deg (mm for a linear motion axis)] 2: output in 4 bytes [unit: 0.0001 deg (μm for a linear motion axis)]
337	Enables/Disables the function for outputting each axis position to registers. (FB value) 0: no output to register 1: output in 2 bytes [unit: deg (mm for a linear motion axis)] 2: output in 4 bytes [unit: 0.0001 deg (μm for a linear motion axis)]
1290 to 1297	Each axis position (command value) register number of output destination
1300 to 1307	Each axis position (FB value) register number of output destination

<Example 1>

S1C1G	Setting value
336	1
337	0
1290	10
1291	11
1292	12
1293	13
1294	14
1295	15

When the parameters are set as shown in the above table, the position is output to the registers as follows:

M010	= Each axis position (command value)	S (1st axis)	[unit: deg]
M011	= Each axis position (command value)	L (2nd axis)	[unit: deg]
M012	= Each axis position (command value)	U (3rd axis)	[unit: deg]
M013	= Each axis position (command value)	R (4th axis)	[unit: deg]
M014	= Each axis position (command value)	B (5th axis)	[unit: deg]
M015	= Each axis position (command value)	T (6th axis)	[unit: deg]

<Example 2>

S1C1G	Setting value
336	0
337	2
1300	10
1301	12
1302	14
1303	16
1304	18
1305	20

When the parameters are set as shown in the above table, the position is output to the registers as follows:

M010	= Lower 2 bytes of the	Each axis position (FB value)	S (1st axis)	[unit: 0.0001 deg]
M011	= Upper 2 bytes of the	Each axis position (FB value)	S (1st axis)	[unit: 0.0001 deg]
M012	= Lower 2 bytes of the	Each axis position (FB value)	L (2nd axis)	[unit: 0.0001 deg]
M013	= Upper 2 bytes of the	Each axis position (FB value)	L (2nd axis)	[unit: 0.0001 deg]
M014	= Lower 2 bytes of the	Each axis position (FB value)	U (3rd axis)	[unit: 0.0001 deg]
M015	= Upper 2 bytes of the	Each axis position (FB value)	U (3rd axis)	[unit: 0.0001 deg]
M016	= Lower 2 bytes of the	Each axis position (FB value)	R (4th axis)	[unit: 0.0001 deg]
M017	= Upper 2 bytes of the	Each axis position (FB value)	R (4th axis)	[unit: 0.0001 deg]
M018	= Lower 2 bytes of the	Each axis position (FB value)	B (5th axis)	[unit: 0.0001 deg]
M019	= Upper 2 bytes of the	Each axis position (FB value)	B (5th axis)	[unit: 0.0001 deg]
M020	= Lower 2 bytes of the	Each axis position (FB value)	T (6th axis)	[unit: 0.0001 deg]
M021	= Upper 2 bytes of the	Each axis position (FB value)	T (6th axis)	[unit: 0.0001 deg]

NOTE

- If the axis position is a negative value, the axis position will be output to the register in 2's complement notation.
- When the output size to the register is set to 2 bytes ("1" is set in S1CxG336 or S1CxG337), the axis position in the size of 2 bytes will be output to the specified register number. If the size exceeds 2 bytes, only the lower 2 bytes will be output.
- When the output size to the register is set to 4 bytes ("2" is set in S1CxG336 or S1CxG337), the lower 2 bytes will be output to the specified register number, and the upper 2 bytes will be output to the next number of the specified register number. Before performing setting, check the usage status of the registers.
- If "0" is set as the register number of output destination (S1CxG1290 to 1297, S1CxG1300 to 1307), the present axis position will not be output to the register. Thus, no value can be output to the register number M000. Also, if the same register number of output destination is used more than twice, the former data will be overwritten by the latter data.

6.12.6 Function for Outputting Torque Command Value to Register

6.12.6.1 Outline

The torque command value of the manipulator is output to a register. The torque command value is the current torque command value of the measured axis. The torque command value is expressed as a percentage [%] with the rated motor torque of the axis as 100%.

6.12.6.2 Parameters

The following parameters specify the details of the function, output register numbers, and offsets.

S1CxG	Description
122	Specifies the output axis to apply the function for a outputting torque command value to a register. The axis is specified in bits. Bit OFF: disable Bit ON: enable
910 to 917	Specifies the register number of the output destination for outputting a torque command value to a register.
1060 to 1067	Specifies the offset for outputting a torque command value to a register.

Output specification

- (specified M register) = (torque command value) + (offset) [unit: %]

<Example 1>

S1C1G	Setting value
122	63
910	10
911	11
912	12
913	13
914	14
915	15

When the parameters are set as shown in the above table, the torque command values are output to the registers as follows:

M010 = Torque (command value) S (1st axis) [unit: %]
M011 = Torque (command value) L (2nd axis) [unit: %]
M012 = Torque (command value) U (3rd axis) [unit: %]
M013 = Torque (command value) R (4th axis) [unit: %]
M014 = Torque (command value) B (5th axis) [unit: %]
M015 = Torque (command value) T (6th axis) [unit: %]

NOTE

- If "0" is set as the register number of the output destination (S1CxG910 to 917), the torque command value will not be output to the register. Thus, no value can be output to the register number M000. Also, if the same register number of the output destination is used more than once, the former data will be overwritten by the latter data.
- The update cycle for the register output values of the torque command values is approximately 100 msec.

6.13 Softlimit Setting Function

6.13.1 About the Softlimit Setting Function

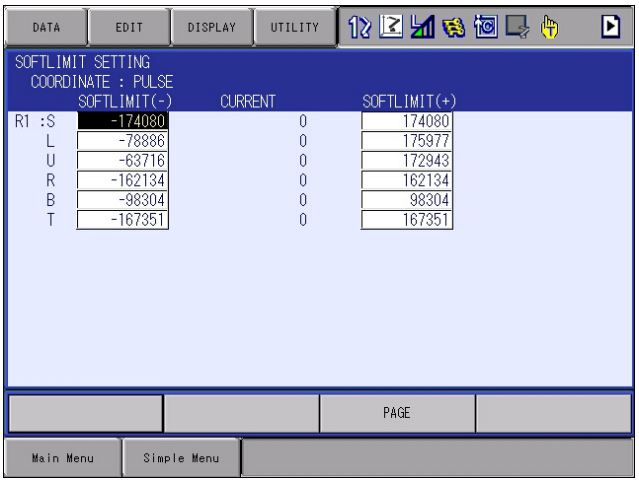
The softlimit setting function is a function to set the softlimit to limit the range of the manipulator motion in software.

6.13.2 The Softlimit Setting Screen

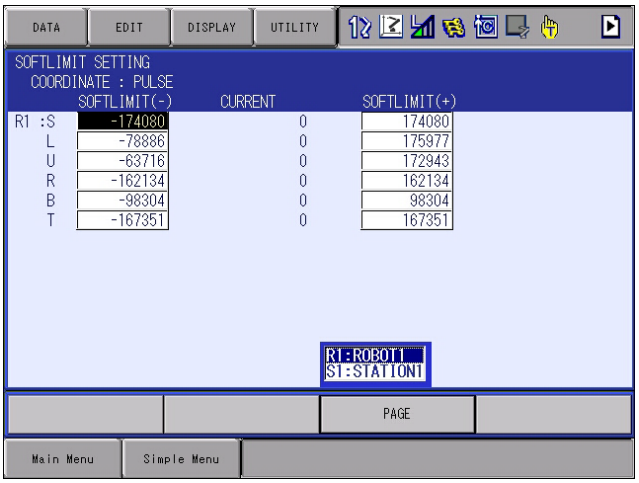
SUPPLE -MENT

The softlimit setting screen is displayed only at teach mode and the management mode.

1. Select {ROBOT} in the main menu.
2. Select {SOFTLIMIT SETTING}.
   – The softlimit setting screen is displayed.

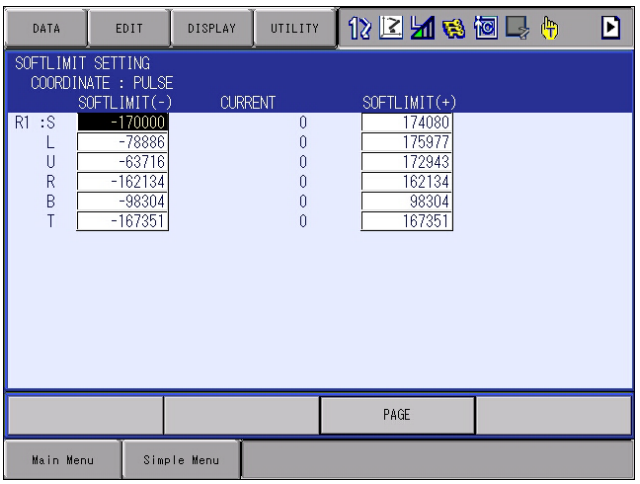


3. Set the control group as desired.
   – Switch to the desired control group by [PAGE] or the selection dialog.
   – As for the selection dialog, select [PAGE] on the screen and move the cursor to desired control group. Press [SELECT].



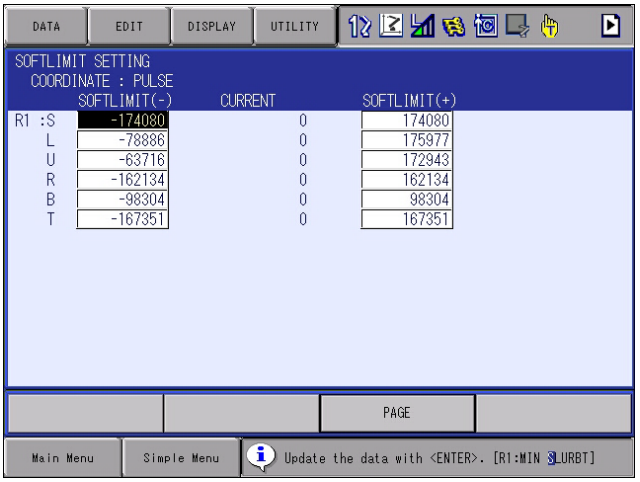
6.13.3 Setting the Softlimit by Numerical Value Input

1. Move the cursor to the desired axis of the softlimit (+) or the softlimit (-), and press [SELECT].
2. Enter the values of the softlimit (+)/ the softlimit (-), and press [ENTER].
   – The softlimit is set.



6.13.4 Set the Current Value to the Softlimit

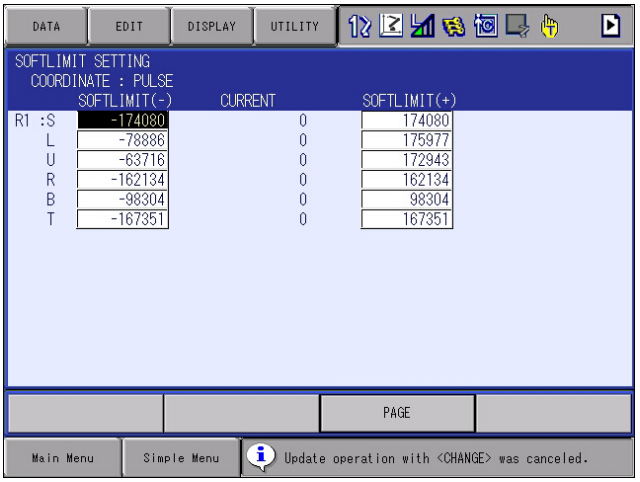
1. Move the manipulator by the [Axis Key].
   – Move the manipulator to the position of which value is maximum number or minimum number of the softlimit by the [Axis Key].
2. Move the cursor to the desired axis of the softlimit (+) or the softlimit (-).
   – When change the maximum number of the first softlimit, move the cursor to the first axis of the softlimit (+).
   – When change the minimum number of the first softlimit, move the cursor to the first axis of the softlimit (-).
3. Press [MODIFY].
   – The message “Update the data with <ENTER>.” appears.



   – If perform the one of the following operations, the modify operation will be canceled.

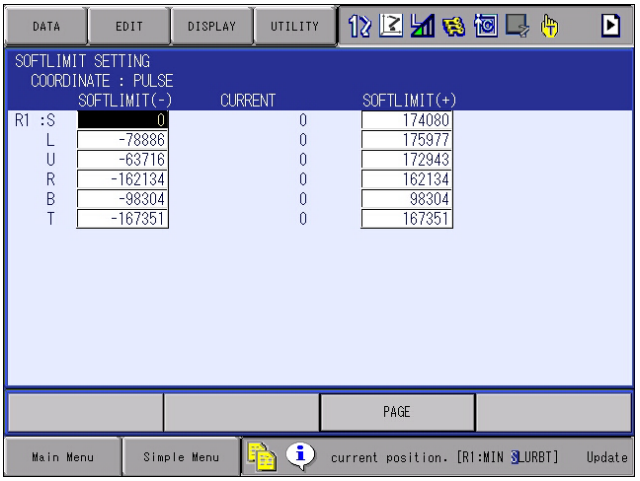
   • Press [MODIFY].
   • Press [SELECT].
   • Press the one of [↑] [↓] [←] [→].
   • Press [PAGE].
   • Press [Numeric Key].
   • Select the reserved display.
   • Switch the screen.
   • Switch the mode.

– The message “Update operation with <CHANGE> was canceled.” appears.



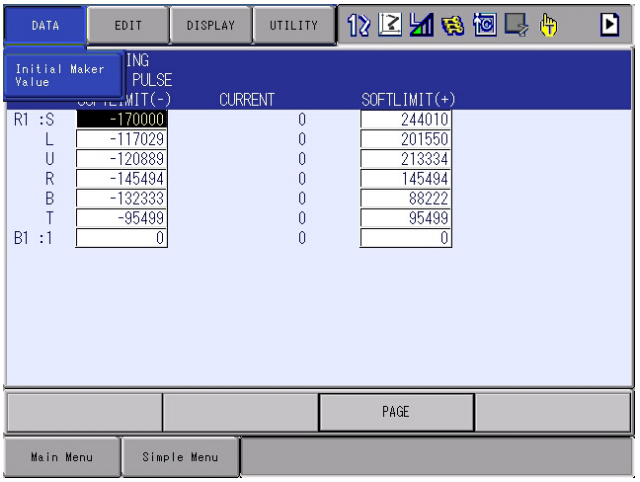
4. Press [ENTER].

– The current position is set as the softlimit.

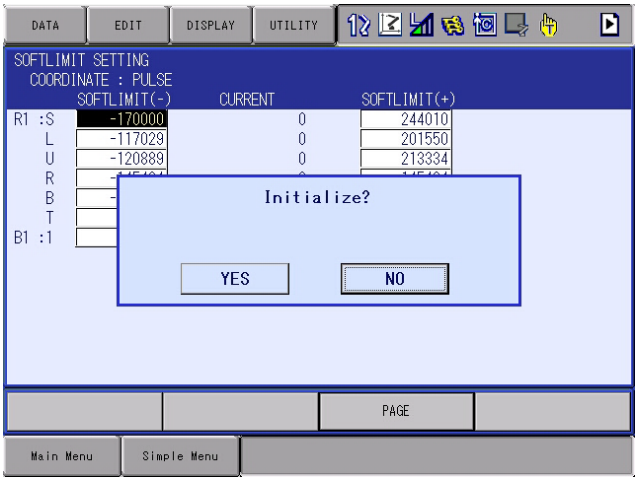


6.13.5 Set the Softlimit (+)/ the Softlimit (-) to the Initial Maker Value

1. Select {DATA} in the pull-down menu.
   – {Initial Maker Value} appears.



2. Select {Initial Maker Value}.
   – The confirmation dialog appears.



3. Select “YES”.
   – The initial maker value is set for all displayed axes.
   The operation is canceled when “NO” is selected.

NOTE

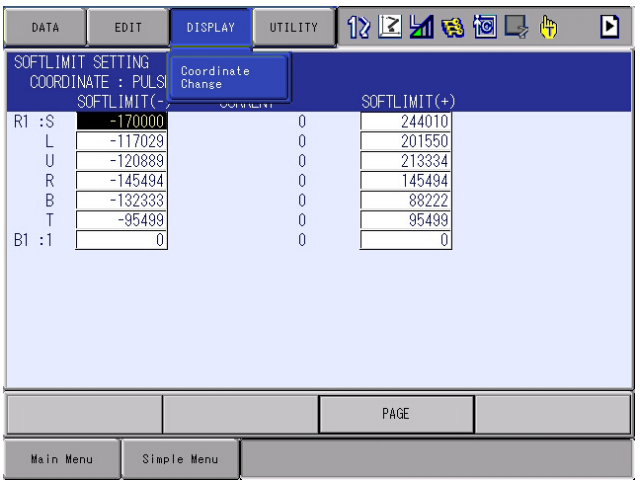
The initial maker value limits the range of the mechanical motion of the manipulator, and it varies according to the model of the robot.

It is different from the motion range which was set to add the base station axis.

6.13.6 Change the Coordinate Display of the Softlimit (+)/ the Softlimit (-)

1. Select {DISPLAY} in the pull-down menu.

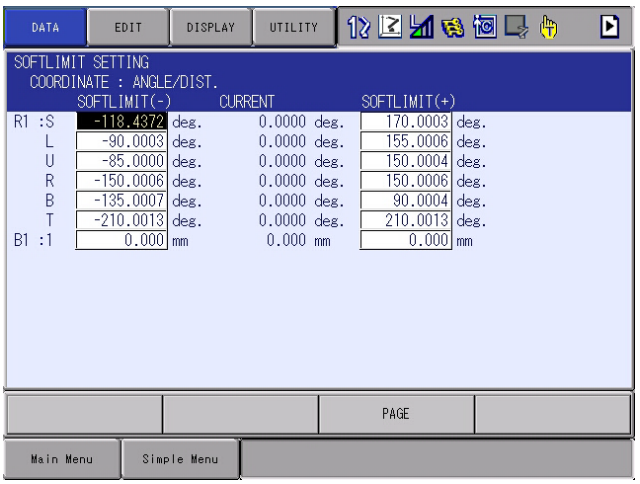
   – {Coordinate Change} appears.



2. Select {Coordinate Change}.

   – When the displaying coordinate is a pulse,
   the robot axis is changed to the angle display;
   the base axis is changed to the distance display; and
   the station axes is changed for each axis by the value of the station axis display parameter (S2C265 to 288).

   When the first bit is OFF, the first axis is changed to the angle display.
   When the second bit is ON, the second axis is changed to the distance display.
   When the display coordinate is angle/distance, the all axes are changed to the pulse display.



NOTE

- When the display of the softlimit value is the angle display, the pulse display and the sign may be different.
- Be sure to confirm the motion range by the jog operation after changing the softlimit value.

6.14 Job Edit Function During Playback

6.14.1 Function

Jobs can be edited during playback, including during play mode.

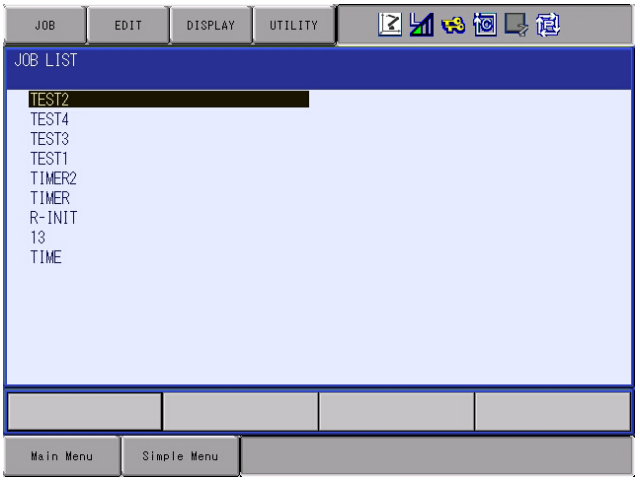
- Editable : user job
- Not Editable : macro job and system job

6.14.2 Job Edit During Playback

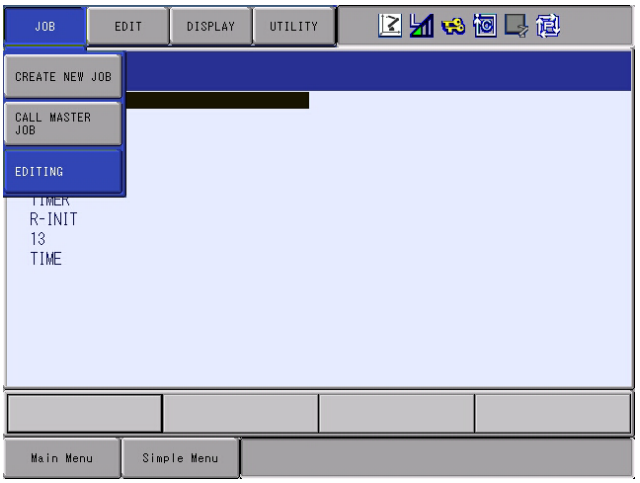
6.14.2.1 Basic Operation

The job edit operation during playback is described below.

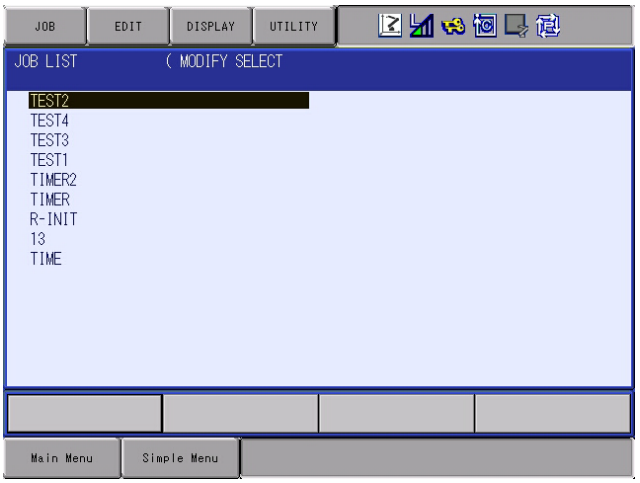
1. During playback, select the main menu {JOB}, then select the submenu {SELECT JOB}.
   – JOB LIST display appears.



2. Select {EDITING} under the pull-down menu {JOB}.



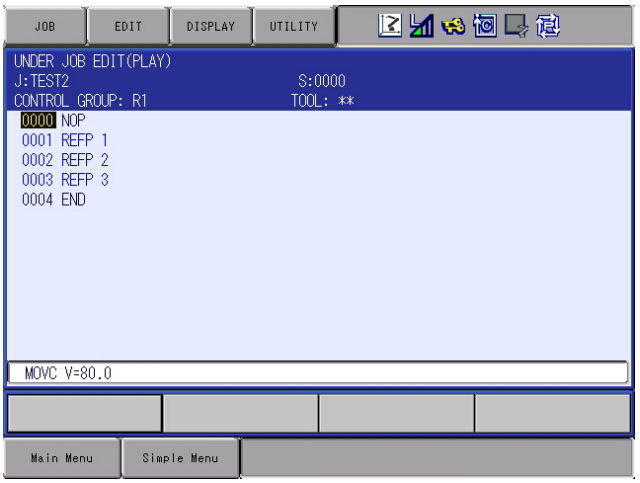
3. Select the job to be edited from JOB LIST.



– The selected job will be registered in the display of the submenu “PLAY EDIT JOB LIST”.

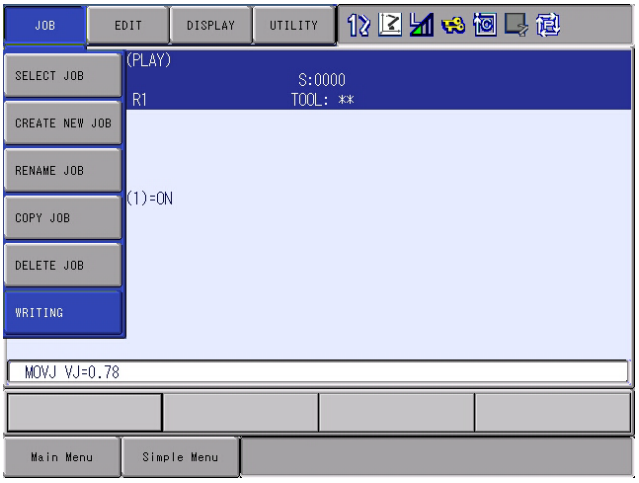
4. Edit the selected job.

– Edit the job selected in the above step in the same manner as teach mode.

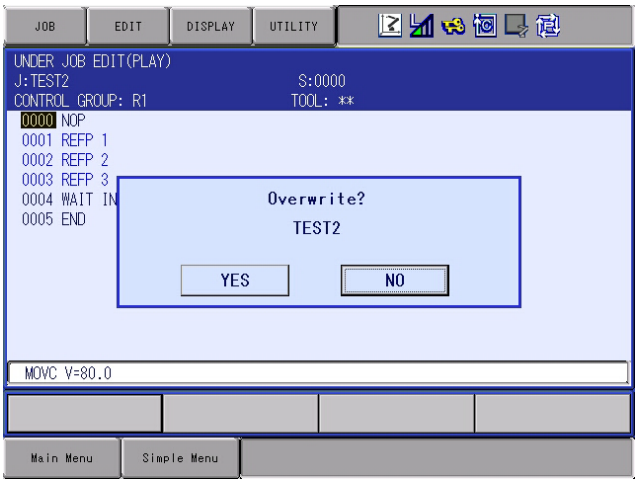


– Regarding restrictions on editing, refer to *chapter 6.14.2.2 “Editing”* .

5. Select {WRITING} under the pull-down menu {JOB} to reflect the edited data.



– If the job to be written to is listed in “JOB LIST”, a confirmation dialog “Overwrite?” appears. Select “YES” to reflect the edited data. Refer to the “SUPPLEMENT” on the next page.



– If the job with the same name is not listed in “JOB LIST”, the job to be written to will be added to “JOB LIST”. Refer to the following “SUPPLEMENT”.

SUPPLE -MENT

If data is reflected during playback, the message “Requesting playback edit JOB writing” appears, and the status becomes a write request. To write the job, execute the instruction “LATESTJOB” in the write request status or end playback. If data is reflected in play mode but not during playback, the job will be written immediately.

However, if the job to be written to is being executed (including jobs in the call stack),
“Error 5240: Cannot write in the JOB in execution.”
appears, and the edited data will not be reflected.

If a job in the call stack is written to in play mode but not during playback,
“Error 5241: Cannot write in the JOB in JOB STACK.”
appears, and the edited data will not be reflected.

If data is reflected during teaching, the job will be written immediately.

6.14.2.2 Editing

The data of the selected job (see *the step 4 of chapter 6.14.2.1 "Basic Operation"*) can be edited in the same manner as the normal teach mode. However, the functions that affect the manipulator motion are restricted as follows:

- Position teaching cannot be edited.
- The pull-down menu during editing is restricted as shown in *fig. 6-1 "Pull-Down Menu (EDIT) * Cursor Is on Line No."* to *fig. 6-4 "Pull-Down Menu (UTILITY)"*.

*Fig. 6-1: Pull-Down Menu (EDIT) * Cursor Is on Line No.*

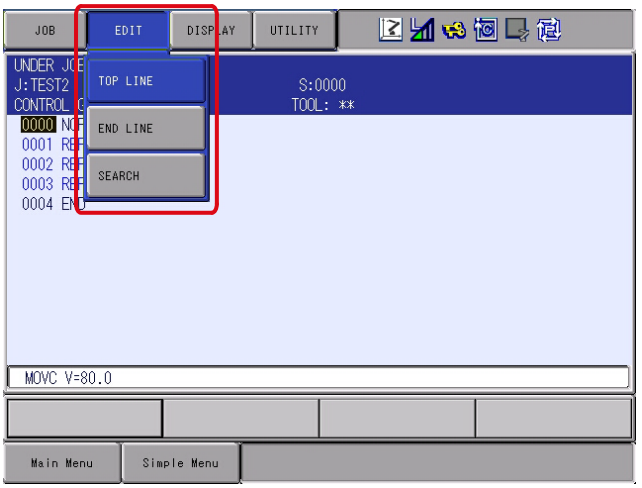


*Fig. 6-2: Pull-Down Menu (EDIT) * Cursor Is on Instruction*

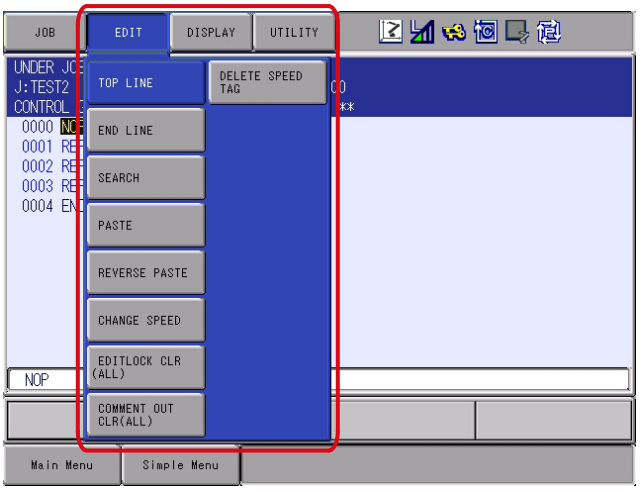


Fig. 6-3: Pull-Down Menu (DISPLAY)

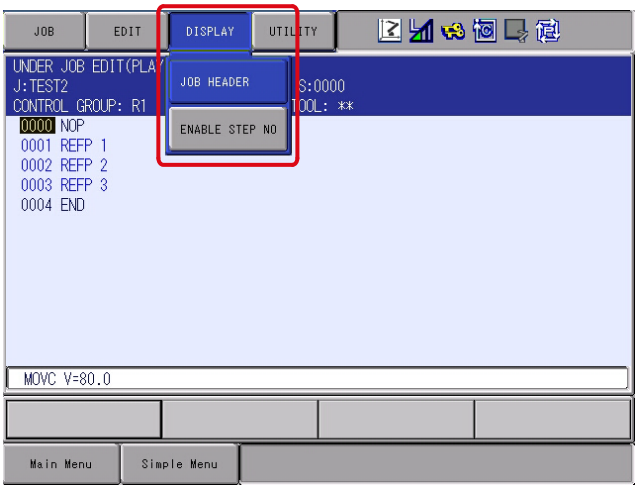
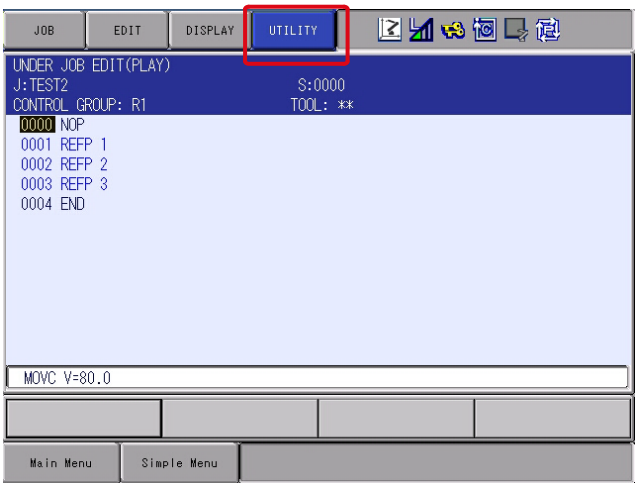


Fig. 6-4: Pull-Down Menu (UTILITY)



In addition to the job edit operation described above, {CREATE NEW JOB}, {RENAME JOB}, {COPY JOB}, and {DELETE JOB} under the pull-down menu {JOB} are also available.

All of the above operations are performed for the jobs listed in “PLAY EDIT JOB LIST”.

To reflect the edited data in the job listed in JOB LIST, {WRITING} must be done.

Regarding {DELETE JOB}, only the jobs listed in “PLAY EDIT JOB LIST” can be deleted. The jobs in “JOB LIST” will not be deleted.

SUPPLE -MENT

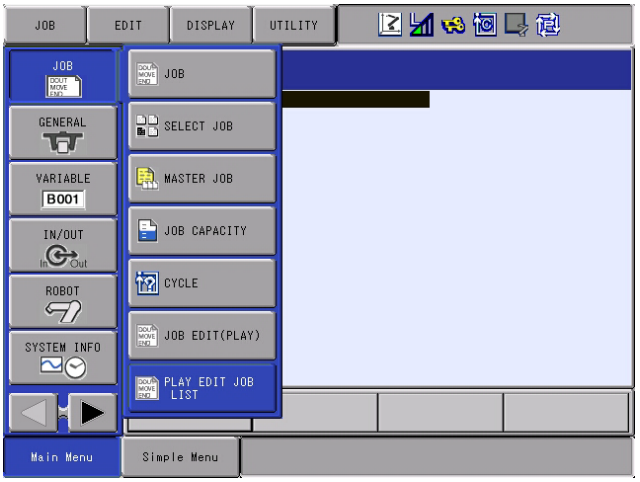
The above {WRITING}, {DELETE JOB}, {RENAME JOB}, and {COPY JOB} can be done in the same manner on the “PLAY EDIT JOB LIST” display.

6.14.2.3 Editing Multiple Jobs

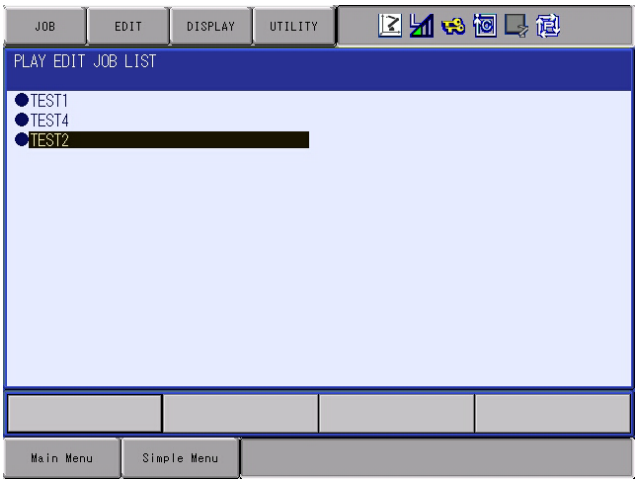
The procedure to delete or write multiple jobs at once on the PLAY EDIT JOB LIST display is described below.

■ **Deleting Multiple Jobs**

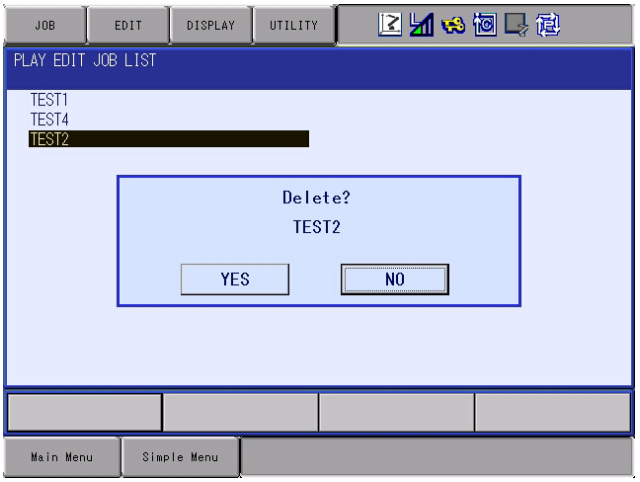
1. Select the main menu {JOB}, then select the submenu {PLAY EDIT JOB LIST}.



2. Select the job to be deleted by [SHIFT] + [SELECT].
   – "●" appears on the left of the selected job.

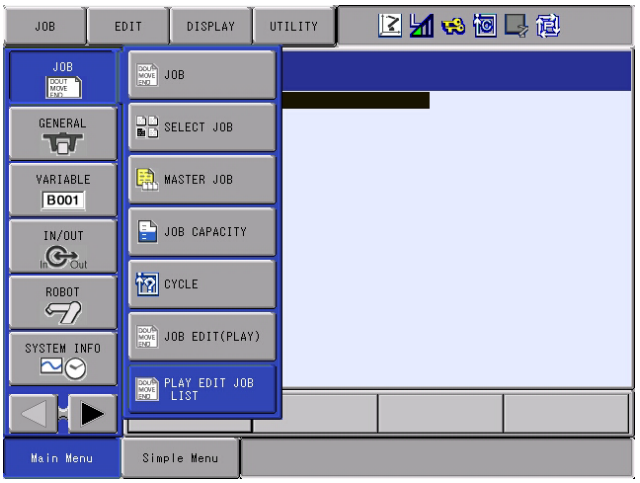


3. Select {DELETE JOB} under the pull-down menu {JOB}.
   – A confirmation dialog box appears for each selected job. Select "YES" to delete the job from the PLAY EDIT JOB LIST display.

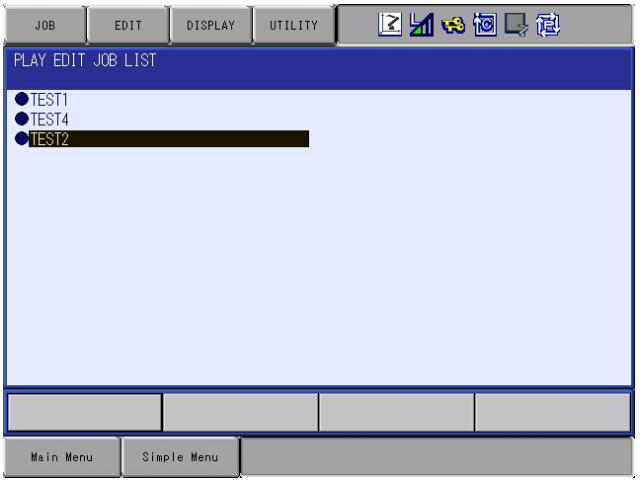


■ **Writing to Multiple Jobs**

1. Select the main menu {JOB}, then select the submenu {PLAY EDIT JOB LIST}.

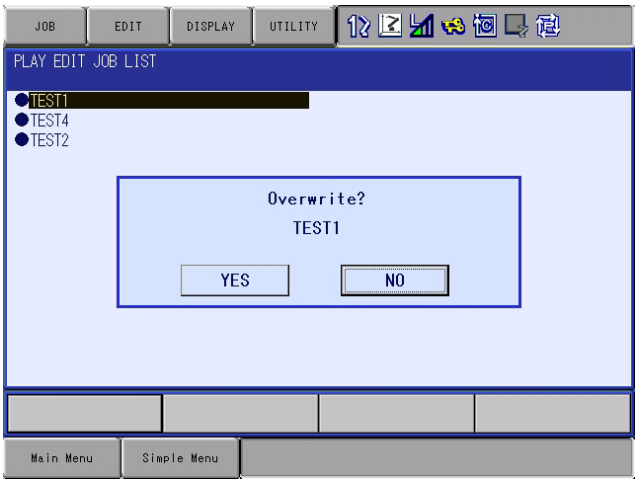


2. Select the job to be written to by [SHIFT] + [SELECT].
   – "●" appears on the left of the selected job.



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

   – If the job to be written to is listed in JOB LIST, a confirmation dialog "Overwrite?" appears. Select "YES" to reflect the edited data. If "NO" is selected, the edited data will not be reflected. To cancel writing, press [CANCEL] while the confirmation dialog appears.
   If the job with the same name is not listed in "JOB LIST", the job to be written to will be added to "JOB LIST". Refer to the "SUPPLEMENT" below.



SUPPLE-MENT

If data is reflected during playback, the message "Requesting playback edit JOB writing" appears, and the status becomes a write request. To write the job, execute the instruction "LATESTJOB" in the write request status or end playback. If data is reflected in play mode but not during playback, the job will be written immediately.

However, if the job to be written to is being executed (including jobs in the call stack),
"Error 5240: Cannot write in the JOB in execution."
appears, and the edited data will not be reflected.

If a job in the call stack is written to in play mode but not during playback,
"Error 5241: Cannot write in the JOB in JOB STACK."
appears, and the edited data will not be reflected.

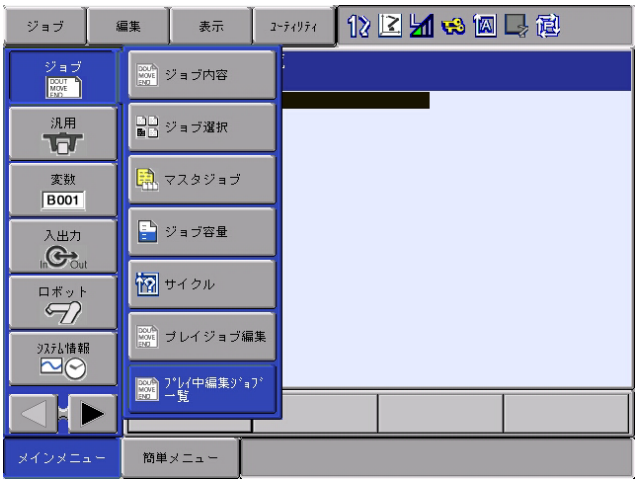
If data is reflected during teaching, the job will be written immediately.

6.14.2.4 Canceling Write Request

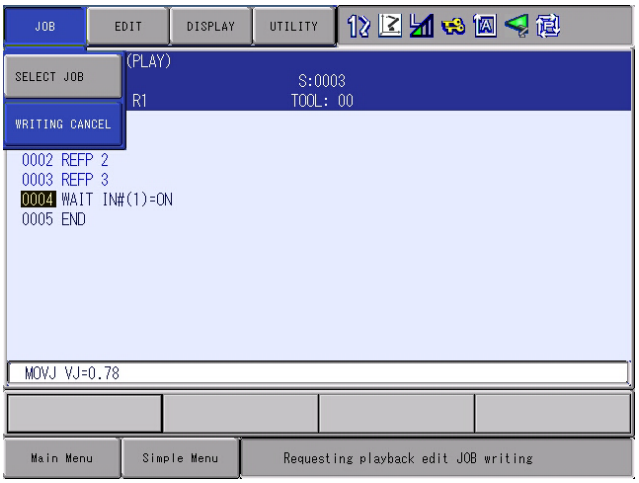
The procedure to cancel a write request is described below.

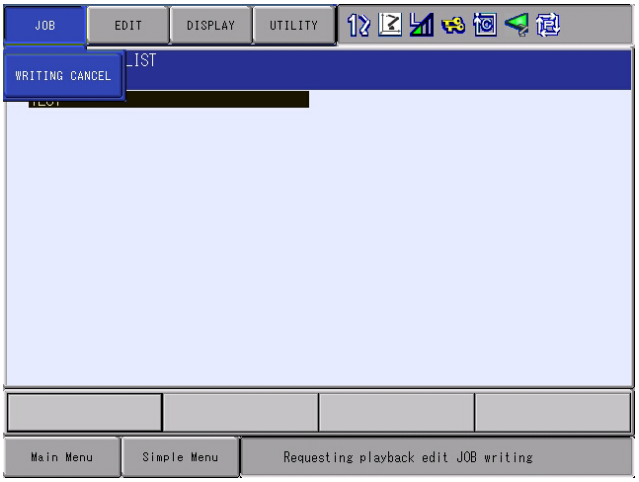
■ **Canceling Write Request**

1. Select the main menu {JOB}, then select the submenu {PLAY EDIT JOB LIST},
   or
   select the main menu {JOB}, then select the submenu {JOB EDIT (PLAY)}.



2. Select {WRITING CANCEL} under the pull-down menu {JOB}.





NOTICE

- When the mode switch is changed to teach mode during job editing

Even if the mode switch is changed to teach mode without reflecting or canceling the edited data, the changed data will be saved. In this case, select the main menu {JOB}, then select the submenu {SELECT JOB} or {PLAY EDIT JOB LIST} to edit data in the same manner as in play mode. However, position teaching cannot be done.

SUPPLE -MENT

Regarding the job edited in play mode, even after the mode is changed to teach mode, the edited data will not be reflected if {WRITING} is not done.

- Writing a job

{WRITING} operates differently depending on the status of the robot.

Select {JOB}, then select {WRITING} to reflect the edited data in the job. The data is reflected as described below depending on whether the job is being executed or not.

1. When the job is NOT being executed: The data is reflected immediately.
2. When the job is being executed: The data is reflected when the instruction “LATESTJOB” is executed or when the job execution is completed.

“Requesting playback edit JOB writing” appears while waiting for reflect operation (during a write request).

SUPPLE -MENT

- The executing job cannot be written to even by the instruction “LATESTJOB”.
- If a power failure occurs during a write request, the write request will be canceled upon restarting, and the job will not be reflected.

- During a file transfer

{WRITING} cannot be done during file transfer (i.e. external memory operation or data transmission).

In addition, a file cannot be transferred during a write request.

- During a write request

Editing is inhibited during a write request (while “Requesting playback edit JOB writing” appears).

To edit data, wait for the writing to be completed or cancel the write request.

6.15 Logging Function

6.15.1 Logging Function

By using the logging function, the history (log) of the controller's operation, data editing, and job execution can be saved in chronological order and displayed on the screen.

The user can select operations to be logged and save the log data in an external device.

6.15.2 Data to be Logged

The following data can be saved by using this function:

- Operation log:
  - Mode switching (PLAY/TEACH/REMOTE)
    (Operations in remote mode are also saved in logs.)
  - Safeguarding OPEN (PLAY)
  - Selecting a job (including direct open)
  - Calling the master job
  - Initializing a file or job
  - Loading and saving a file or job (normal termination/abnormal termination)
    (Loading and saving operations by the DCI function or the data transmission function are not saved in logs.)
  - Creating, deleting, renaming a job
  - Converting a job
    - Parallel shift job conversion, mirror shift job conversion, relative job conversion, user coordinates shift conversion, PAM (position correcting during playback), PMT (position correcting due to tool deformation), 4-point teaching
  - Changing the home position of the manipulator
  - Login/logoff (Only available when the password protection function (optional) is used.)
  - Turning ON/OFF the power supply
- Edit log:
  - Job
    - Adding an instruction
    - Changing conditions in an instruction
    - Deleting an instruction
    - Cut, paste, and reverse paste
    - UNDO and REDO
    - Editing a job header
    - Line edit lock and line commenting out
    - Canceling all line edit lock, canceling all line commenting out
  - Editing a condition file/general data
  - Editing a parameter

• Editing the CIO
Editing on the ladder program window.
When compiling is executed, the edit histories (addition/modification/deletion of lines) are output together. The recorded times are the actual times at which the lines were edited, so they may not be the same as the time at which compiling was executed.

• Editing a variable
(Operations in remote mode are not saved in logs.)

• Editing I/O
Logs of switching ON and OFF of a general-purpose input signal or a general-purpose output signal are obtained.

NOTE Only the editing operations performed by the user will be logged. If the status of a variable or I/O is modified by an instruction in the job, etc., such modification will not be logged.

• Job execution log:
The job execution log can be saved when a job is started, completed, or stopped, and this log can be referred to later. For example, if the power supply is turned OFF for some reason and the job is stopped during execution, the job execution log can be used to make recovery operations easier.

  • Job name
  • Line number
  • Task (local task number)
  • Event (START, NEXT, BACK, TEST, STOP)
  • Cause of stop
    • Completion of execution (execution of the instruction of a given line number is completed), END (END of the job), PAUSE instruction, ABORT instruction, servo OFF, hold, key OFF (key is released during FWD, BWD, or test operation), turning OFF of the power supply
  • Date

NOTE The job execution logs of JUMP, CALL, PSTART (independent control function), interrupt job, etc., in which jobs are switched during execution, are not saved.

6.15.3 Number of Stored Logs

The number of storable logs are as follows:

• Operation logs : 200
• Edit logs : 200
• Job execution logs : 200

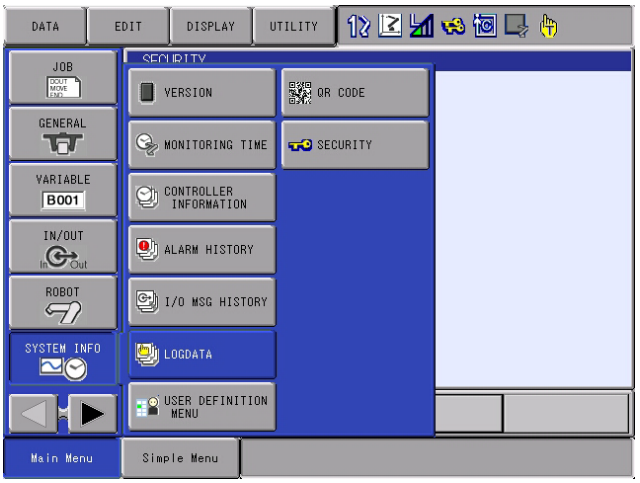
If the number described above is exceeded, old data will be deleted and new data will be saved.

6.15.4 Operating Methods

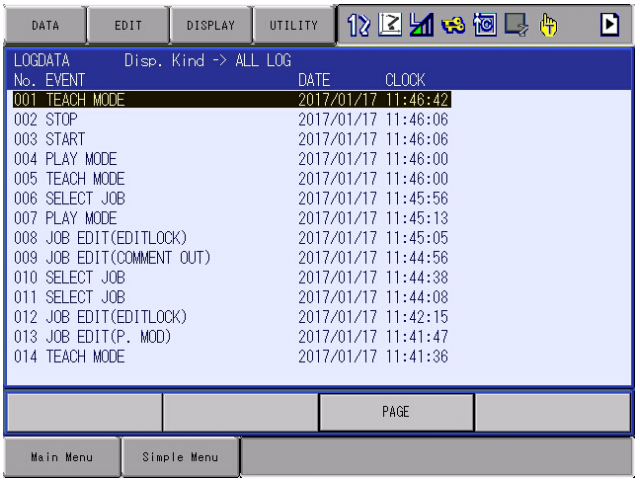
6.15.4.1 Displaying List of Logs

The log list can be referred to with the following procedures:

1. Select the main menu → {SYSTEM INFO} → {LOGDATA}.



2. Select {LOGDATA}.
   – The LOGDATA window appears.



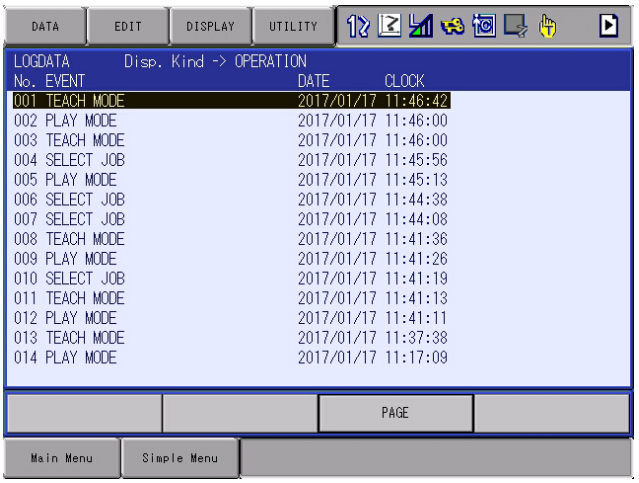
The list of logs can be shown for each log type (operation/edit/job execution).

1. Select {DISPLAY} in the menu.
   – {ALL}, {OPERATION}, {EDITING}, and {JOB EXECUTION} appear.
2. Select the desired log type.
   – The list of logs of the selected log type appears.
   – Select {ALL} to see the list of all logs of operation, edit, and job execution, select.

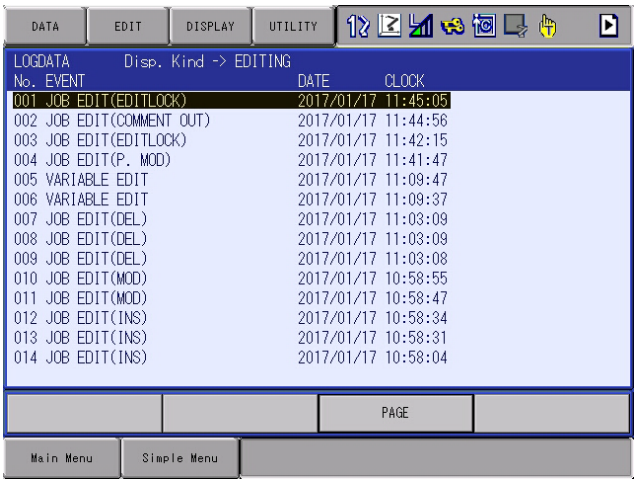
Alternatively,

1. Touch {PAGE} at the bottom of the window.
   – The dialog box for selecting the log type “all”, “operation”, “edit”, or “job execution” appears.
2. Select the desired log type to see the list of logs.
   – Press [PAGE] to switch the list of logs in the order of “all”, “operation”, “edit”, “job execution”, and then “all”.

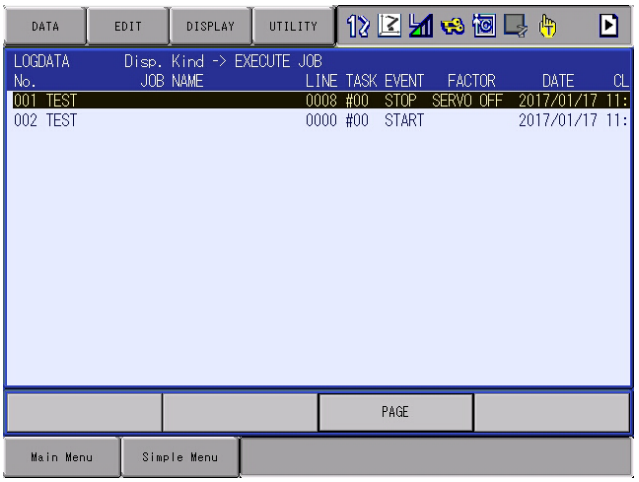
Operation log list



Edit log list

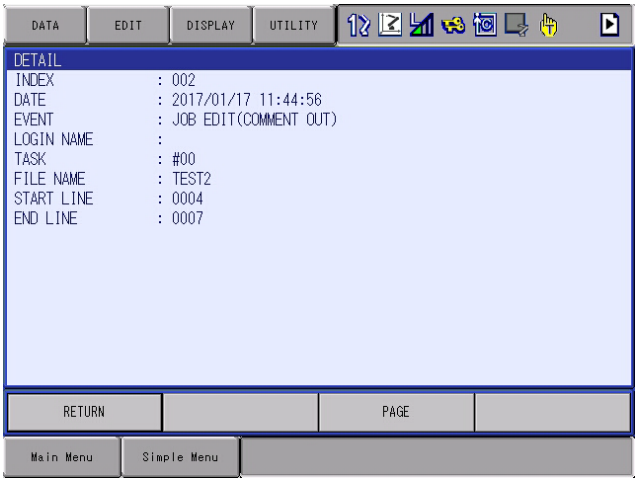


Job execution log list



6.15.4.2 Displaying Log Details

On the {LOGDATA} window, moving the cursor to the desired log and pressing the [SELECT] display the selected log's details.



When touching the {RETURN} button at the bottom of the window or pressing [CANCEL], the window returns to the {LOGDATA} window.

The items displayed in the {DETAIL} window are shown in the tables on the following pages. However, the following items are displayed regardless of whether the displayed log type is operation, edit, or job execution.

- INDEX
- DATE
- EVENT
- LOGIN NAME

Table 6-4: Operation Log

Log name	Remark	Items displayed in the detailed display section				
TEACH MODE	-	-	-	-	-	-
PLAY MODE	-	-	-	-	-	-
REMOTE MODE	-	-	-	-	-	-
SELECT JOB	-	Task	Job name	-	-	-
SAFETY FENCE OPEN	-	Task	Job name	Line number	Current value	-
MASTER JOB CALL	-	Task	Job name	-	-	-
FILE INIT	-	File name	-	-	-	-
FILE LOAD END	-	File name	-	-	-	-
FILE SAVE END	-	File name	-	-	-	-
FILE LOAD ERROR	-	File name	-	-	-	-
FILE SAVE ERROR	-	File name	-	-	-	-
JOB CREATE	-	Job name	-	-	-	-
JOB DELETE	-	Job name	-	-	-	-
JOB RENAME	-	Job name	Destination job name	-	-	-
PARALLEL SHIFT	-	Job name	Destination job name	-	-	-
MIRROR SHIFT	-	Job name	Destination job name	-	-	-
JOB (PAM)	-	Job name	-	-	-	-
JOB (RELATIVE)	-	Job name	Destination job name	-	-	-
JOB (USER COORD. SHIFT)	-	Job name	Destination job name	-	-	-
JOB (4-POINT TEACH)	-	Job name	-	-	-	-
JOB (PMT)	-	Job name	-	-	-	-
ORG ABSO	-	Group number	Axis number	Setting	Current value	-
LOGIN	-	-	-	-	-	-
LOGOUT	-	-	-	-	-	-
POWER ON	-	-	-	-	-	-
POWER OFF	-	-	-	-	-	-

Table 6-5: Edit Log

Log name	Remark	Items displayed in the detailed display section				
JOB EDIT(INS)	-	Task	File name	Line number	Value after editing	Current value
JOB EDIT(MOD)	-	Task	File name	Line number	Value after editing	-
JOB EDIT(DEL)	-	Task	File name	Line number	Deleted line	-
JOB EDIT(P. REG)	-	Task	Job name	Line number	Current value	-
JOB EDIT(P. MOD)	-	Task	File name	Line number	Current value	-
JOB EDIT(CUT)	-	Task	File name	Processing start position	Processing completion position	-
JOB EDIT(PASTE)	-	Task	File name	Processing start position	Processing completion position	-
JOB EDIT(R. PST)	-	Task	File name	Processing start position	Processing completion position	-
JOB EDIT(UNDO)	-	Task	Job name	-	-	-
JOB EDIT(REDO)	-	Task	Job name	-	-	-
JOB EDIT(HEADER)	Numeric value	Job name	Element number	Value before editing	Value after editing	-
	Character string	Job name	Element number	Value after editing	-	-
OTHER FILE EDT	Numeric value	File name	Element number	Value before editing	Value after editing	-
	Character string	File name	Element number	Value after editing	-	-
PARAMETER EDIT	-	Parameter type	Parameter number	Value before editing	Value after editing	-
LADDER EDIT(ADD)	-	Line number	Value after editing	System/User	-	-
LADDER EDIT(CHG)	-	Line number	Value after editing	System/User	-	-
LADDER EDIT(DEL)	-	Line number	Deleted line	System/User	-	-
COMPILE	-	-	-	-	-	-
VARIABLE EDIT	Numeric value	Variable type	Variable number	Value before editing	Value after editing	-
	Character string	Variable type	Variable number	Value after editing	-	-
	Position variable	Variable type	Variable number	Value before editing	Value after editing	-
I/O EDIT	-	I/O number	Value after editing	-	-	-

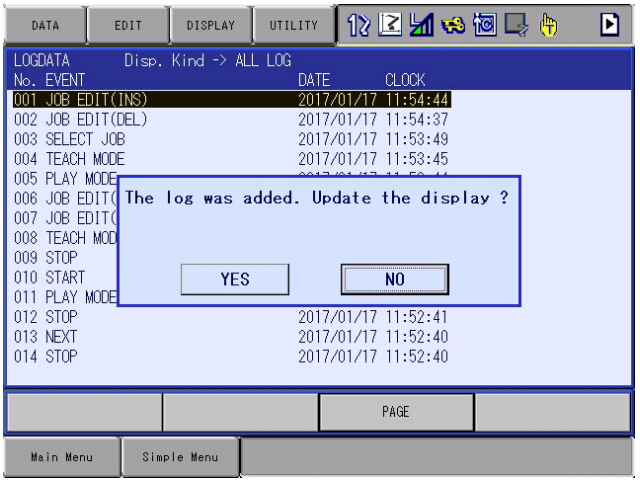
Table 6-6: Job Execution Log

Log name	Remark	Items displayed in the detailed display section				
START	-	Task	Job name	Line number	-	-
NEXT	-	Task	Job name	Line number	-	-
BACK	-	Task	Job name	Line number	-	-
TEST	-	Task	Job name	Line number	-	-
STOP	-	Task	Job name	Line number	Cause of stop	-

6.15.4.3 Updating Log Information

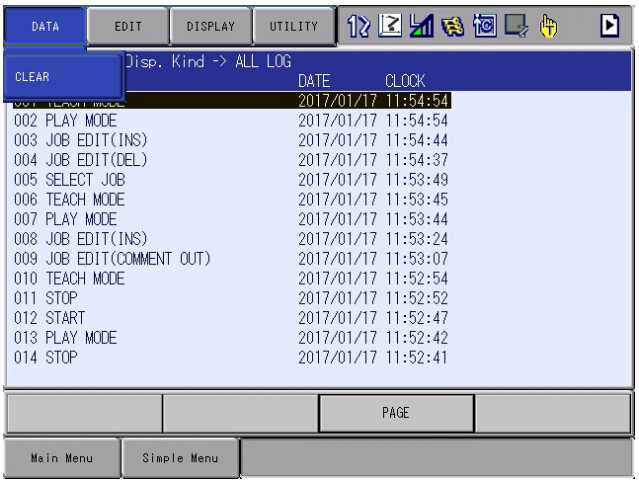
When a new log is added while displaying the {LOGDATA} window, pressing [SELECT] displays a confirmation dialog “The log was added. Update the display?”. When selecting “YES”, a log data is obtained again and the window is updated. When selecting “NO”, the window display is not updated, but after that, when pressing [SELECT], the same dialog appears again.

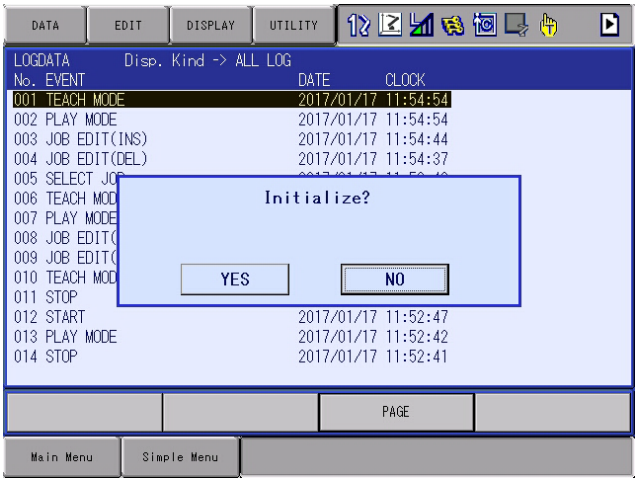
When the log display type is set to “OPERATION”, “EDIT”, or “JOB EXECUTION”, the confirmation dialog described above appears only when a log of the currently displayed type is added and [SELECT] is pressed.



6.15.4.4 Deleting Log Information

Only when security is in management mode, selecting “DATA” in the pull-down menu on the LOGDATA window displays {INITIALIZE}. Selecting {INITIALIZE} displays the confirmation dialog “Initialize?”. When “YES” is selected, all the logs of the currently displayed type are deleted.

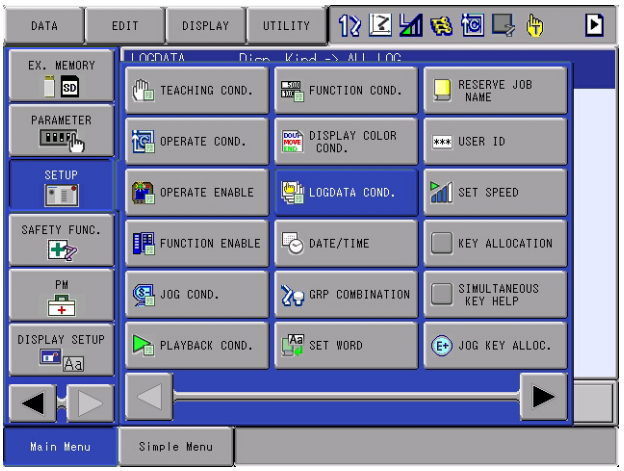




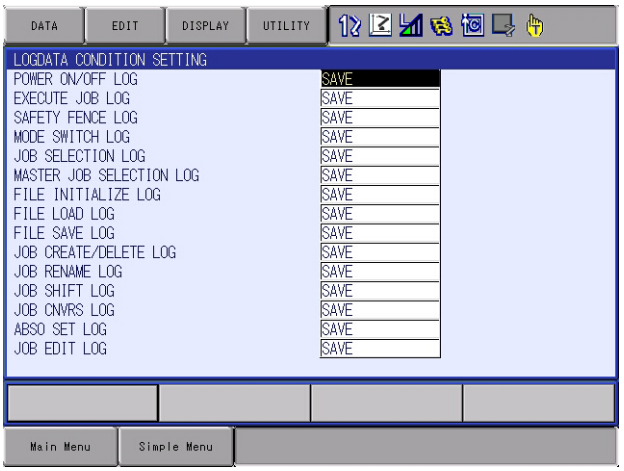
6.15.4.5 Selecting Operation to Be Logged

By selecting operations to be logged, unnecessary logging can be prevented.

1. Select the main menu → {SETUP} → {LOGDATA COND.}.
   – The LOGDATA CONDITION SETTING window appears.



2. Move the cursor to the desired log, and press [SELECT].
   – “SAVE” and “NOT SAVE” alternate.
   – When “NOT SAVE” is selected, the log will not be saved even if the operation is performed.



The log names and the logged data are as follows.

Log name	Logged data
POWER ON/OFF LOG	POWER ON, POWER OFF
EXECUTE JOB LOG	START, NEXT, BACK, TEST, STOP
SAFETY FENCE LOG	SAFETY FENCE OPEN
MODE SWITCH LOG	• TEACH MODE • PLAY MODE • REMOTE MODE
JOB SELECTION LOG	SELECT JOB
MASTER JOB SELECTION LOG	MASTER JOB CALL
LOG ON/LOG OFF LOG	• LOGIN • LOGOUT
FILE INITIALIZE LOG	FILE INIT
FILE LOAD LOG	• FILE LOAD END • FILE LOAD ERROR
FILE SAVE LOG	• FILE SAVE END • FILE SAVE ERROR
JOB CREATE/DELETE LOG	• JOB CREATE • JOB DELETE
JOB RENAME LOG	JOB RENAME
JOB SHIFT LOG	• PARALLEL SHIFT • MIRROR SHIFT
JOB PAM LOG	PAM
ABSO SET LOG	ORG ABSO
JOB EDIT LOG	• JOB EDIT(INS) • JOB EDIT(MOD) • JOB EDIT(DEL) • JOB EDIT(P. REG) • JOB EDIT(P. MOD)
JOB CUT/PASTE LOG	• JOB EDIT(CUT) • JOB EDIT(PASTE) • JOB EDIT(R. PST)
JOB UNDO/REDO LOG	• JOB EDIT(UNDO) • JOB EDIT(REDO)
JOB HEADER EDIT LOG	• JOB EDIT(HEADER)
FILE EDIT LOG	OTHER FILE EDT
PARAMETER EDIT LOG	PARAMETER EDIT
VARIABLE EDIT LOG	VARIABLE EDIT
SIGNAL EDIT LOG	I/O EDIT
LADDER EDIT LOG	• LADDER EDIT(ADD) • LADDER EDIT(CHG) • LADDER EDIT(DEL)

6.16 QR Code Creation Function

6.16.1 Outline

By using this QR code creation function, the status of the YRC1000micro (system configuration, alarm information, current position data, etc.) can be shown as a QR code on the programming pendant display. The user can use this function to send the current status of YRC1000micro to YASKAWA representative rapidly and accurately when making inquiries or in case an abnormality occurs.

Also, by using an Android application called “MOTOMAN Touch!”, the user can send both information (serial number, etc.) read from the QR code of the YRC1000micro and information about the status of the YRC1000micro read from the programming pendant to the YASKAWA representative. This application provides rapid and correct transmission of information, and thus helps the user to reduce down-time.

NOTE

<QR Code Creation Function>

- While the QR Code Creation function is under function, only following keys and the exclusive keys used for this function are available. (for the key exclusively used for this function, refer to *chapter 6.16.5 “Operation Method”* .

  [START]
  [HOLD]
  [EMERGENCYSTOP]
  Mode Switch
  Enable Switch

  Accordingly, operation of the manipulator in the teaching mode (jog operation) is not available. The manipulator stops its operation if the QR Code Creation function is executed.
  Do not complete the QR Code Creation function while the axis operation key is being pressed because the operation triggered by the key immediately resumes when the function completes.

- Even if PLAYBACK OPERATION CONTINUATION FUNCTION (S2C437=1) is set valid, its window would not appear if the QR Code Creation Function is executed.

<MOTOMAN Touch!>

- Inquire of YASKAWA representative for downloading method of “MOTOMAN Touch!”.
- “MOTOMAN Touch!” is not designed to avoid failures or reduce the recovery time.

6.16.2 Main Function

By using the QR code, information of the YRC1000micro in the following table can be displayed on the programming pendant.

Item	Description
QR Code Data	· ALARM (the latest four alarms) · ALARM HISTORY (the latest ten alarms for each) MAJOR FAILURE ALARM MINOR FAILURE ALARM USER ALARM (SYSTEM) USER ALARM (USER) OFF-LINE ALARM · MONITORING TIME SYS MONITORING TIME SERVO POWER TIME PLAYBACK TIME MOVING TIME OPERATING TIME · HOME POSITION · CURRENT VALUE · SERVO MONITOR Note: Only “ALARM” and “ALARM HISTORY” data are available in the maintenance mode.
Function	· Operations executed by a key Display switch ([FWD] or [BWD]) Completion of the QR Code Creation Function · Operations executed by a button on the display Display switch (“Next”, “Back”, or “First”.) Completion of the QR Code Creation Function
QR Code Format	· Format type 10 to 18 (automatically set according to the number of data) · Data 8-bit byte (binary) · Error correction level Level M · Maximum number of data in a QR code 560-byte at maximum (when the format type is 18)

Usage of the QR code by “MOTOMAN Touch!” is as follows.

Item	Description
Reading/Displaying of the YRC1000micro serial number, etc.	Read the QR code on the YRC1000micro with the smart phone QR code reader, and then displays the serial number, etc.
Reading/Displaying of the status information of the YRC1000micro	Read the QR code on the programming with the smart phone QR code reader, and then displays the alarm history, etc.
Inquiry	Attach above mentioned QR code data and pictures to an e-mail and send it to the in charge call center. (use the mailer)

“MOTOMAN Touch!” is an application which operates in Android 4.2 or higher environment. However, depending on the manufacturers or type of the smart phone, it may not work.

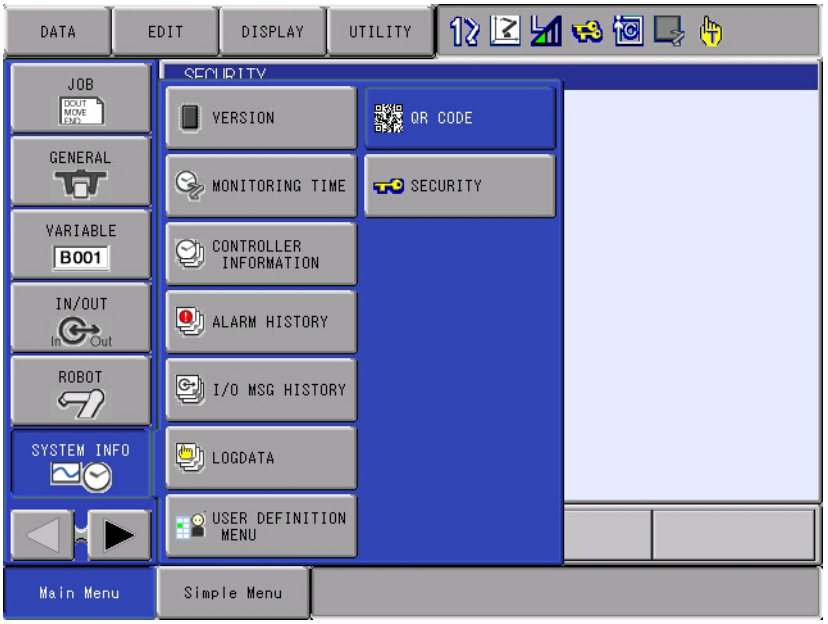
QR code is a trademark of DENSO WAVE INCORPORATED.

Android is a trademark of Google Inc.

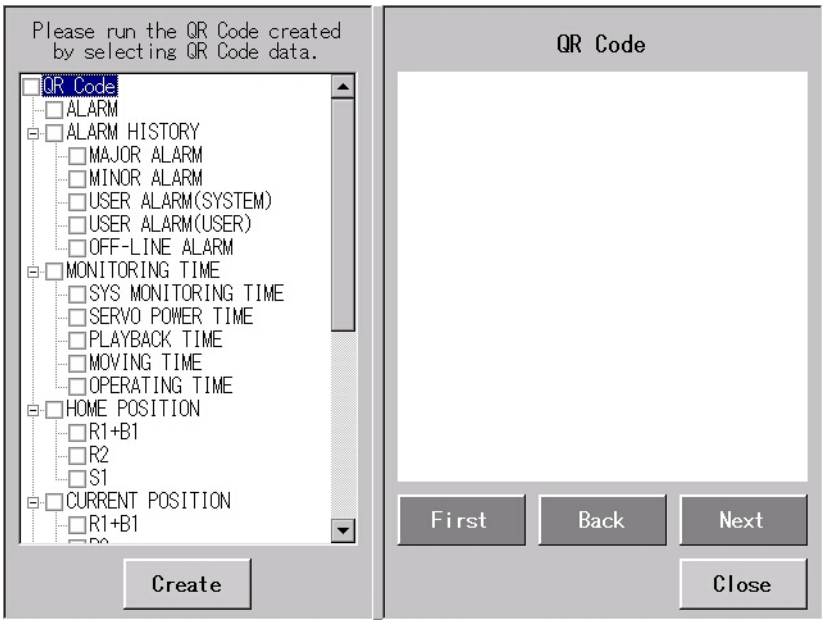
6.16.3 Method of Starting Up QR Code Creation Function

6.16.3.1 Starting Up the Function by Pressing {SYSTEM INFO} under the Main Menu→ {QR CODE}

1. Select {SYSTEM INFO} under the main menu.
   – {QR CODE} appears in the sub menu.

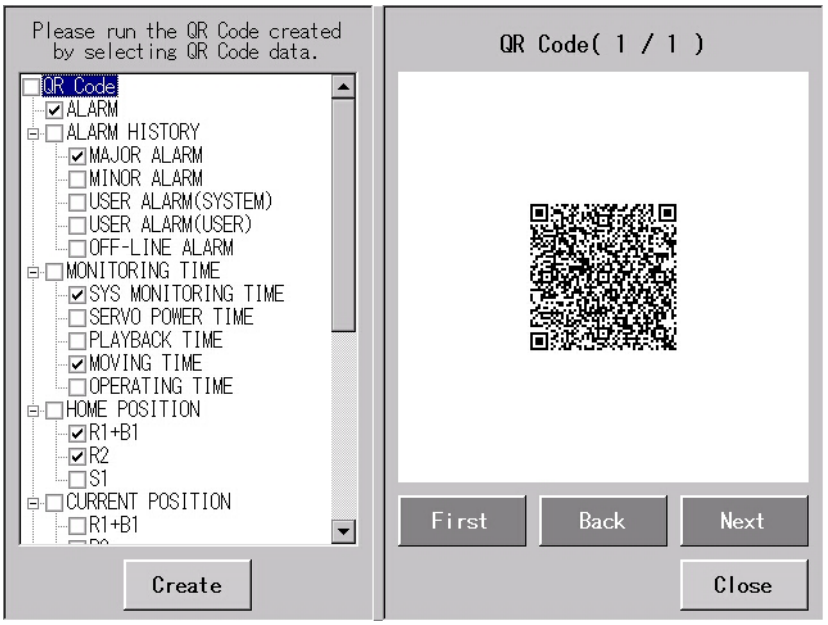


2. Select {QR CODE} from the sub menu.
   – QR CODE Creation function starts up.



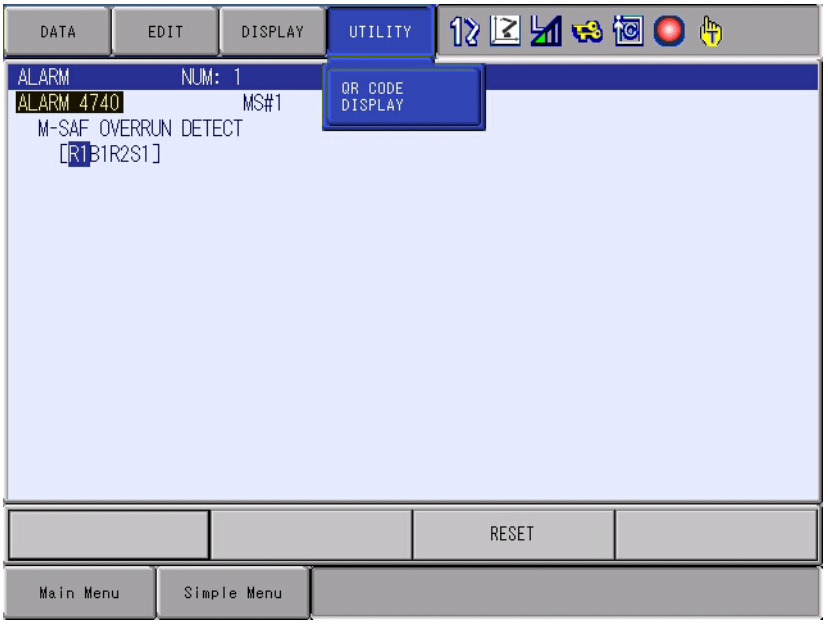
3. Select data to be codified into a QR code, and then press {Create} button.

   – A QR code appears.

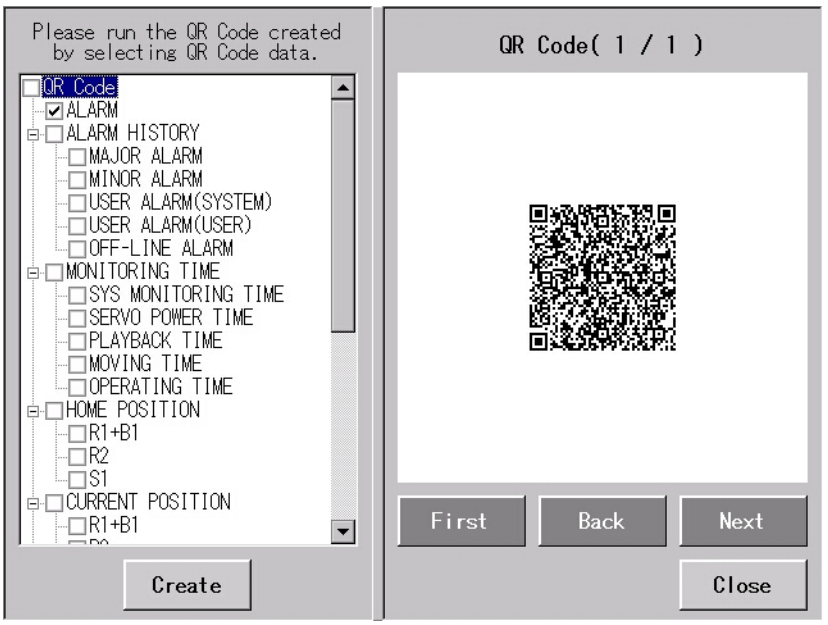


6.16.3.2 Starting Up the Function by Selecting the Pull-Down Menu {UTILITY} → {QR CODE DISPLAY}

1. Select {UTILITY} under the pull down menu.
   – {QR CODE} appears in the sub menu when the window has a function to display QR code data.

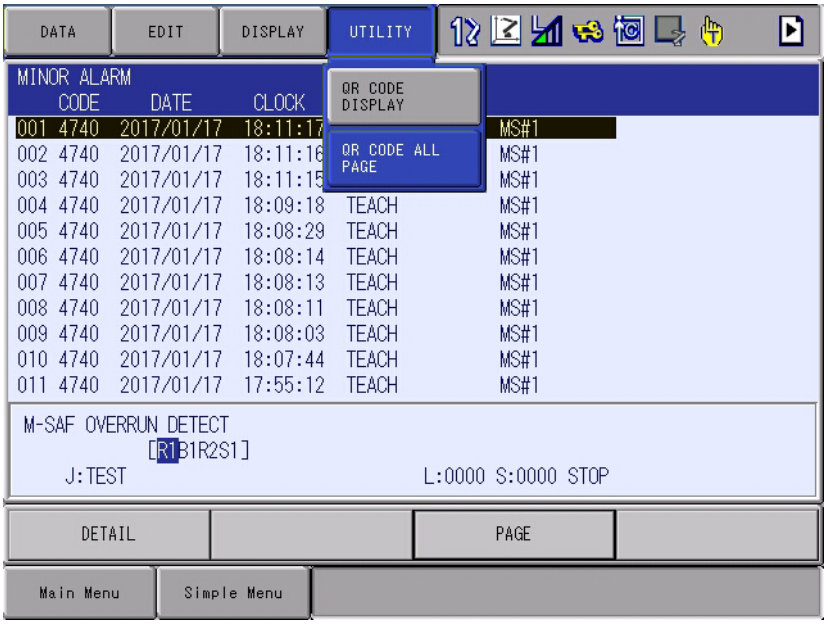


2. Select {QR CODE DISPLAY} from the sub menu.
   – QR CODE Creation function starts up and a QR code of the data displayed on the window appears.

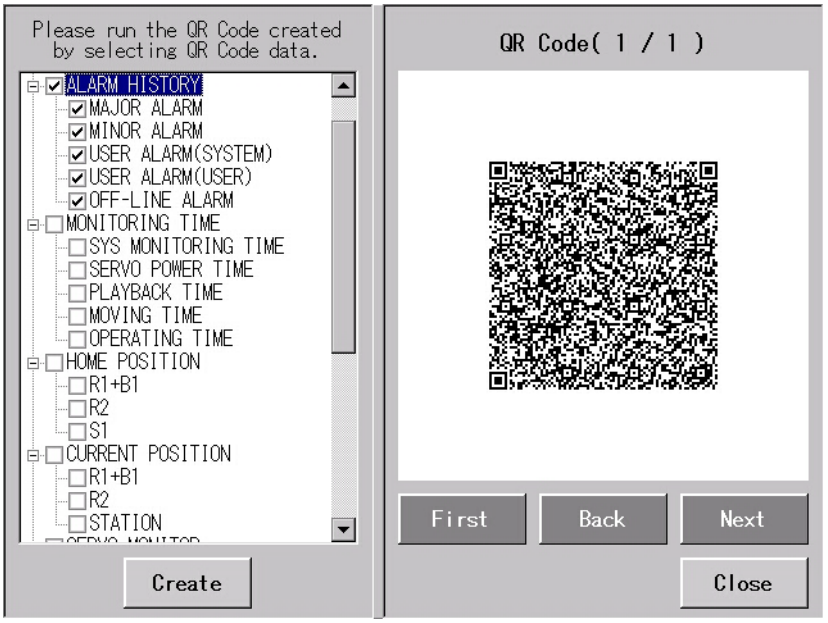


6.16.3.3 Starting Up the Function by Selecting the Pull-Down Menu {UTILITY} → {QR CODE ALL PAGE}

1. Select {UTILITY} under the pull down menu.
   – {QR CODE} appears in the sub menu when the window has a function to display a QR code data.



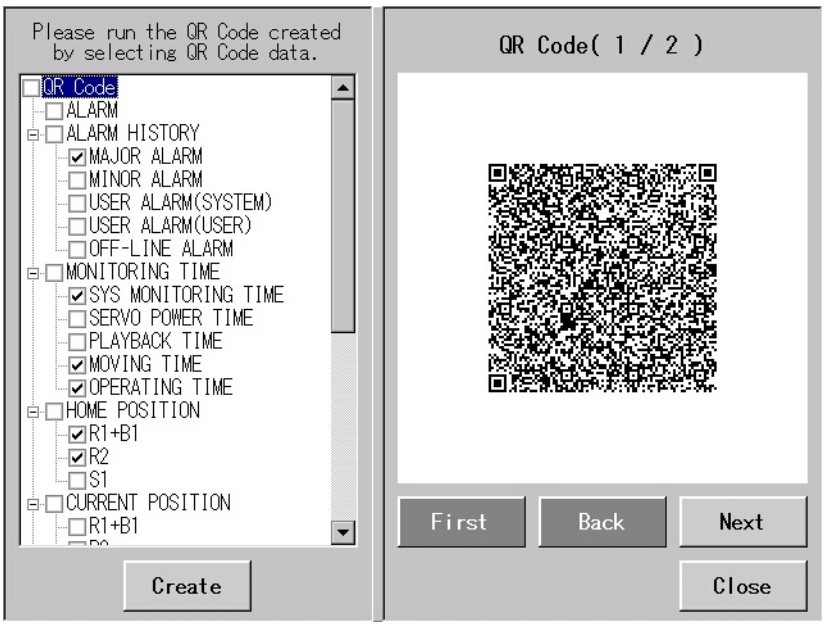
2. Select {QR CODE ALL PAGE} from the sub menu.
   – QR Code Creation function starts up and QR codes of the window on which page switching or display switching is available appear. (when ALARM HISTORY is selected, data for the latest ten alarms at each alarm are created)



6.16.4 Display Configuration

The window for the QR Code Creation Function consists of two areas.

- Data for QR code select area
- QR code display area



Data for QR code select area QR code display area

Displaying status of the button varies depending on the ON/OFF of the button function or the shift of the focusing point.

Example: {Next}

Normal display Active display No display



The QR code number and the total number of QR codes are displayed in the QR code display area.

6.16.5 Operation Method

6.16.5.1 Data for QR Code Select Area

Select data to be codified into a QR code and press {Create} button.
A QR code appears.

Use the programming pendant keys or directly touch the display to perform the above-mentioned operation.

When using the programming pendant keys, following keys are usable:

- **Cursor key**
  - Shifts the area to be focused.

- **[SELECT]**
  - When the focus is in the list area of data to be codified into a QR code, selects a data to be codified into the QR code.
  - When the focus is on {Create}, creates a QR code.

- **[PAGE]**
  - Displays the next QR code (if two or more QR codes are created).
  - Displays the previous QR code by pressing [SHIFT] + [PAGE].

- **[AREA]**
  - Shifts the area to be focused.

- **[CANCEL]**
  - Exits the QR Code Creation Function.

6.16.5.2 QR Code Display Area

A QR code can be displayed, and the CR code to be displayed can be switched.

Use the programming pendant keys or directly touch the display to perform the above-mentioned operation.

When using the programming pendant keys, following keys are usable:

- **Cursor**
  - Shifts the area to be focused.
- **[SELECT]**
  - When the focus is on {Return}, displays the first QR code.
  - When the focus is on {Back}, displays the previous QR code.
  - When the focus is on {Next}, displays the next QR code.
  - When the focus is on {Close}, exits the QR Code Creation Function.
- **[PAGE]**
  - Displays the next QR (if two or more QR codes are created).
  - Displays the previous QR code by pressing [SHIFT] + [PAGE].
- **[AREA]**
  - Shifts the area to be focused.
- **[CANCEL]**
  - Exits the QR Code Creation Function.

6.16.6 QR Code Syntax

6.16.6.1 Basic Syntax

The basic syntax of a QR code is shown below.

- Data header
- System information
- Data 1

When the volume of the data is too large, this function divides the data into several sections before codifying into a QR code.

At this time, the data header and the system information is set to the first data.

- Data header
- System information
- Data 1

- Data 2

- Data 3

“ , (comma)” , “ (space)” , and “(new line character)” are used to separate the data.

Data which is not selected in the “Data for QR code select area” will not be codified into the QR code.

6.16.6.2 Data Header

No.	Item	Syntax
1	Version	??x.xx
2	Year, month, date	YYMMDD
3	Time	HHTT

Note: “?”: any one character, “*”: any line, “X”: any number

1. Version

   Syntax : “??x.xx”

   ?? : Version of the controller
   If the controller is YRC1000micro, “Y1” is indicated.

   x.xx : Version of the QR Code Creation function
   (decimal number)

2. Year, Month, Date

   Syntax : “YYMMDD”

   YY : Year when the QR code is created (last two digits)

   MM : Month when the QR code is created

   DD : Date when the QR code is created

3. Time

   Syntax : “HHTT”

   HH : Hour when the QR code is created

   TT : Minute when the QR code is created

6.16.6.3 System Information

No.	Item	Syntax
1	System version	*.x.xx*(*)-xx
2	Parameter version	xx.xx
3	Purpose of system	*

Note: “?”: any single character, “*”: any line, “X”: any number

1. System version

   Syntax : “*.x.xx*(*)-xx”
   System version number displayed on the version window

2. Parameter version

   Syntax : “xx.xx”
   Parameter version number displayed on the version window

3. Purpose of system

   Syntax : “ * ”
   Purpose of system displayed on the version window

6.16.6.4 Alarm

Four alarms can be codified into the QR code at maximum in ascending order.

No.	Item	Syntax
1	Alarm data code	<ALARM>
2	Alarm data	Refer to ■ *"Alarm Data"* .

1. Alarm data code

   Syntax : "<ALARM>"
   The first line of the alarm data

■ **Alarm Data**

Following shows the syntax of alarm data (one line).

No.	Item	Syntax
1	Alarm number	xxxx
2	Sub code	*
3	Information about options	*
4	Date of alarm occurrence	YYYY/MM/DD
5	Time of alarm occurrence	HH:TT:SS

Note: "?": any single character, "*": any line, "X": any number

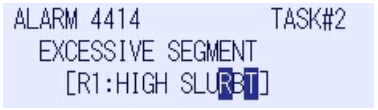
1. Alarm number

   Syntax : "xxxx"
   Alarm number

2. Sub code

   Syntax : " * "
   Sub code
   Only the inverted characters are displayed, if any.

Example: Sub code



[R1: HIGH: RT]

3. Information about options

   Syntax : " * "
   Sub code
   Information about options

4. Date of alarm occurrence

   Syntax : "YYYY/MM/DD"
   Date when the alarm occurred

5. Time of alarm occurrence

   Syntax : "HH:TT:SS"
   Time when the alarm occurred

6.16.6.5 Alarm History

The latest ten alarms, in the order of registration, for each alarm can be codified.

No.	Item	Syntax
1	Alarm history data code	<ALARM HISTORY>
2	Major failure alarm code	MAJOR
3	Major failure alarm data	Refer to ■ *"Alarm Data"* .
4	Minor failure alarm code	MINOR
5	Minor failure alarm data	Refer to ■ *"Alarm Data"* .
6	User alarm (system) code	IO_SYS
7	User alarm (system) data	Refer to ■ *"Alarm Data"* .
8	User alarm (user) code	IO_USR
9	User alarm (user) data	Refer to ■ *"Alarm Data"* .
10	OFF line alarm code	OFFLINE
11	OFF line alarm data	Refer to ■ *"Alarm Data"* .

1. Alarm history data code

   Syntax : "<ALARM HISTORY>"

   The first line of the alarm history data

2. Major failure alarm code

   Syntax : "<MAJOR>"

   The first line of the major failure alarm data

4. Minor failure alarm code

   Syntax : "<MINOR>"

   The first line of the minor failure alarm data

6. User alarm (system) code

   Syntax : "IO_SYS"

   The first line of the user alarm (system) data

8. User alarm (user) code

   Syntax : "IO_USR"

   The first line of the user alarm (user) data

10. OFF line alarm code

    Syntax : "OFFLINE"

    The first line of the OFF line alarm data

■ **Alarm History Data**

Following shows the syntax of the alarm history data (one line).

No.	Item	Syntax
1	Alarm number	xxxx
2	Sub code	*
3	Mode	*
4	Information about options	*
5	Date of alarm occurrence	YYYY/MM/DD
6	Time of alarm occurrence	HH:TT:SS

Note: “?”: any single character, “*”: any line, “X”: any number

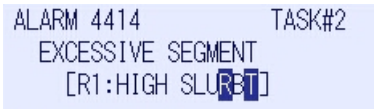
1. Alarm number

   Syntax : “xxxx”
   Alarm number

2. Sub code

   Syntax : “ * ”
   Sub code
   Only the inverted characters are displayed, if any.

Example: Sub code



[R1: HIGH: RT]

3. Mode

   Structure : “ * ”
   Mode

4. Information about options

   Structure : “ * ”
   Sub code
   Information about options

5. Date of alarm occurrence

   Structure : “YYYY/MM/DD”
   Date when the alarm occurred

6. Time of alarm occurrence

   Structure : “HH:TT:SS”
   Time when the alarm occurred

6.16.6.6 Monitoring Time

No.	Item	Syntax
1	Monitoring time data code	<MONITORING TIME>
2	System monitoring time code	SYS MONITORING TIME
3	System monitoring time data	Refer to ■ *"System Monitoring Time Data"* .
4	Servo power time code	SERVO POWER TIME
5	Servo power time data	Refer to ■ *"Data for Servo Power Time, Play Back Time and Moving Time"* .
6	Play back time code	PLAYBACK TIME
7	Play back time data	Refer to ■ *"Data for Servo Power Time, Play Back Time and Moving Time"* .
8	Moving time code	MOVING TIME
9	Moving time data	Refer to ■ *"Data for Servo Power Time, Play Back Time and Moving Time"* .
10	Operating time code	OPERATING TIME
11	Operating time data	Refer to ■ *"Data for Servo Power Time, Play Back Time and Moving Time"* .

1. Monitoring time data code

   Syntax : "<MONITORING TIME>"
   The first line of the monitoring time data

2. System monitoring time code

   Syntax : "SYSTEM MONITORING TIME"
   The first line of the system monitoring time data

4. Servo power time code

   Syntax : "SERVO POWER TIME"
   The first line of the servo power time data

6. Play back time code

   Syntax : "PLAYBACK TIME"
   The first line of the play back time data

8. Moving time code

   Syntax : "MOVING TIME"
   The first line of the moving time data

10. Operating time code

    Syntax : "OPERATING TIME"
    The first line of the operating time data

■ **System Monitoring Time Data**

Following shows the syntax of the system monitoring time data (one line).

No.	Item	Syntax
1	Item code	*
2	Starting date of measurement	YY/MM/DD
3	Starting time of measurement	HH:TT
4	Elapsed time	xxxxx:xx'xx

Note: "?": any single character, "*": any line, "X": any number

1. Item code

   Syntax : " * "

   CONTROL POWER

   SERVO POWER

   PLAYBACK TIME

   MOVING TIME

   OPERATING TIME

   ENERGY TIME

2. Starting date of measurement

   Syntax : "YY/MM/DD"

   Date when the measurement is started

3. Starting time of measurement

   Syntax : "HH:TT"

   Time when the measurement is started

4. Elapsed time

   Syntax : "xxxxx:xx'xx"

   Elapsed time since the measurement is started
   (do not use "0".)

■ **Data for Servo Power Time, Play Back Time and Moving Time**

Following shows the syntax of the servo power time data, play back time data and moving time data (one line).

No.	Item	Syntax
1	Control group	*
2	Starting date of measurement	YY/MM/DD
3	Starting time of measurement	HH:TT
4	Elapsed time	xxxxx:xx'xx

Note: "?": any single character, "*": any line, "X": any number

1. Control group

   Syntax : "?xx"

   Control group

   Robot : R1, R2

   Base : B1, B2

   Station : S1 to S3

(Setting is unnecessary if the control group does not exist in the system.

2. Starting date of measurement

   Syntax : "YY/MM/DD"

   Date when the measurement is started

3. Starting time of measurement

   Syntax : "HH:TT"

   Time when the measurement is started

4. Elapsed time

   Syntax : "xxxxx:xx'xx"

   Elapsed time since the measurement is started
   (do not use "0".)

■ **Operating Time Data**

No.	Item	Syntax
1	Purpose of operation	*
2	Starting date of measurement	YY/MM/DD
3	Starting time of measurement	HH:TT
4	Elapsed time	xxxxx:xx'xx

Note: "?": any single character, "*": any line, "X": any number

1. Purpose of operation

   Syntax : " * "

   Purpose of this operation

(Setting is unnecessary if the control group does not exist in the system.

2. Starting date of measurement

   Syntax : "YY/MM/DD"

   Date when the measurement is started

3. Starting time of measurement

   Syntax : "HH:TT"

   Time when the measurement is started

4. Elapsed time

   Syntax : "xxxxx:xx'xx"

   Elapsed time since the measurement is started
   (do not use "0".)

6.16.6.7 Home Position

No.	Item	Construction
1	Home position data code	<HOME POSITION>
2	Home position data	Refer to ■ *"Home Position Data"* .

1. Home position data code

Structure : "<HOME POSITION>"

The first line of the home position data

■ **Home Position Data**

Following shows the syntax of the home position data (one line).

No.	Item	Syntax
1	Control group (robot/station)	?xx
2	Axis name 1 to 8: Absolute data 1 to 8	?:-xxxxx・・・
3	Control group (base)	?xx
4	Axis name 1 to 8:Absolute data 1 to 8	?:-xxxxx・・・

Note: "?": any single character, "*": any line, "X": any number

1. Control group (robot/station)

Syntax : "?xx"

Control group

Robot : R1, R2

Station : S1 to S3

(Setting is unnecessary if the control group does not exist in the system.)

2. Axis name: Absolute data

Syntax : "?:-xxxxx・・・"

? : S, L, U, R, B, T, E, 1, 2, 3, 4, 5, 6 (axis name)

(Setting is unnecessary if this control group does not exist in the system.)

\- : - (minus sign)

(Setting is unnecessary if the data is not a negative data.)

xxxxx : Absolute data

(Display " * ", if " * " is used to display.)

3. Control group (base)

Syntax : "?xx"

Control group

Base : B1, B2

(Setting is unnecessary if this control group does not exist in the system.)

4. Axis name: Absolute data

Syntax : “?:-xxxxx・・・”

? : 1, 2, 3, 4, 5, 6 (axis name)

(Setting is unnecessary if this control group does not exist in the system.)

- : - (minus sign)

(Setting is unnecessary if the data is no a negative data.)

xxxxx : Absolute data

(Display “ * ”, if “ * ” is used to display.)

6.16.6.8 Current Position

No.	Item	Syntax
1	Current position data code	<CURRENT POSITION>
2	Current position data	Refer to ■ *“Current Position Data (Pulse coordinate)”* and *chapter 6.8.2 “Teaching Condition Setting”* .

1. Current position data code

Syntax : “<CURRENT POSITION>”

The first line of the current position data

2. Current position data

Setting of the current position requires a coordinate (pulse, robot, or user), which is selected in the current position window.

In case other than above mentioned coordinate is selected, set the current position with the pulse coordinate.

■ **Current Position Data (Pulse coordinate)**

Following shows the syntax of the current position data (one line).

No.	Item	Syntax
1	Coordinate	*
2	Tool	TOOL:xx
3	Control group (robot/station)	?xx
4	Axis name 1 to 8:Absolute data 1 to 8	?:-xxxxx・・・
5	Control group (base)	?xx
6	Axis name 1 to 8:Absolute data 1 to 8	?:-xxxxx・・・

Note: “?”: any single character, “*”: any line, “X”: any number

1. Coordinate

Syntax : “ * ”

* : PULSE (pulse coordinate)

2. Tool

Syntax : “TOOL:xx”

xx : 00 to 63 (tool number)

3. Control group (robot/station)

Syntax : “?xx”

Control group

Robot : R1, R2

Station : S1 to S3

(Setting is unnecessary if this control group does not exist in the system.)

4. Axis name: Current position data

Syntax : “?:-xxxxx・・・”

? : S, L, U, R, B, T, E, 1, 2, 3, 4, 5, 6 (axis name)

(Setting is unnecessary if this control group does not exist in the system.)

- : - (minus sign)

(Setting is unnecessary if the data is not a negative data.)

xxxxx・・・ : Current position data

5. Control group (base)

Syntax : “?xx”

Base : B1, B2

(Setting is unnecessary if this control group does not exist in the system.)

6. Axis name: Current position data

Syntax : “?:-xxxxx・・・”

? : 1, 2, 3, 4, 5, 6 (axis name)

(Setting is unnecessary if this control group does not exist in the system.)

- : - (minus sign)

(Setting is unnecessary if the data is not a negative data.)

xxxxx・・・ : Current position data

■ **Current Position Data (Base/user/robot coordinate)**

Following shows the syntax of the current position data (base / user / robot coordinate (one line).

No.	Item	Syntax
1	Coordinate	*
2	Tool	TOOL:xx
3	Control group (robot)	?xx
4	X-axis coordinate	X:-xxx.xxxmm
5	Y-axis coordinate	Y:-xxx.xxxmm
6	Z-axis coordinate	Z:-xxx.xxxmm
7	Rx angle	Rx:-xxx.xxxxdeg.
8	Ry angle	Ry:-xxx.xxxxdeg.
9	Rz angle	Rz:-xxx.xxxxdeg.
10	Re angle (7-axis robot)	Re:-xxx.xxxxdeg.
11	Figure (front or back)	*:*
12	Figure (up or down	*:*
13	Figure (flip or no flip)	*:*
14	X0-axis coordinate (base)	X0:-xxx.xxxmm
15	Y0-axis coordinate (base)	Y0:-xxx.xxxmm
16	Z0-axis coordinate (base)	Z0:-xxx.xxxmm

Note: “?”: any single character, “*” : any line, “X”: any number

1. Item code

Syntax : “ * ”

* : ROBOT (robot coordinate)

: BASE (base coordinate)

: USER#1 to USER#63 (user coordinate)

2. Tool

Syntax : “TOOL:xx”

xx : 00 to 63 (tool number)

3. Control group

Syntax : “?xx”

Control group

Robot : R1, R2

(Setting is unnecessary if this control group does not exist in the system.)

4. X-axis coordinate

Syntax : “X:-xxx.xxxmm”

\- : - (minus sign)

(Setting is unnecessary if the data is not a negative data.)

xxx.xxx• • • : Current position data (unit: mm)

5. Y-axis coordinate

Syntax : “Y:-xxx.xxxmm”

\- : - (minus sign)

(Setting is unnecessary if the data is not a negative data.)

xxx.xxx• • • : Current position data (unit: mm)

6. Z-axis coordinate

Syntax : “Z:-xxx.xxxmm”

\- : - (minus sign)

(Setting is unnecessary if the data is not a negative data.)

xxx.xxx• • • : Current position data (unit: mm)

7. Rx angle

Syntax : “Rx:-xxx.xxxxdeg.”

\- : - (minus sign)

(Setting is unnecessary if the data is not a negative data.)

xxx.xxx• • • : Current position data (unit: deg.)

8. Ry angle

Syntax : “Ry:-xxx.xxxxdeg.”

\- : - (minus sign)

(Setting is unnecessary if the data is not a negative data.)

xxx.xxx• • • : Current position data (unit: deg.)

9. Rz angle

Syntax : “Rz:-xxx.xxxxdeg.”

\- : - (minus sign)

(Setting is unnecessary if the data is not a negative data.)

xxx.xxx• • • : Current position data (unit: deg.)

10. Re angle

Syntax : “Re:-xxx.xxxxdeg.”

\- : - (minus sign)

(Setting is unnecessary if the data is not a negative data.)

xxx.xxx• • • : Current position data (unit: deg.)

11. Figure (front or back)

Syntax : “*:*”

* : FRONT

REAR

* : S<180

: S>=180

12. Figure (up or down)

Syntax : “*:*”

* : UP

DOWN

* : R<180

: R>=180

13. Figure (flip or no flip)

Syntax : “*:*”

* : FLIP

NO FLIP

* : T<180

: T>=180

14. X0-axis coordinate

Syntax : “X0:-xxx.xxxmm”

\- : - (minus sign)

(Setting is unnecessary if the data is not a negative data.)

xxx.xxx• • • : Current position data (unit: mm)

15. Y0-axis coordinate

Syntax : “Y0:-xxx.xxxmm”

\- : - (minus sign)

(Setting is unnecessary if the data is not a negative data.)

xxx.xxx• • • : Current position data (unit: mm)

16. Z0-axis coordinate

Syntax : “Z0:-xxx.xxxmm”

\- : - (minus sign)

(Setting is unnecessary if the data is not a negative data.)

xxx.xxx• • • : Current position data (unit: mm)

6.16.6.9 Servo Monitor

No.	Item	Syntax
1	Servo monitor data code	<SERVO MONITOR>
2	Feedback pulse code	FEEDBACK PULSE
3	Feedback pulse data	Refer to ■ *"Servo Monitor Data"* .
4	Error pulse code	ERROR PULSE
5	Error pulse data	Refer to ■ *"Servo Monitor Data"* .
6	Speed deviation code	SPEED DEVIATION
7	Speed deviation data	Refer to ■ *"Servo Monitor Data"* .
8	Speed instruction code	SPEED INST
9	Speed instruction data	Refer to ■ *"Servo Monitor Data"* .
10	Speed feedback code	FEEDBACK SPEED
11	Speed feedback data	Refer to ■ *"Servo Monitor Data"* .
12	Torque instruction code	TORQUE SPEC
13	Torque instruction data	Refer to ■ *"Servo Monitor Data"* .
14	Maximum torque code	MAX TORQUE
15	Maximum torque data	Refer to ■ *"Servo Monitor Data"* .
16	Encoder accumulative rotation code	ENCODER ROTATE SUM
17	Encoder accumulative rotation data	Refer to ■ *"Servo Monitor Data"* .
18	Position code in 1 turn	IN 1 TURN POSITION
19	Position data in 1 turn	Refer to ■ *"Servo Monitor Data"* .
20	Motor absolute value code	MOTOR ABSOLUTE
21	Motor absolute value data	Refer to ■ *"Servo Monitor Data"* .
22	Encoder temperature code	ENCODER TEMP.
23	Encoder temperature data	Refer to ■ *"Servo Monitor Data"* .
24	Maximum torque (constant speed) code	MAX TRQ (CONST)
25	Maximum torque (constant speed) data	Refer to ■ *"Servo Monitor Data"* .
26	Minimum torque (constant speed) code	MIN TRQ (CONST)
27	Minimum torque (constant speed) data	Refer to ■ *"Servo Monitor Data"* .
28	Motor torque load ratio code	MOTOR DUTY CYCLE
29	Motor torque load ratio data	Refer to ■ *"Servo Monitor Data"* .
30	Load ratio measure time code	MEASURE TIME DUTY
31	Load ratio measure time data	Refer to ■ *"Servo Monitor Data"* .

1. Servo monitor data code

   Syntax : “<SERVO MONITOR>”

   The first line of the servo monitor data

2. Feedback pulse code

   Syntax : “FEEDBACK PULSE”

   The first line of the feedback pulse data

4. Error pulse code

   Syntax : “ERROR PULSE”

   The first line of the error pulse data

6. Speed deviation code

   Syntax : “SPEED DEVIATION”

   The first line of the speed deviation data

8. Speed instruction code

   Syntax : “SPEED INST”

   The first line of the speed instruction data

10. Speed feedback code

    Syntax : “FEEDBACK SPEED”

    The first line of the speed feedback data

12. Torque instruction code

    Syntax : “TORQUE SPEC”

    The first line of the torque instruction data

14. Maximum torque code

    Syntax : “MAX TORQUE”

    The first line of the maximum torque data

16. Encoder accumulative rotation code

    Syntax : “ENCODER ROTATION SUM”

    The first line of the encoder accumulative rotation data

18. Position code in 1 turn

    Syntax : “IN 1 TURN POSITION”

    The first line of the position data in 1 turn

20. Motor absolute value code

    Syntax : “MOTOR ABSOLUTE”

    The first line of the motor absolute value data

22. Encoder temperature code

    Syntax : “ENCODER TEMP.”

    The first line of the encoder temperature data

24. Maximum torque (constant speed) code

    Syntax : “MAX TRQ(CONST)”

    The first line of the maximum torque (constant speed) data

26. Minimum torque (constant speed) code

Syntax : “MIN TRQ(CONST)”

The first line of the minimum torque (constant speed) data

28. Motor torque load ratio code

Syntax : “MOTOR DUTY CYCLE”

The first line of the motor torque load ratio data

30. Load ratio measure time code

Syntax : “MEASURE TIME DUTY”

The first line of the load ratio measure time data

■ **Servo Monitor Data**

Following shows the syntax of the servo monitor (one line).

No.	Item	Syntax
1	Control group (robot/station)	?xx
2	Axis name 1 to 8:Servo monitor data 1 to 8	?:-xxxxx・・・
3	Control group (base)	?xx
4	Axis name 1 to 8:Servo monitor data 1 to 8	?:-xxxxx・・・

Note: “?”: any single character, “*”: any line, “X”: any number

1. Control group (robot/station)

Syntax : “?xx”

Control group

Robot : R1, R2

Station : S1 to S3

(Setting is unnecessary if this control group does not exist in the system.)

2. Axis name: Servo monitor data

Syntax : “?:-xxxxx・・・”

? : S, L, U, R, B, T, E, 1, 2, 3, 4, 5, 6 (axis name)

(Setting is unnecessary if this control group does not exist in the system.)

- : - (minus sign)

(Setting is unnecessary if the data is not a negative data.)

xxxxx・・・ : Current position data

3. Control group (base)

Syntax : “?xx”

Control group

Base : B1, B2

(Setting is unnecessary if this control group does not exist in the system.)

4. Axis name: Servo monitor data

Syntax : “?:-xxxxx・・・”

? : 1, 2, 3, 4, 5, 6 (axis name)

(Setting is unnecessary if this control group does not exist in the system.)

- : - (minus sign)

(Setting is unnecessary if the data is no a negative data.)

xxxxx・・・ : Current position data

6.17 Time Measuring Function

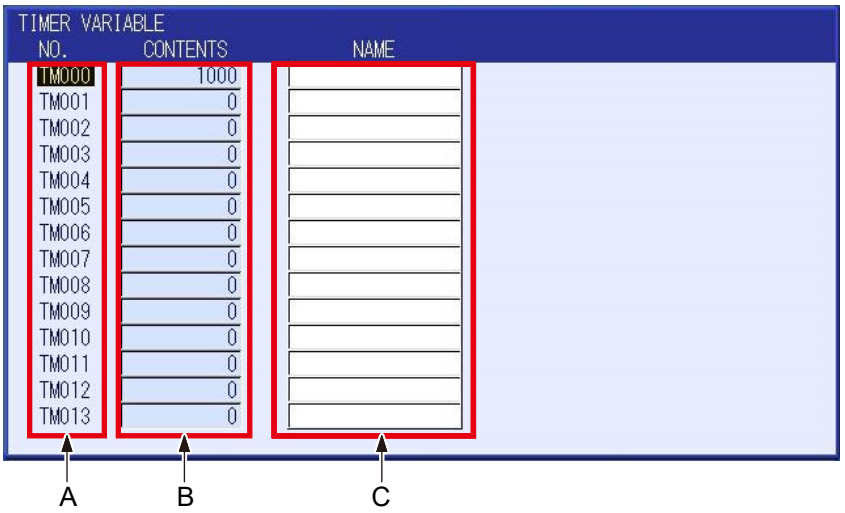
6.17.1 Time Measuring Function

Time measuring function measures the execution time for the specified section in the job or the signal output time of the specified signal.

6.17.2 Timer Variable

The result measured by the time measuring function is stored in the timer variable. The contents of the timer variable can be checked in the timer variable window.

To display the timer variable window, select “VARIABLE” and then “TIMER VARIABLE”.



* The unit is 0.01 sec. (example: 1.00sec for 100)

* When setting a name to the timer variable which is set to be displayed in the job window, the set name and the time measurement result are displayed in the job window.

A. Move the cursor to a variable number

Move the cursor to any variable number and press [SELECT] to display the numerics input box. After inputting a variable number in the box, press [ENTER]. The cursor moves to the variable number.

B. Edit variable contents

The contents cannot be edited, but can be updated by executing the SETTM instruction.

C. Register a variable name

Move the cursor to the “NAME” of the variable number to be registered and press [SELECT]. The character input line appears. After inputting a variable name, press [ENTER] to register the input variable name.

6.17.3 Time Measuring Method

To measure the time, use the SETTM instruction of INFORM instructions.

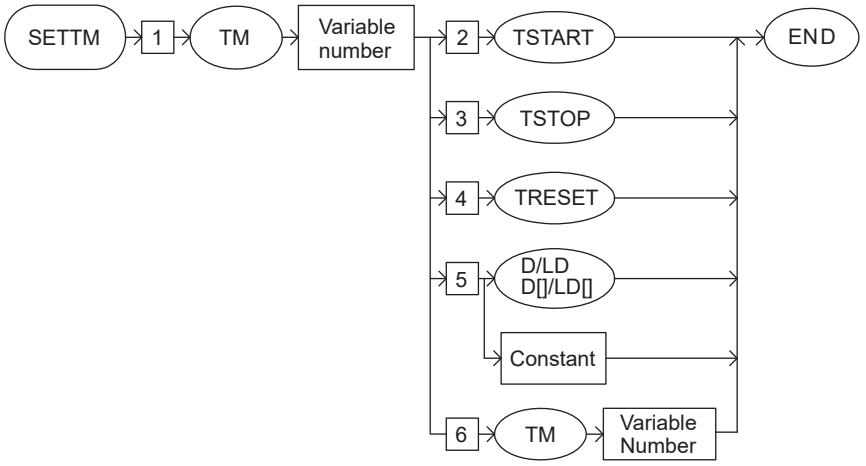
SETTM

SUBSET	STANDARD	EXPANDED
Not Available	Available	Available

Function

Execute these function, such as to start measuring, to end, to reset, and to set the time.

Syntax



Explanation

1. TM variable number

Add the following tag.

No.	Tag	Explanation	Note
1	TM variable number	Specifies the TM variable number for the measurement time writing.	Number: 0 to 59

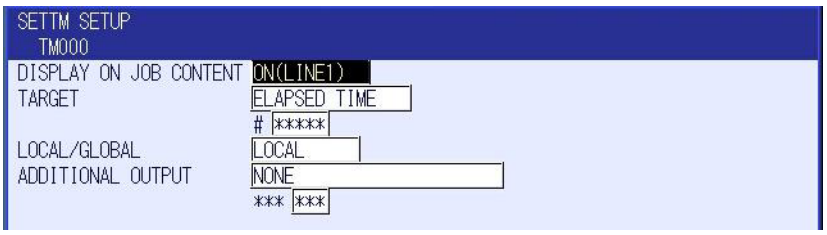
2. TMSTART/TSTOP/TRESET/D Variable number/LD Variable number/D [Arrangement number]/LD [Arrangement number]/Constant/TM Variable number

Select one of them shown in the table below.

No.	Tag	Explanation	Note
2	TSTART	Specifies to start the time measurement.	
3	TSTOP	Specifies to finish the time measurement.	
4	TRESET	Specifies to reset the time measurement.	
5	D Variable number/ LD Variable number/ D [Arrangement number]/ LD [Arrangement number]/ [Constant]	Specifies the time measurement by the integer type variable.	Number: -2147483648 to 2147483647
6	TM variable number	Specifies the time measurement by timer variable.	Number: 0 to 59

Example

The motion setting of SETTM is shown below.



(1) SETTM TM000 TSTART
Starts measuring and sets the measuring time on TM000.

(2) SETTM TM000 TSTOP
Finishes measuring and sets the measuring time on TM000.

(3) SETTM TM000 TRESET
Sets 0 for the measuring time of TM000.

(4) SETTM TM000 1000
Sets 1000 for the measuring time of TM000, and starts measuring at the same time.

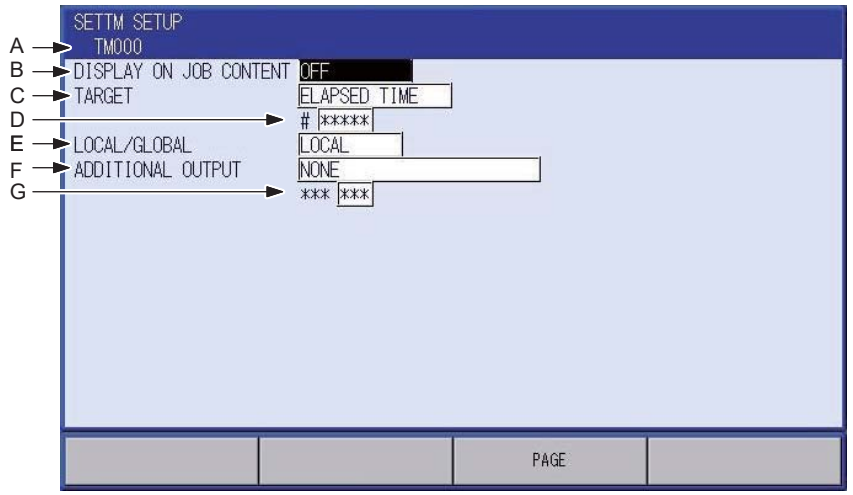
(5) SETTM TM000 TM001
Sets TM001 for measuring time of TM000, and starts measuring at the same time.

6.17.4 Setting for Time Measurement

For time measurement, set a measuring method for each timer variable. Perform the setting in the SETTM SETUP window.

Display the SETTM SETUP window as follows:

1. Set the management mode or higher to the security mode.
2. Select “SETUP” under the main menu. Then select “SETTM SETUP”.



A. Displays a timer variable number whose time measuring method is to be set.

To change the timer variable number, press the [PAGE] key or the PAGE button at the bottom of the window.

B. Sets whether to display the result in the job window.

Select “OFF”, “ON(LINE1)”, “ON(LINE2)” or “ON(LINE3)”. When “ON(LINE1)”, “ON(LINE2)” or “ON(LINE3)” is selected, the time measuring result is displayed on the specified line in the auxiliary area of the job window. The same setting cannot be performed for two or more timer variables. For example, while “ON(LINE1)” is set for the timer variable 0, it is changed to “OFF” if “ON(LINE1)” is specified for the timer variable 1.

C. Sets a measuring target.

Select “ELAPSED TIME”, “SIGNAL ON TIME” or “SIGNAL OFF TIME”. When “ELAPSED TIME” is selected, the time measuring target is the elapsed time in the specified section. When “SIGNAL ON TIME” or “SIGNAL OFF TIME” is selected, the time measuring target is ON or OFF time of the specified signal in the specified section.

D. When the measuring target is “SIGNAL ON TIME” or “SIGNAL OFF TIME”

Sets a signal number whose time is to be measured when the measuring target is “SIGNAL ON TIME” or “SIGNAL OFF TIME”.

E. Selects the time measuring type from “LOCAL” and “GLOBAL”.

If “LOCAL” is selected, only the time when the job is executed is measured. If “GLOBAL” is selected, the time when the job is stopped is also measured.

F. Sets an additional output destination where the measuring time is to be output.
Select “NONE”, “GENERAL-PURPOSE OUTPUT (2 GROUP)”, “GENERAL-PURPOSE OUTPUT (4 GROUP)”, “REGISTER (1)” or “REGISTER (2)”. When “GENERAL-PURPOSE OUTPUT (2 GROUP)”, “GENERAL-PURPOSE OUTPUT (4 GROUP)”, “REGISTER (1)” or “REGISTER (2)” is selected, the measuring time is set to the specified output destination.

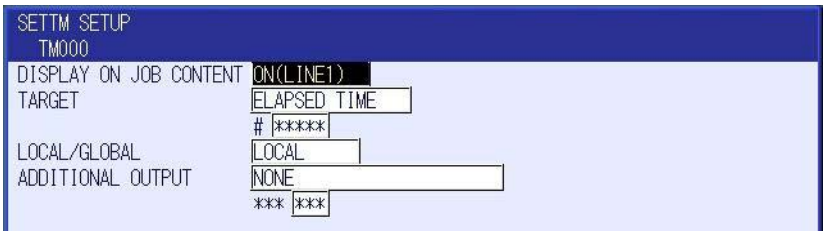
G. Sets a signal number to be output additionally when the additional output target is “GENERAL-PURPOSE OUTPUT 2 GROUP” or “GENERAL-PURPOSE OUTPUT 4 GROUP”.
* Example: -32768 to 32767 is output for “GENERAL-PURPOSE OUTPUT 2 GROUP”. Sets a register number to be output additionally when the additional output target is “REGISTER 1” or “REGISTER 2”.
* Example: As for “REGISTER 1”, 0 to 32767 is output when the measuring time is a positive value.
65535 to 32768 is output when the measuring time is a negative value.
* When the measuring time is out of the output range, the minimum value or the maximum value of the output range is output.

6.17.5 Displaying Time Measurement Result in Job Window

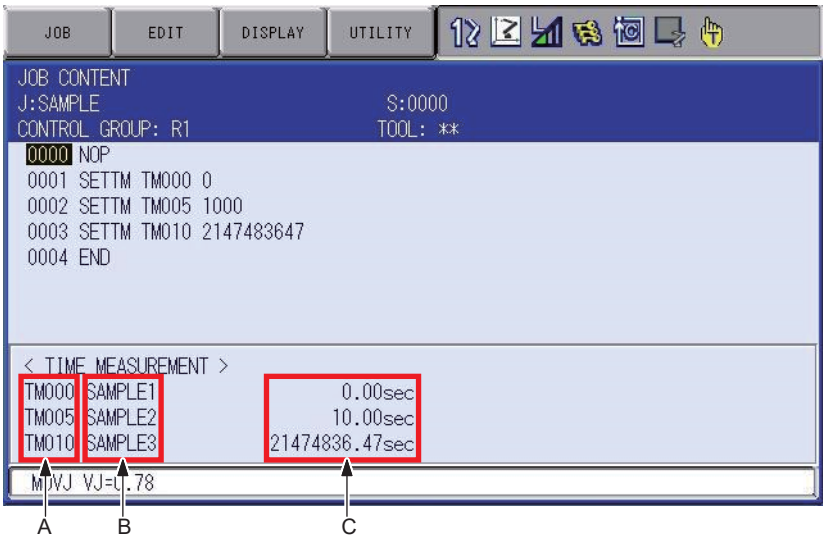
The time measuring result can be checked in the job window.

Display the time measuring result in the job window as follows:

1. Set the management mode or higher to the security mode.
2. Select “SETUP” under the main menu. Then select “SETTM SETUP”.
3. Set “ON(LINE1)”, “ON(LINE2)” or “ON(LINE3)” to DISPLAY ON JOB CONTENT in the SETTM SETUP window.



4. Select {JOB} under the main menu. Then select {JOB CONTENT}.
5. Select {DISPLAY} and {TIME MEASUREMENT} in the pull down menu.



A. Displays the timer variable number.

B. Displays the timer variable name.

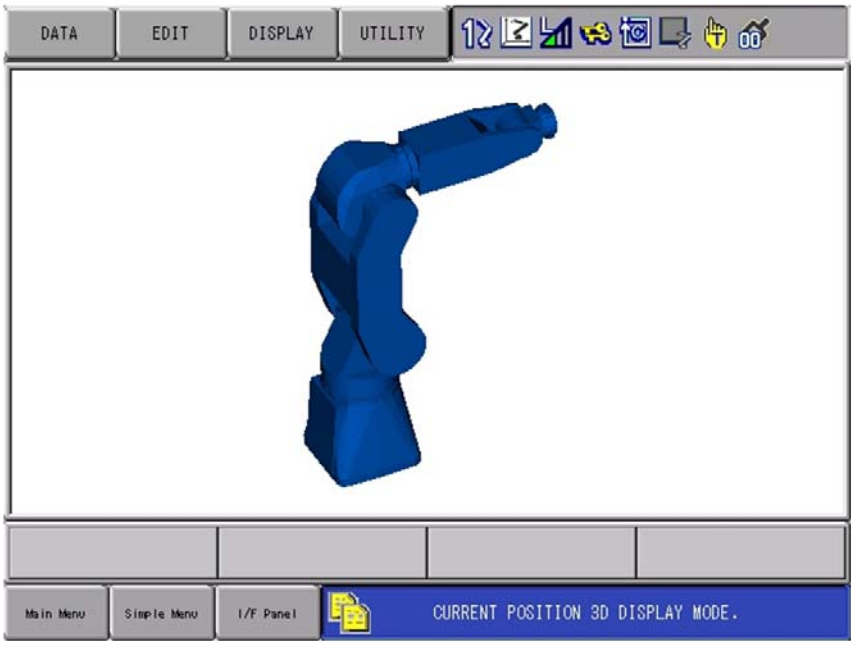
C. Displays the time measuring result.

* Up to three time measuring results can be displayed.

6.18 3D Graphic Display Function

6.18.1 3D Graphic Display Function

The 3D graphic display function (henceforth described as 3D display function) is that, a 3D model of the robot is displayed on the programming pendant window, and the current value of the robot can be confirmed. By using the multi-window function, the job's teaching position displayed in the job content can also be confirmed on the 3D display window. When the functional safety function is valid, the functional safety range can also be displayed.



NOTE Only the robot is displayed. Displaying the peripheral devices are not available.

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6.18.2 Operation Method

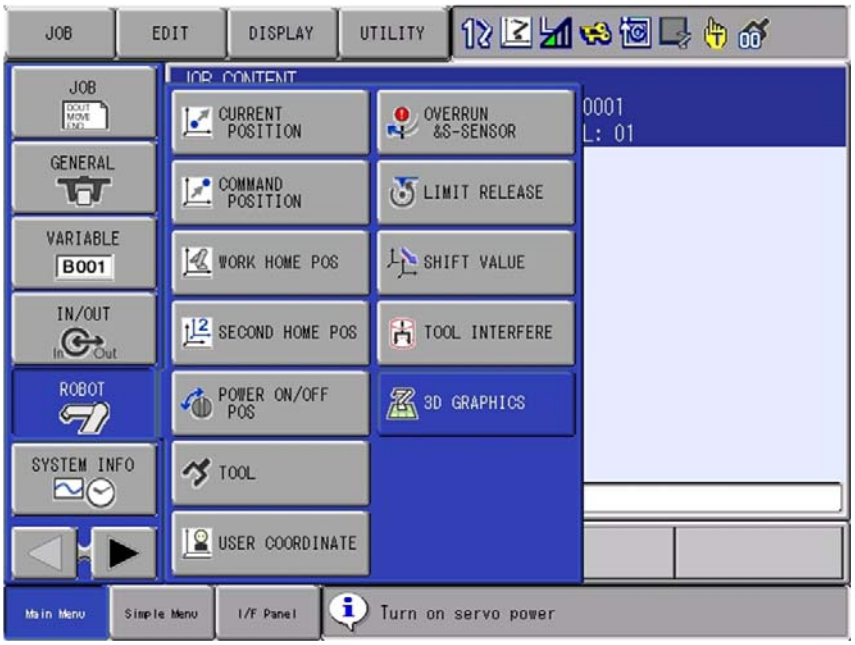
The operations for the 3D display function are described below in this chapter.

The 3D display function operations are basically performed by touching the window.

6.18.2.1 How to Start the 3D Graphic Display Function

The procedures for starting the 3D display function are described below.

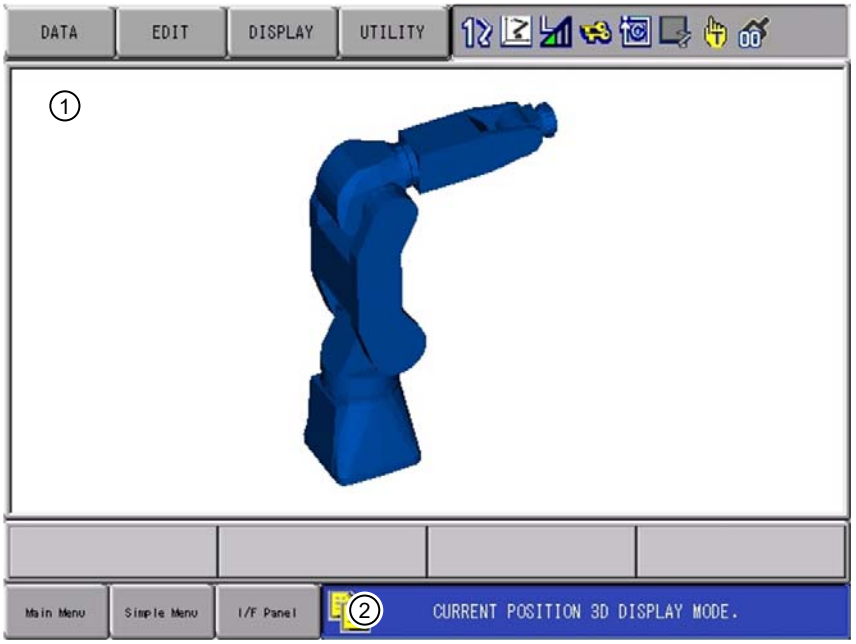
1. From the menu on the left of the window, select {ROBOT}.
2. From the sub-menu, select {3D GRAPHICS}.



6.18.3 Window Configuration

The window configuration is described below.

The 3D display function, when starting, is displayed on the general-purpose display area.

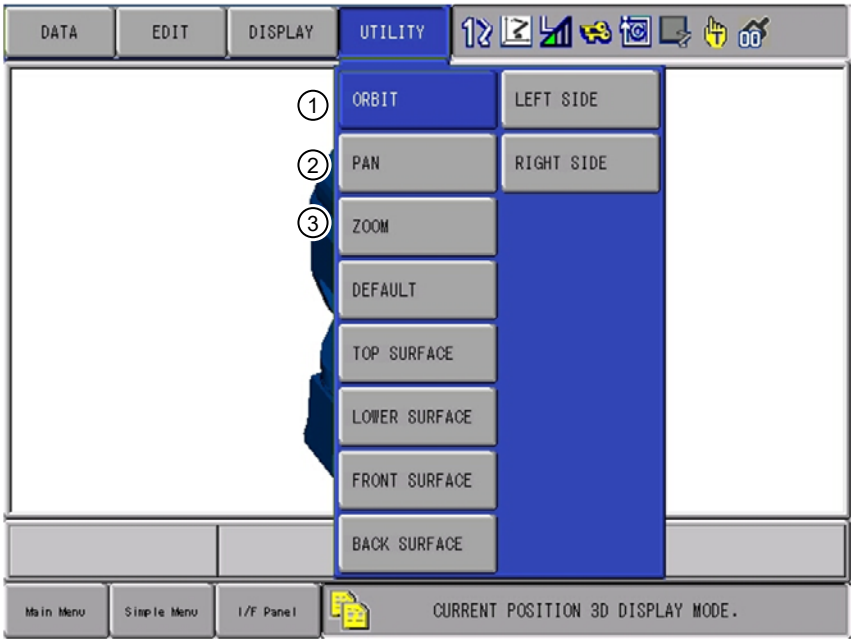


Name		Function
①	3D display area	The area that displays the robot model in 3D.
②	Human interface display area	Messages notifying the 3D display function mode are displayed.

6.18.4 Operating the Viewpoint

The procedure for changing the viewpoint is described below.

1. From the pull-down menu, select {UTILITY}.
2. Select a viewpoint operating method.
3. Touch the 3D display area with one finger, and then move the finger up, down, left and right.
   Touch operations using two fingers or multiple fingers are not supported.
   The types of the viewpoint operation are as follows.



The types of the viewpoint operation are as follows.

Name		Function
①	ORBIT	The viewpoint rotates in the direction of the operation performed using a finger.
②	PAN	The viewpoint moves parallel in the direction of the operation performed using a finger.
③	ZOOM	The viewpoint zooms in when an upward operation is performed using a finger, and zooms out when a downward operation is performed using a finger.

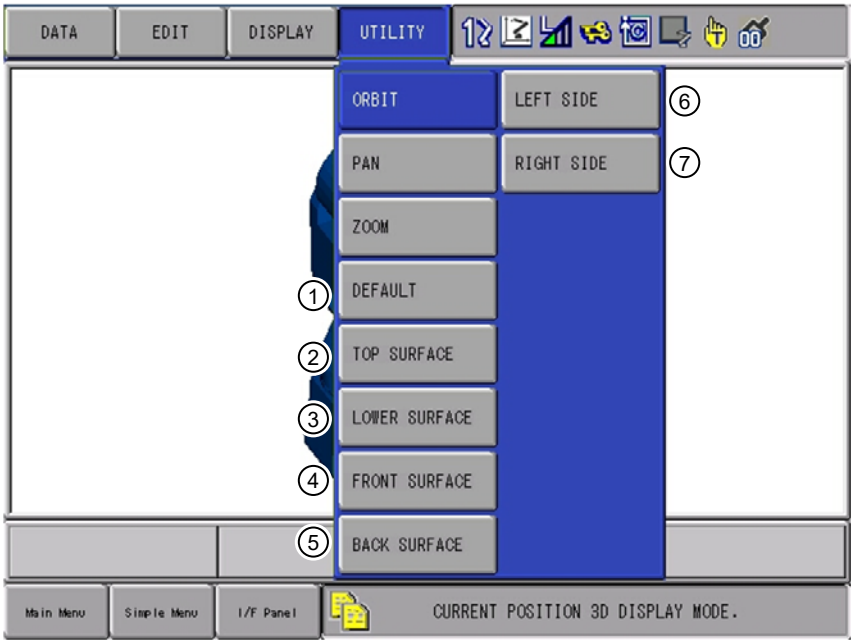
The viewpoint operation can be also performed by the key operations. The operation method is as follows.

Name		Key operation
①	ORBIT	[SHIFT] + [CURSOR]
②	PAN	[CURSOR]
③	ZOOM	[INTERLOCK] + [CURSOR]

6.18.5 Preset Viewpoint

The preset viewpoint, such as the viewpoint position when starting, the top surface and the side, can be called.

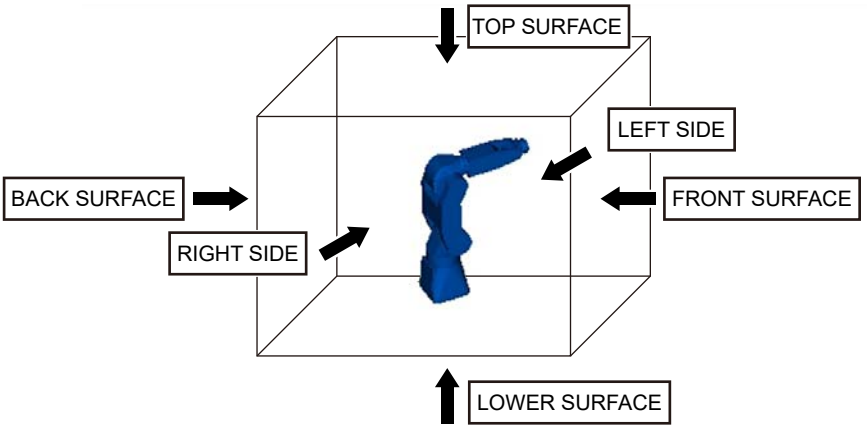
1. From the pull-down menu, select {UTILITY}.
2. Select the preset viewpoint.



The preset viewpoint and the direction of the viewpoint are as follows.

Name		Function
①	DEFAULT	Changes to the viewpoint when starting.
②	TOP SURFACE	Changes to the viewpoint observed from above.
③	LOWER SURFACE	Changes to the viewpoint observed from below.
④	FRONT SURFACE	Changes to the viewpoint observed from front.
⑤	BACK SURFACE	Changes to the viewpoint observed from back.
⑥	LEFT SIDE	Changes to the viewpoint observed from the left side.
⑦	RIGHT SIDE	Changes to the viewpoint observed from the right side.

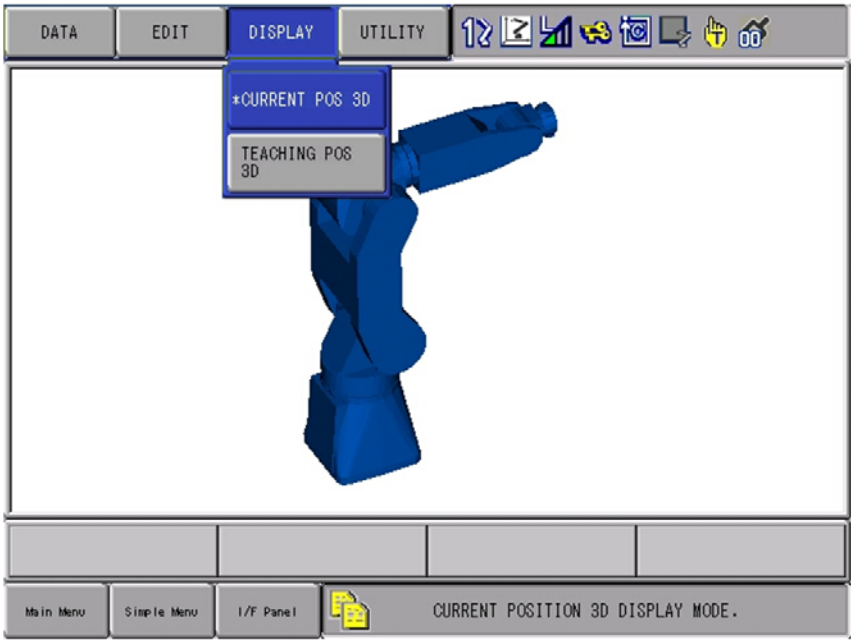
Top surface, lower surface, front surface, back surface, left side and right side are the viewpoints observed from a perpendicular direction from each side of the cuboid defined in the 3D graphic space.



6.18.6 Current Position 3D Display

The current position 3D display mode is described below in this chapter. For changing to the current position 3D display mode, perform the operations in the procedure below.

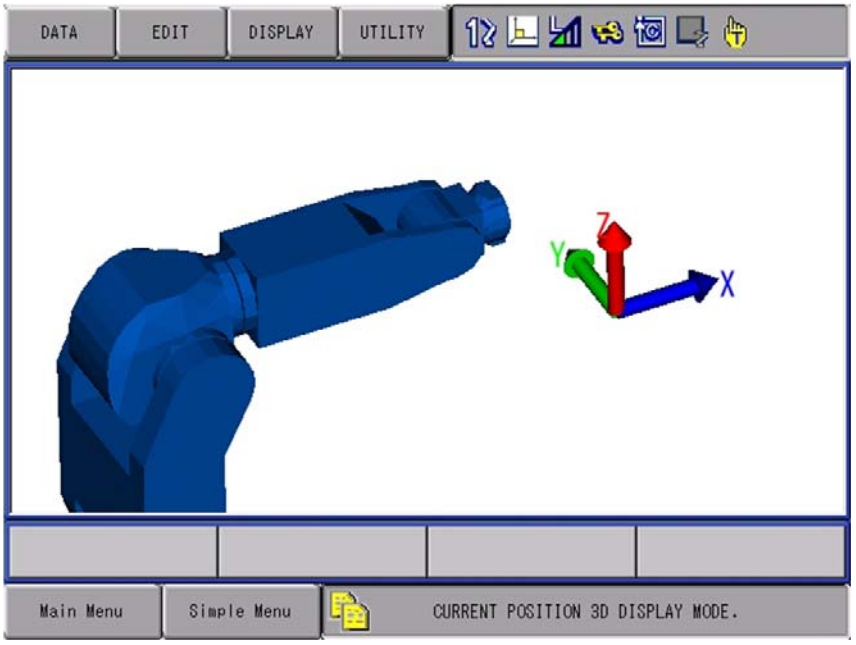
1. From the pull-down menu, select {DISPLAY}.
2. Select {CURRENT POS 3D}.
3. In the human interface display area, the message “CURRENT POSITION 3D DISPLAY MODE.” is displayed.



6.18.6.1 Display Content

■ **Display During TEACH MODE**

In teach mode, according to the jog operation or the FWD key operation of the robot, the posture of the robot in the 3D display area changes. When operating by using the cartesian coordinates system, the tool coordinates system, and the user coordinate system, an arrow that indicates the operation direction is displayed. The displayed position is the position (TCP position) considering the selected tool data. The directions of the arrow are the positive direction of the X-axis, the Y-axis, and the Z-axis. The each axis is displayed as follows; X-axis direction is blue, the Y-axis direction is green, and the Z-axis direction is red.



NOTE The robot cannot be operated by dragging the arrow.

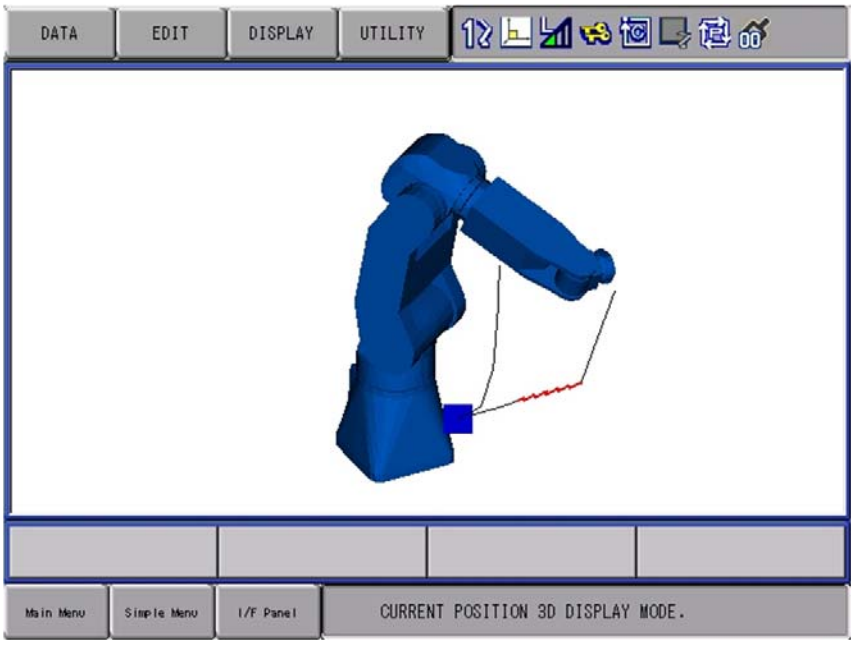
■ **Display During PLAY MODE**

Even in play mode, in accordance with the motion of the robot, the posture of the robot in the 3D display area changes.

And during playback, the motion path is displayed. The motion path, in the working section, is displayed in different color. When the IO instruction is executed, the icon is changed and displayed.

NOTE

- The motion path display requires the processing for drawing the information, therefore, the path display is less delayed than the actual motion of the robot.
- Since the path is displayed on the basis of sampling data, depending on the speed, the angular position may not be displayed at the corner.



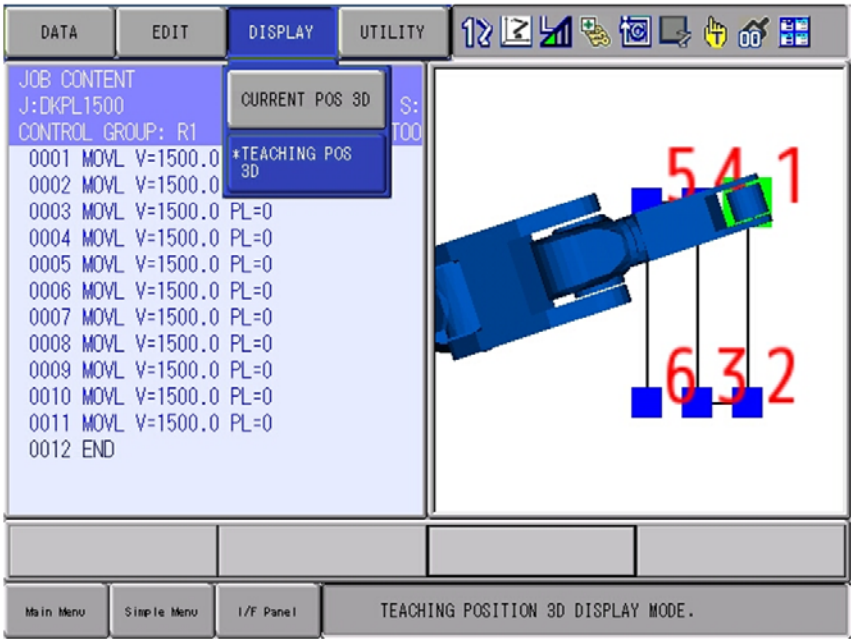
6.18.7 Teaching Position 3D Display

The teaching position 3D display mode is described below in this chapter.

In teaching position 3D display mode, the job teaching position displayed in the job contents is displayed in 3D. When performing the jog operation, the operation will not be reflected to the robot, and the current position will not be displayed.
The teaching position 3D display mode is only valid in teach mode. And when the mode is changed to play mode, it is changed to the current position 3D display mode.

For changing to the teaching position 3D display mode, perform the operations in the procedure below.

1. From the pull-down menu, select {DISPLAY}.
2. Select {TEACHING POS 3D}.
3. In the human interface display area, the message “TEACHING POSITION 3D DISPLAY MODE.” is displayed.



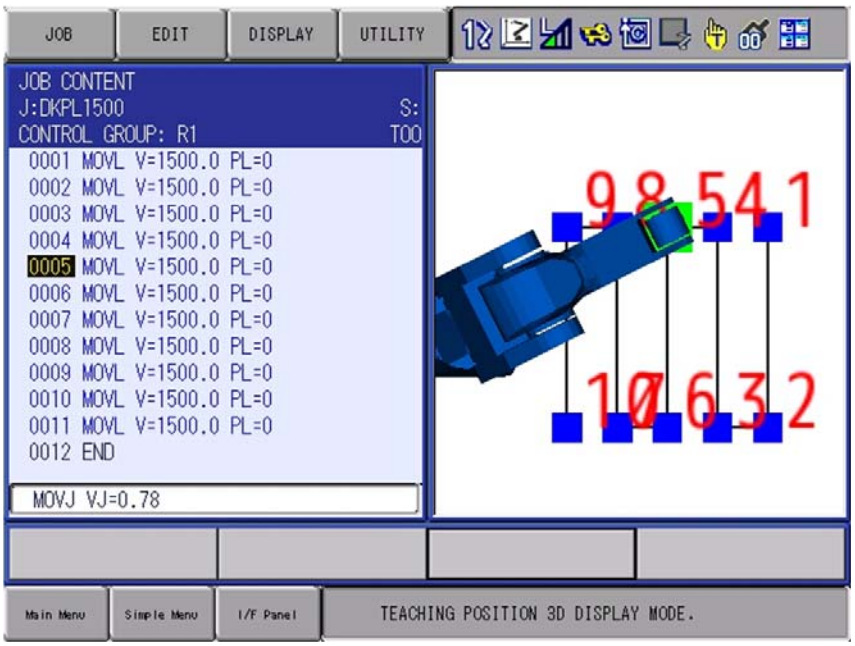
NOTE

- When changing to play mode, the {TEACHING POS 3D} menu will not display.
- The job content window must be displayed.

6.18.7.1 Display Content

On the job content window, when the cursor is moved to the move instruction position, the posture of the robot in the 3D display area changes to the posture of the teaching position.

The teaching positions of the previous five steps and the following five steps are displayed in broken lines. The position of each broken line indicates the TCP position with an icon. The teaching position currently displayed has a large icon. The step number is displayed next to the icon.



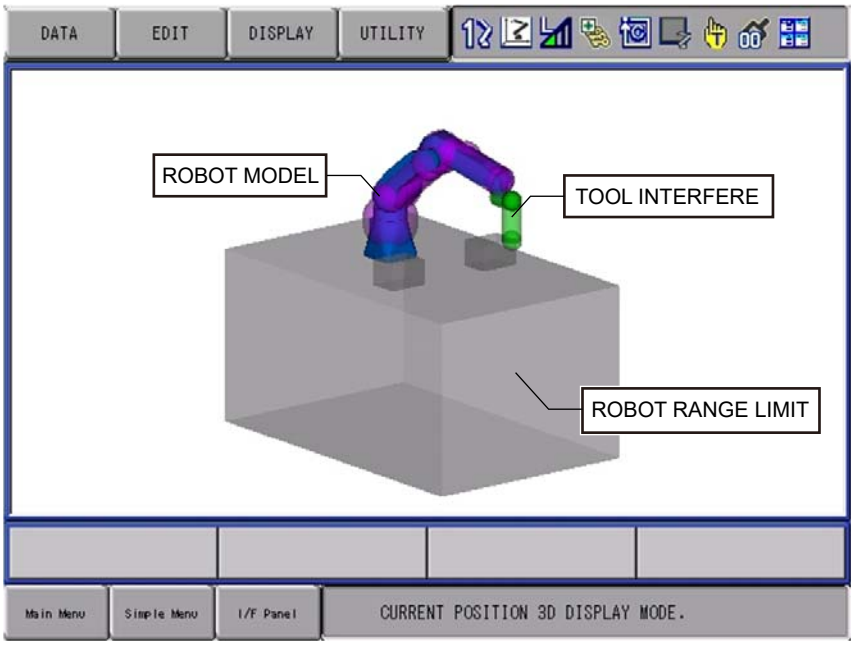
NOTE

- The displayed step is only for the job displayed in the job content. Job calling is not displayed.
- The broken lines connect the teaching positions linearly, so it differs to the actual motion path of the robot.

6.18.8 Functional Safety Range Display

The functional safety range display is described below in this chapter.

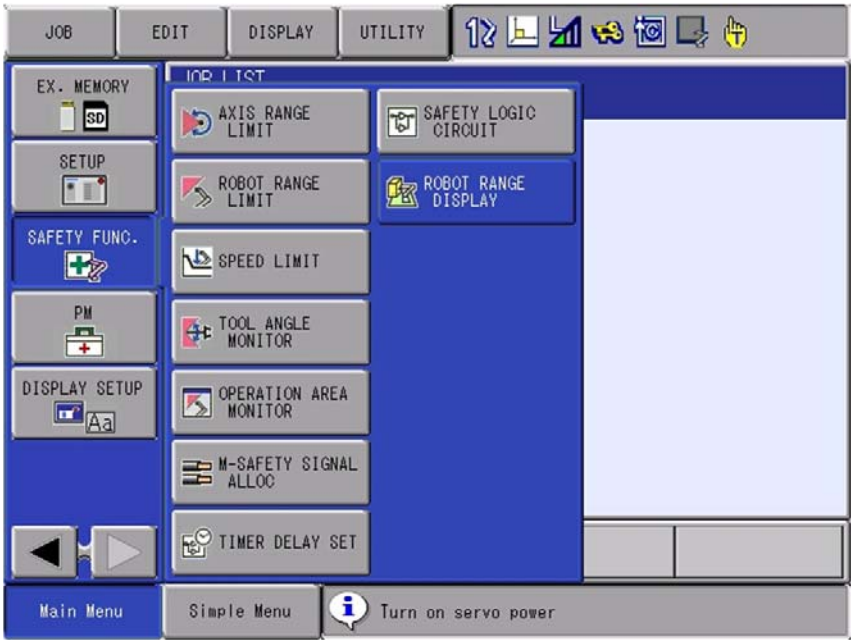
For the system which functional safety is valid, the functional safety range is displayed on the 3D display window. The areas that can be displayed are the robot operation limit range and the tool interference. The robot model for the range monitoring is also displayed.



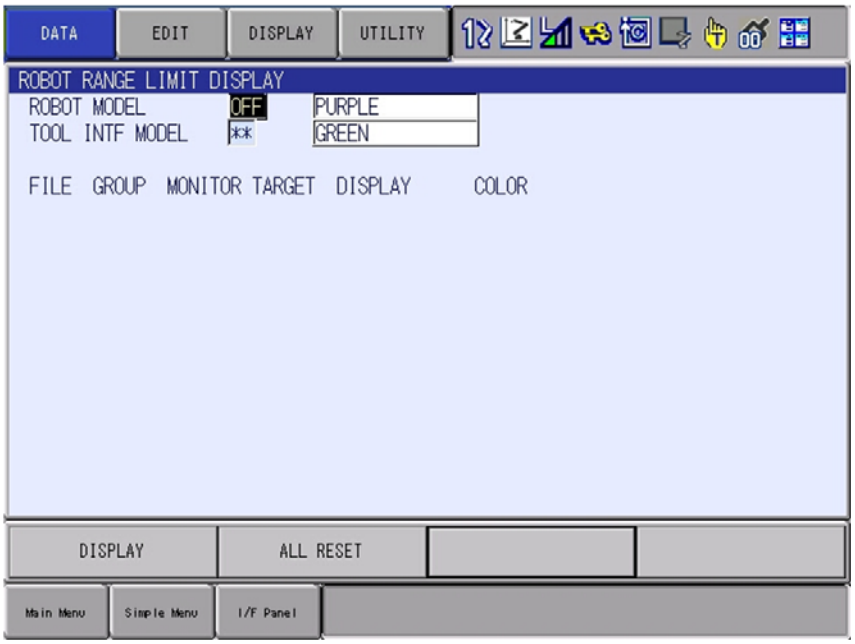
6.18.8.1 Display Setting

For setting the display, perform the operations in the procedure below.

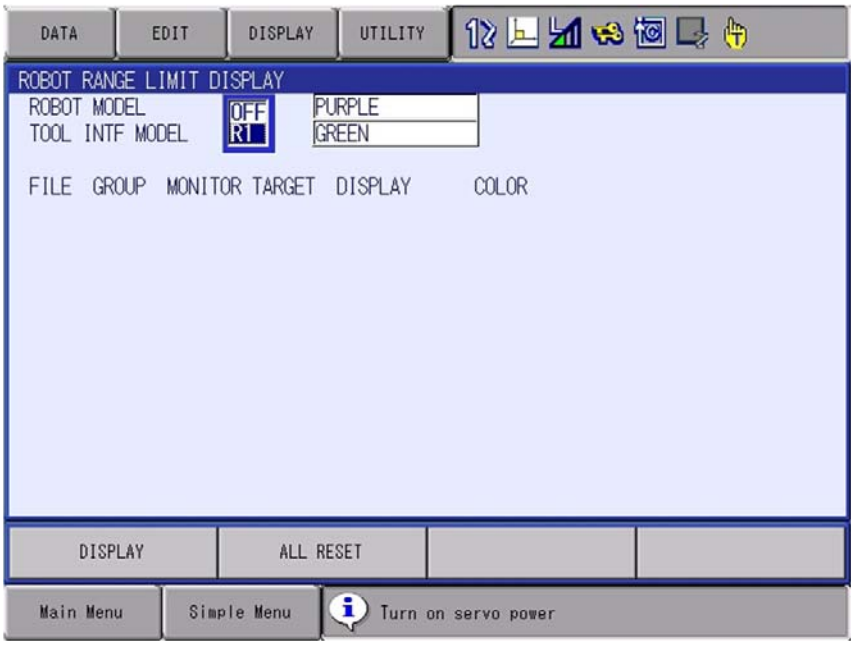
1. From the menu on the left of the window, select {SAFETY FUNC.}.
2. From the sub-menu, select {ROBOT RANGE DISPLAY}.



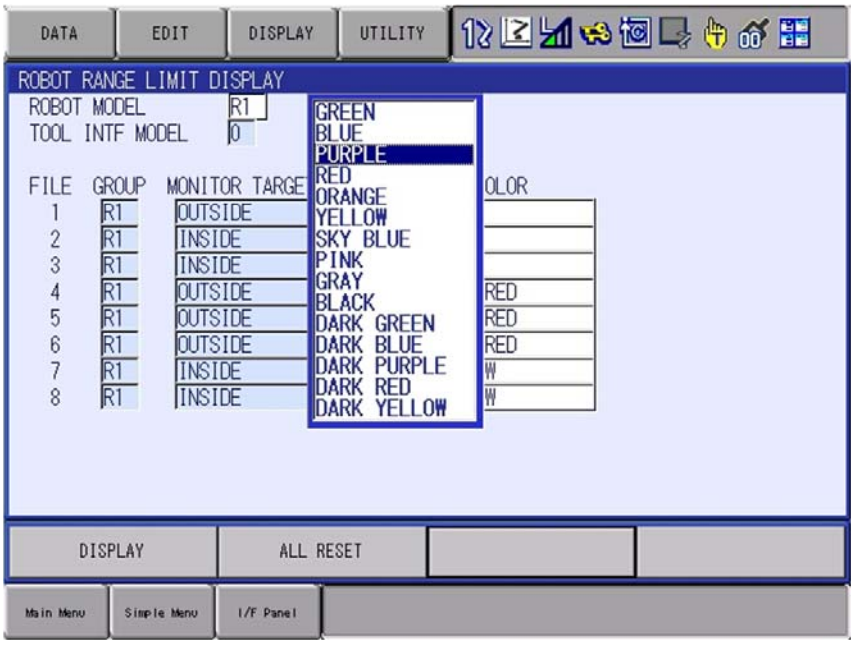
3. The ROBOT RANGE LIMIT DISPLAY window is displayed.



4. Select the target robot model.

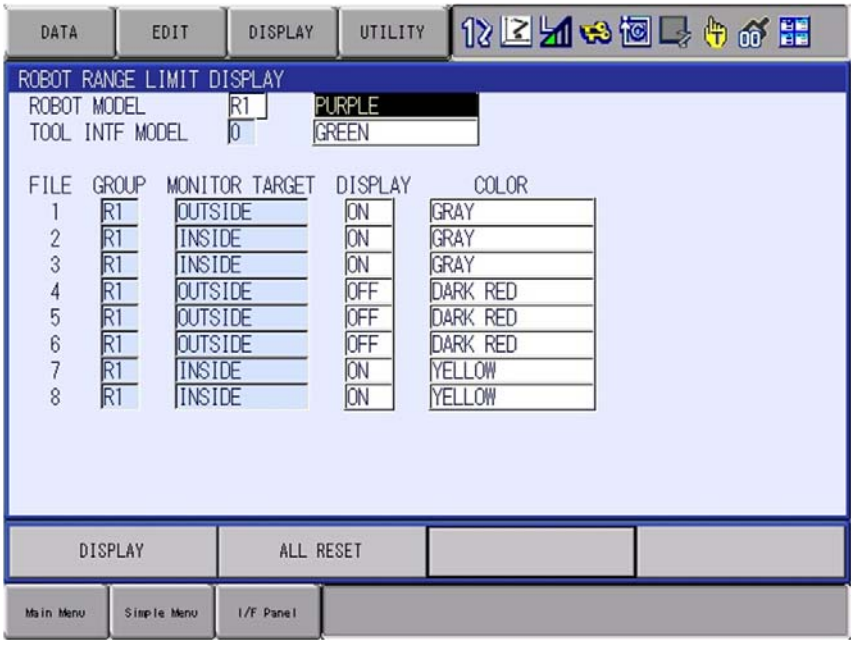


5. Select the model color.



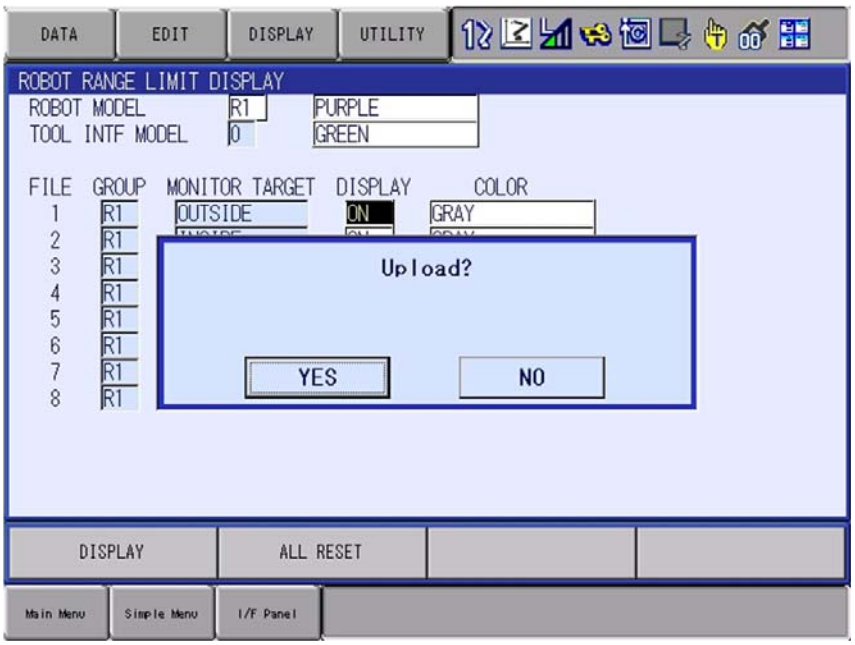
6. The tool interference model is selected by the tool of the target robot. The color can be changed.

7. When the robot model is selected, the target robot range limit display file is displayed. Set ON to “DISPLAY” of the file number to be concealed. And set OFF to it when hiding the file number.



8. Press {DISPLAY}.
9. A message, “Upload?” is displayed. Press {YES}.

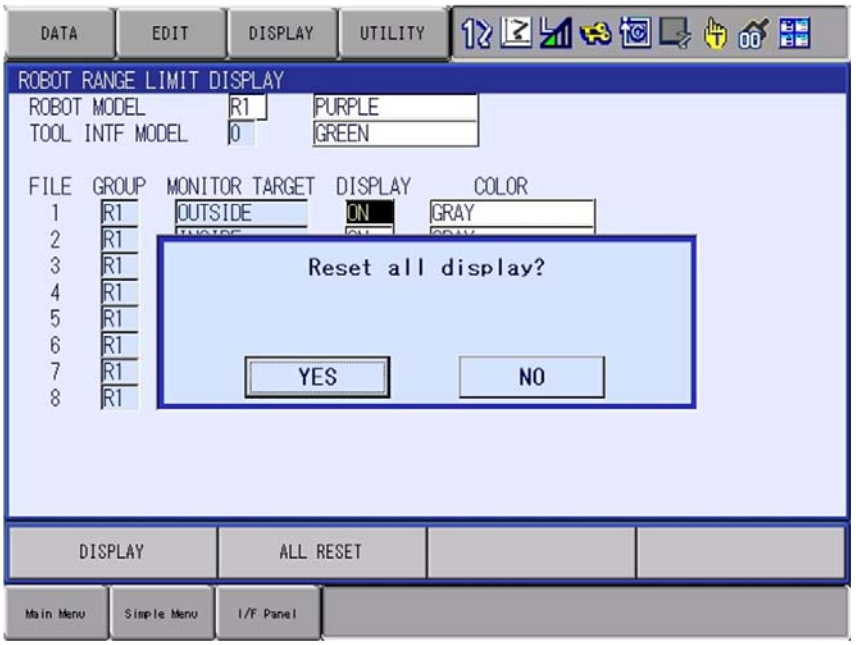
The settings are reflected in the 3D display function. When {NO} is pressed, the settings will not be reflected in the 3D display function.



6.18.9 Concealing Setting

For concealing all functional safety range, perform the operations in the procedure below.

1. From the menu on the left of the window, select {SAFETY FUNC.}.
2. From the sub-menu, select {ROBOT RANGE DISPLAY}.
3. The ROBOT RANGE LIMIT DISPLAY window is displayed.
4. When {ALL RESET} is pressed, a message saying “Reset all display?” is displayed.
   When {YES} is pressed, the settings are reset.
   When {NO} is pressed, the settings will not be reset.



5. Press {DISPLAY}.
6. A message saying “Upload?” is displayed. Press {YES}. The settings are reflected in the 3D display function. When {NO} is pressed, the settings will not be reflected in the 3D display function.

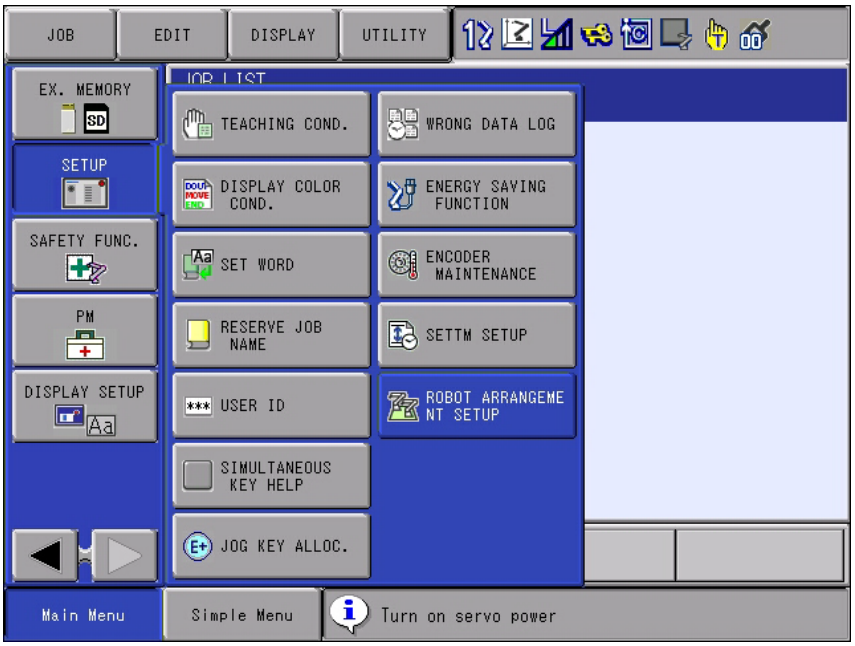
6.18.10 Other Settings

Other settings are described in this chapter.

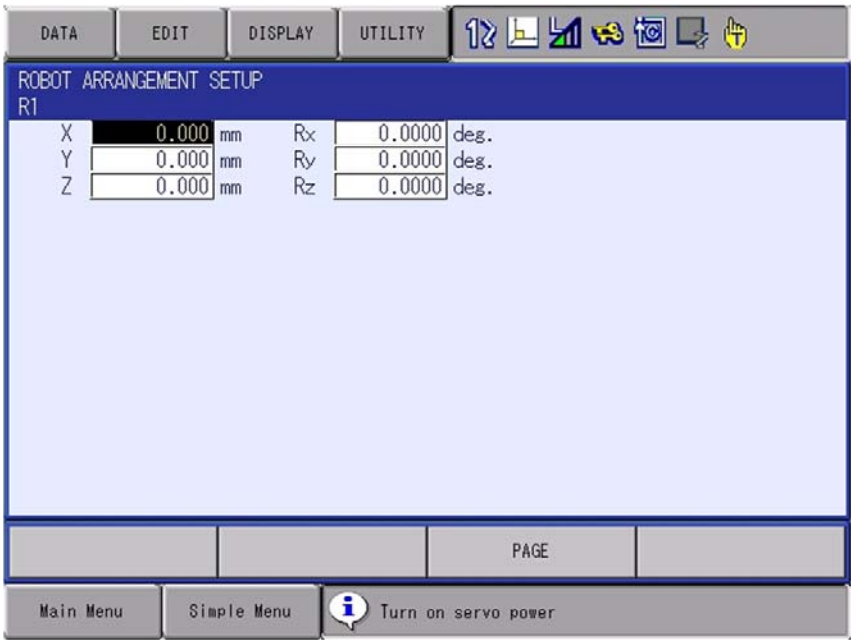
6.18.10.1 How to Change the Robot Model Arrangement in a Multiple Robot System

For multiple robot systems, the robot arrangement displayed in the 3D display function can closely match the actual arrangement. When changing the arrangement, perform the operations in the procedure below.

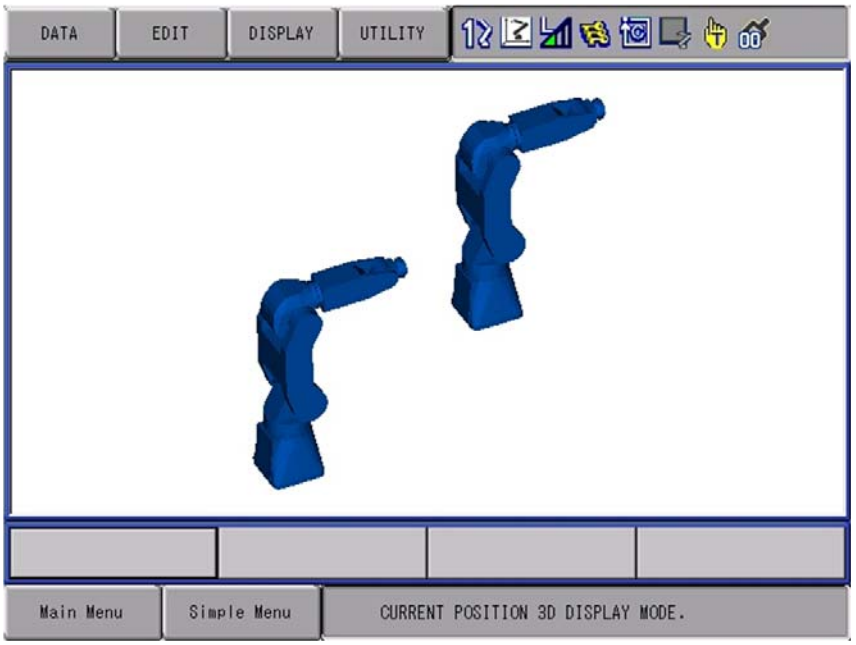
1. From the menu on the left of the window, select {SETUP}.
2. From the sub-menu, select {ROBOT ARRANGEMENT SETUP}.



3. The ROBOT ARRANGEMENT SETUP window is displayed.



4. Enter the arrangement.
5. For changing the robot to set, press {PAGE} and then select. Also [PAGE] can be changed.
6. The entered settings are reflected in the 3D graphic window.



6.19 Remote Pendant Operation Function

6.19.1 Overview of the Remote Pendant Operation Function

By using the remote pendant operation function, the display of the programming pendant can be viewed and controlled via a web browser. Thus, the display of the programming pendant can be shown and the status of the YRC1000micro can be checked from a remote location. The administrator can set the login name and password of the user who performs the remote pendant operation, and also can set the access method for viewing or operating the programming pendant for each user.

The administrator can register up to 100 user accounts.

Only the administrator can modify the data of a registered user account.

NOTE

- While the programming pendant is being controlled by the remote pendant operation, the programming pendant cannot be controlled by using the programming pendant itself.
- In the remote pendant operation, the maintenance mode cannot be operated.

6.19.2 Recommended Environment

For security and convenience, we recommend the following web browsers with the latest versions when using the remote pendant operation function.

- Recommended web browsers:
  Microsoft Internet Explorer 10.0 or later
  Firefox 6 or later
  Chrome 4 or later

6.19.3 Connection with the YRC1000micro

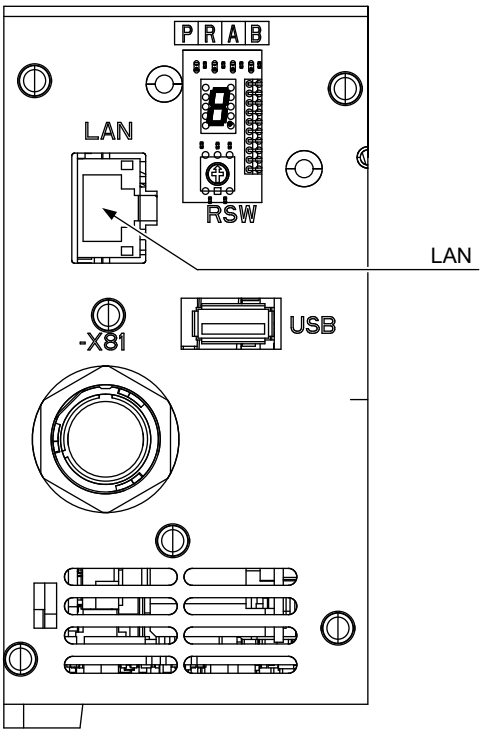
6.19.3.1 Ethernet Cable Connections

Connect the Ethernet cable (shielded cable: category 5 or higher) to the LAN connector on the front of the YRC1000micro.

NOTE

To the enabled LAN interface, the YRC1000micro confirms the presence or the type of the connected cable when starting. Thus, to avoid performing an unnecessary check process, enable the LAN interface only when actually connecting the Ethernet cable.

Fig. 6-5: Front View of the YRC1000micro (LAN Connector Part)



6.19.3.2 LAN Interface Settings

■ **Setting procedure**

To use the remote pendant operation function, first perform the LAN interface settings.

NOTE

- Make sure to perform the following settings in the management mode.
- In the operation mode or the edit mode, only reference to the settings is available.

1. Turn ON the power supply while pressing {Main Menu}.
   – The maintenance mode starts.



2. Set the security mode to the “MANAGEMENT MODE”.



3. Select {SYSTEM} under the Main Menu.

   – Sub menu appears.



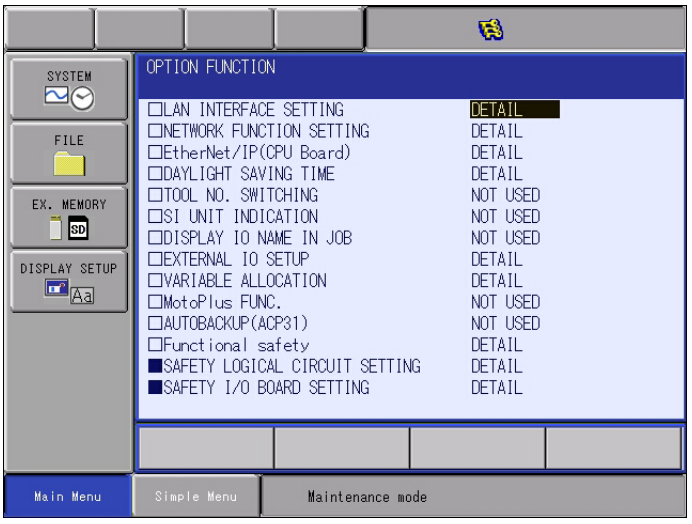
4. Select {SETUP}.

   – The SETUP window appears.

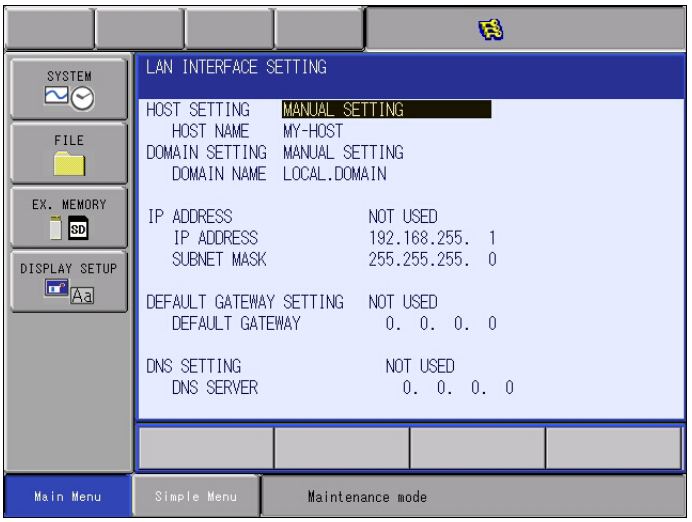


5. Select “OPTION FUNCTION”.

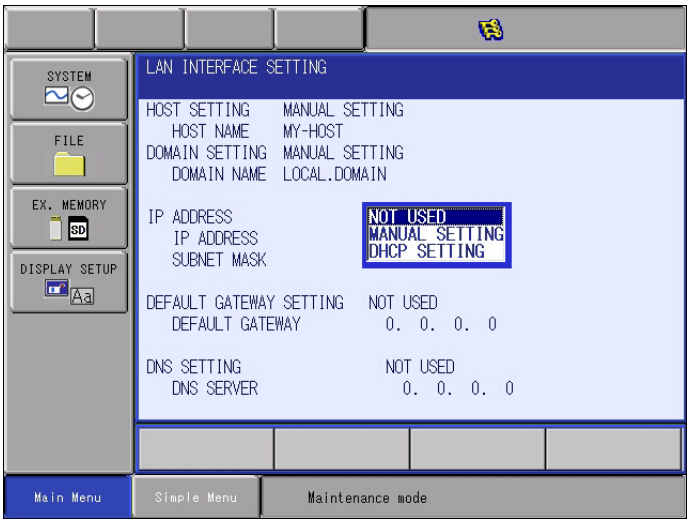
   – The OPTION FUNCTION window appears.



6. Select “DETAIL” of the “LAN INTERFACE SETTING”.
   – The LAN INTERFACE SETTING window appears.

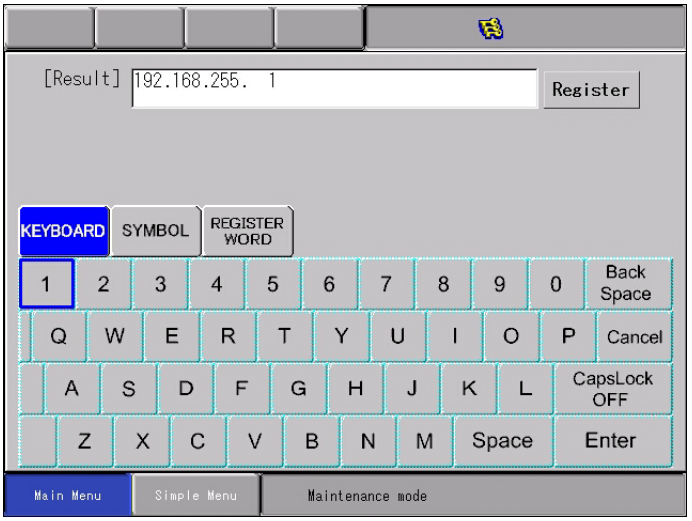


7. Select “IP ADDRESS”.
   – The pull-down menu appears.
   Select either “MANUAL SETTING” or “DHCP SETTING”.



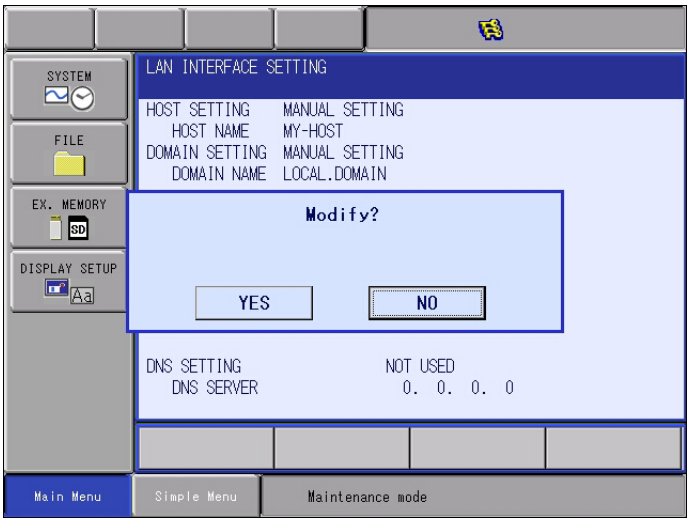
8. Select the communication parameter to be modified.

   – After “IP ADDRESS” is enabled, select other communication parameters which must be modified.
   Select the parameter by using the pull-down menu, or enter the parameter directly by using the virtual keyboard.

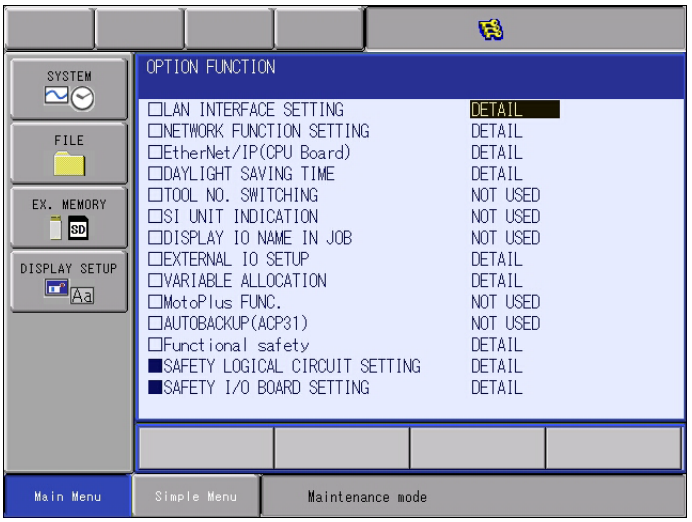


9. Press [ENTER].

   – The confirmation dialog box appears.



10. Select {YES}.
    – Select {YES} to return to the OPTION FUNCTION window.



11. Turn the power OFF and then ON again.
    – By turning the power OFF and then ON again, the normal operation mode will start.

6.19.3.3 LAN Interface Setting Items

In the LAN interface settings, perform the following settings.

■ **Host Setting**

Select the host name setting method of the YRC1000micro from the pull-down menu.

MANUAL SETTING : The character string set in the following item is used as the host name.

DCHP SETTING : The host name is acquired from the DCHP server.

• HOST NAME
If “MANUAL SETTING” is set for host setting method, enter the host name by using the character string.
Characters which can be used for the host name are half-width alphanumeric characters, hyphens (-) and underscores (_).
Include one or more alphabetic character, and set the name within 32 characters.

■ **Setting the Domain**

Select the domain name of the YRC1000micro setting method from the pull-down menu.

MANUAL SETTING : The character string set in the following item is used as the domain name.

DCHP SETTING : The domain name is acquired from the DCHP server.

• DOMAIN NAME
If “MANUAL SETTING” is set for domain setting method, enter the domain name by using the character string.
Characters which can be used for the domain name are half-width alphanumeric characters, hyphens (-) and underscores (_).
Include one or more alphabetic character, and set the name within 32 characters.

■ **IP Address**

Select the IP address setting method from the pull-down menu.

NOT USED : LAN is not used.

MANUAL SETTING : The value set in the following item is used as the IP address/subnet mask.

DCHP SETTING : The IP address is acquired from the DCHP server.

• IP ADDRESS
If “MANUAL SETTING” is set for IP address setting method, set the IP address to this item. Use half-width numbers and periods (.) for the IP address, and set “xx.xx.xx.xx” using the following format: xx is decimal number from 0 to 255.
(Example) 192.168.255.1

NOTE

YRC1000micro supports only IPv4 and does not support IPv6.

[10.0.0.xx] (xx: 0 to 255) cannot be used for the IP address of the LAN.

• SUBNET MASK
If “MANUAL SETTING” is set for IP address setting method, set the subnet mask to this item. Use half-width numbers and periods (.) for the subnet mask, and set “xx.xx.xx.xx” using the following format: xx is decimal number from 0 to 255.
(Example) 255.255.255.0

■ **Default Gateway**

Select the default gateway of the YRC1000micro setting method from the pull-down menu.

NOT USED : The default gateway is not used.

MANUAL SETTING : The value set in the following item is used as the default gateway.

DCHP SETTING : The default gateway is acquired from the DCHP server.

• DEFAULT GATEWAY
If “MANUAL SETTING” is set for default gateway setting method, set the default gateway to this item. Use half-width numbers and periods (.) for the default gateway, and set “xx.xx.xx.xx” using the following format: xx is decimal number from 0 to 255.
(Example) 192.168.255.200

■ DNS Setting

For using the DNS (Domain Name System) client function, and for the setting method of DNS server when using the DNS client function, select from the pull-down menu.

NOT USED : The DNS is not used.

MANUAL SETTING : The value set in the following item is used as the DNS server.

DCHP SETTING : The DNS Server is acquired from the DCHP server.

- DNS SERVER
  If “MANUAL SETTING” is set for DNS setting method, set the IP address of the DNS server to this item. Use half-width numbers and periods (.) for the IP address of the DNS server, and set “xx.xx.xx.xx” using the following format: xx is decimal number from 0 to 255.

■ SNTP Setting

For using the SNTP (Simple Network Time Protocol) client function, and for the setting method of SNTP server when using the SNTP client function, select from the pull-down menu.

NOT USED : The SNTP is not used.

MANUAL SETTING : The value set in the following item is used as the SNTP server.

DCHP SETTING : The SNTP Server is acquired from the DCHP server.

- SNTP SERVER
  If “MANUAL SETTING” is set for SNTP setting method, set the SNTP setting to this item. Use half-width numbers and periods (.) for the SNTP server IP address, and set “xx.xx.xx.xx” using the following format: xx is decimal number from 0 to 255.
  Note that if the DNS client function is enabled, the FQDN (Fully Qualified Domain Name: “Hostname@domainname” name format) can also be set. Characters which can be used for the FQDN are half-width alphanumeric characters, hyphens (-), underscores (_) and the at-sign (@) which is the character boundary between the host name and the domain name. Set it within 128 characters.

- TIME DIFFERENCE FROM UTC
  The time that can be acquired by using SNTP is UTC (Coordinated Universal Time). To calculate the local time from UTC, enter the time difference between UTC and the local time.
  Every time a symbol is selected, “+” and “-” switches. Enter half-width numeric characters for each hour and minute. The settable range is from -12:00 to +14:00.

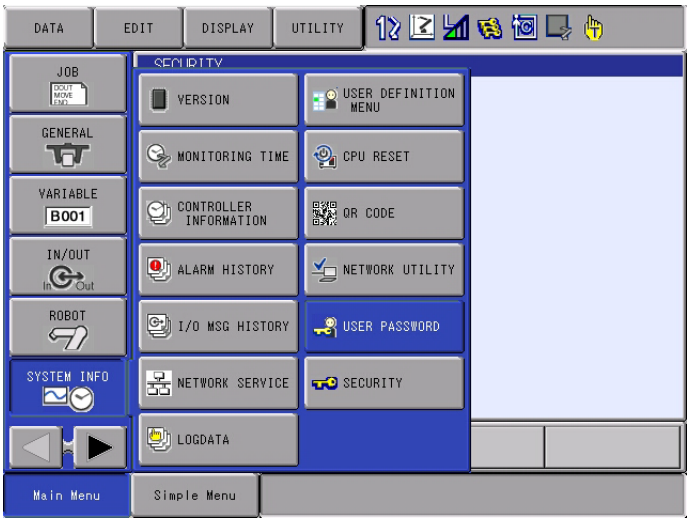
- INQUIRY INTERVAL (H)
  Enter a time interval for making an inquiry to the SNTP server. Enter the hour (H) using half-width numeric characters. The settable range is 10 to 99.

6.19.4 User Settings for the Remote Pendant Operation

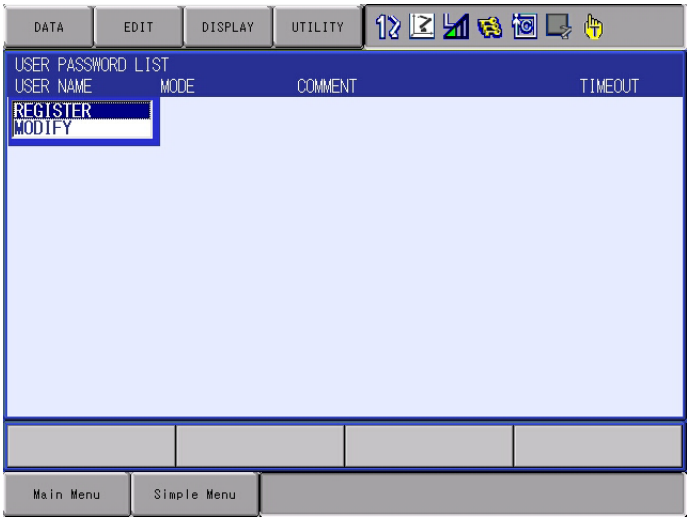
6.19.4.1 Registration of a New User Account

To register a new user account, follow the procedure below.

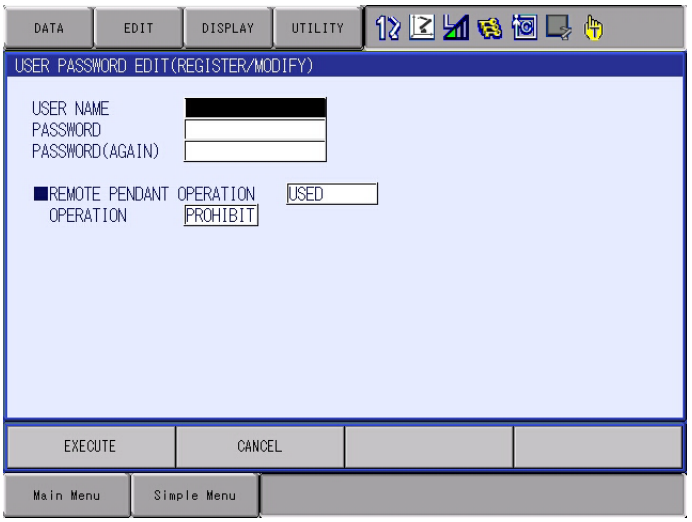
1. Select {SYSTEM INFO} - {USER PASSWORD} under the Main Menu.



2. The USER PASSWORD LIST window appears.
   Move the cursor to “USER NAME”, and press [SELECT].
3. The selection list appears.
   Move the cursor to “REGISTER”, and press [SELECT].

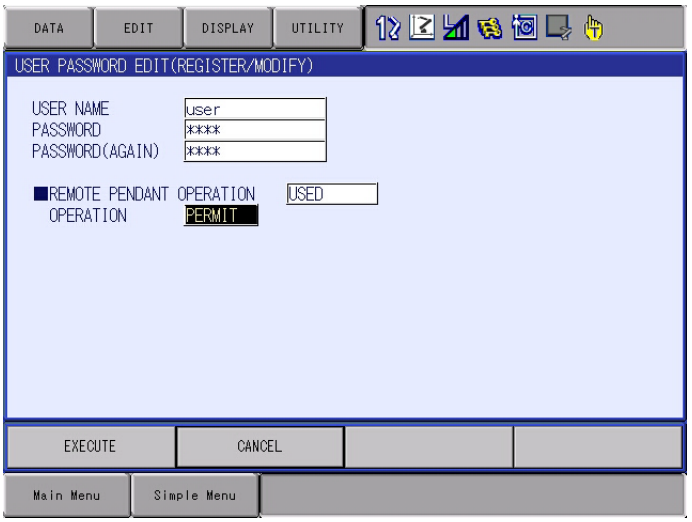


4. The USER PASSWORD EDIT (REGISTER/MODIFY) window appears.
   Make the settings for the user account as shown below.

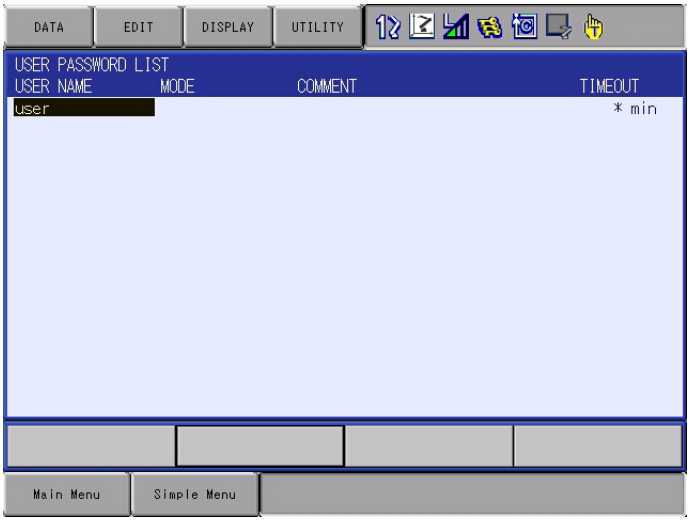


   – USER NAME:
     For the user name, 1 to 16 alphanumeric characters can be used.
   – PASSWORD:
     For the password, 4 to 16 numeric characters can be used.
   – REMOTE PENDANT OPERATION:
     Specify whether to use this user name or not in the remote pendant operation function. (USED/NOT USED)
   – OPERATION:
     Select the access level of the user. (PROHIBIT/PERMIT)

5. Press [ENTER] or select {EXECUTE}.



6. The user account is registered.

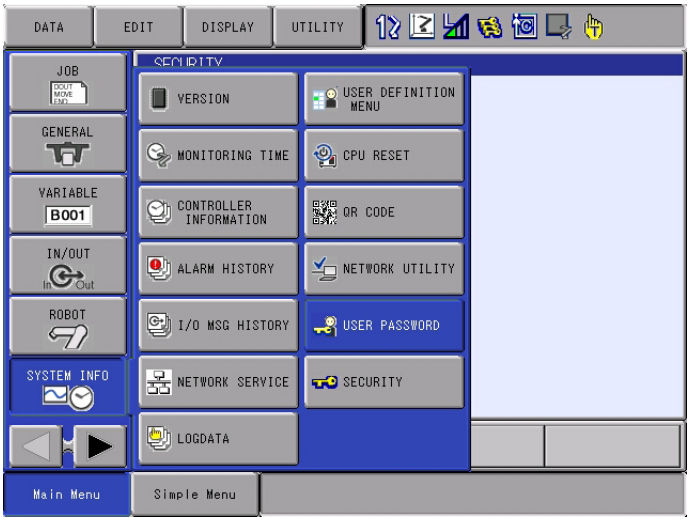


NOTE The above-mentioned procedure must be performed in the management mode or higher in the security mode (authorization).

6.19.4.2 Modification of a User Account

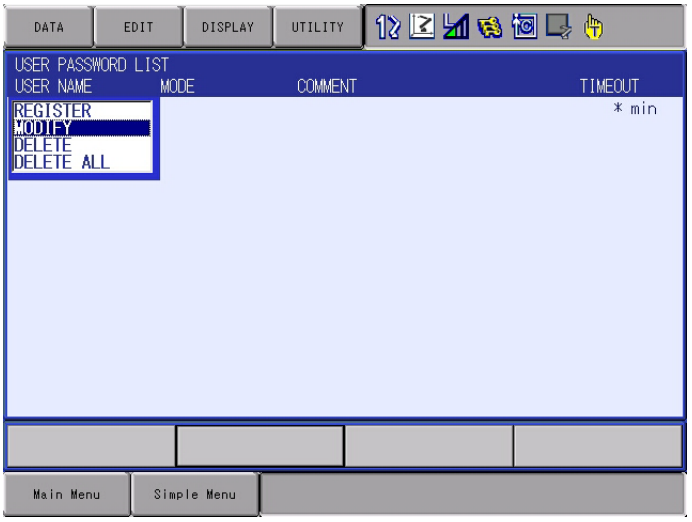
To modify the user account, follow the procedure below.

1. Select {SYSTEM INFO} - {USER PASSWORD} under the Main Menu.

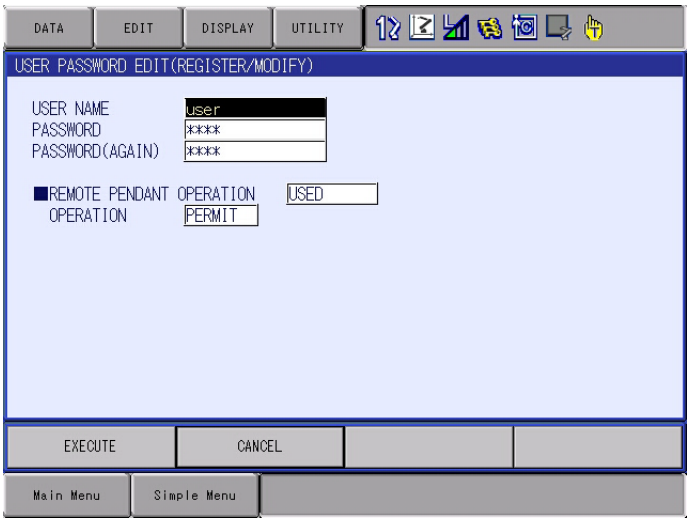


2. Move the cursor to the user name to be modified, and press [SELECT].

3. The selection list appears.
   Move the cursor to “MODIFY”, and press [SELECT].

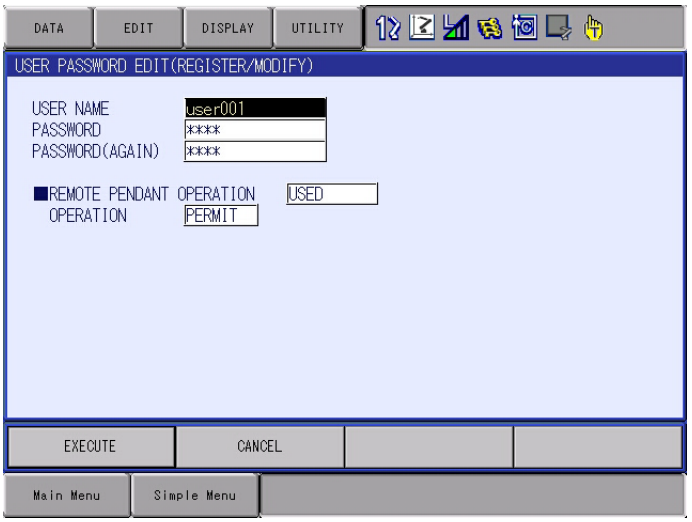


4. The USER PASSWORD EDIT (REGISTER/MODIFY) window appears.
   Set the user account as shown below.

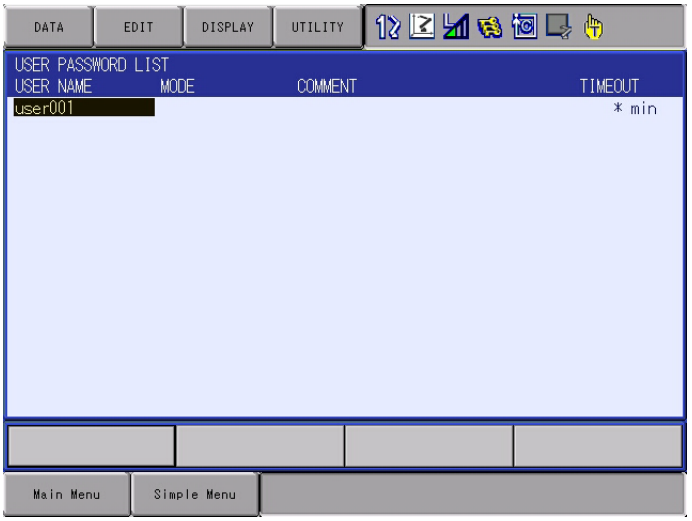


   – USER NAME:
     For the user name, 1 to 16 alphanumeric characters can be used.
   – PASSWORD:
     For the password, 4 to 16 numeric characters can be used.
   – REMOTE PENDANT OPERATION:
     Specify whether to use this user name or not in the remote pendant operation function. (USED/NOT USED)
   – OPERATION:
     Select the access level of the user. (PROHIBIT/PERMIT)

5. Press [ENTER] or select {EXECUTE}.



6. The user account is modified as specified.

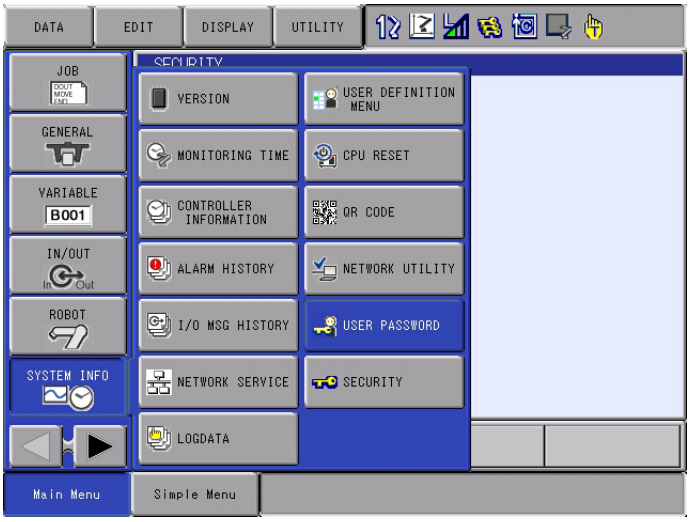


NOTE The above-mentioned procedure must be performed in the management mode or higher in the security mode (authorization).

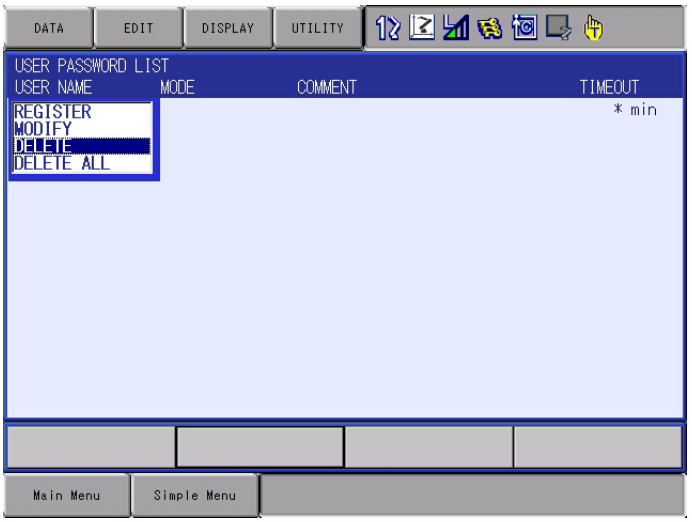
6.19.4.3 Deletion of a User Account

To delete the user account, follow the procedure below.

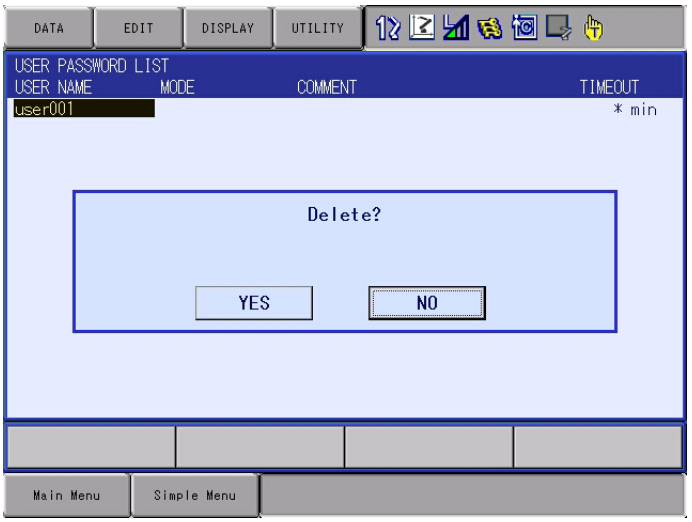
1. Select {SYSTEM INFO} - {USER PASSWORD} under the Main Menu.



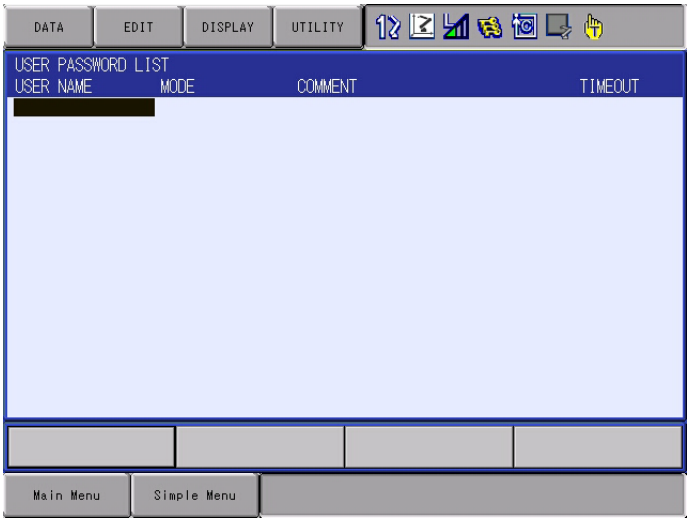
2. Move the cursor to the user name to be deleted, and press [SELECT].
3. The selection list appears.
   Move the cursor to “DELETE”, and press [SELECT].



4. The confirmation dialog “Delete?” appears.
   Select {YES}.



5. The user account is deleted.

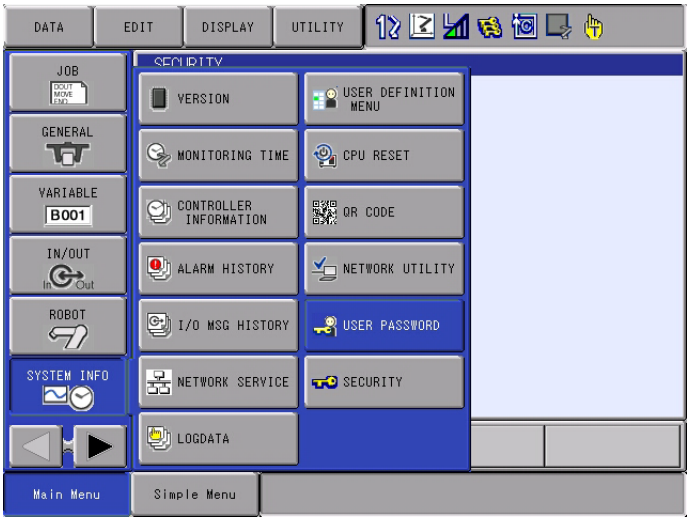


NOTE The above-mentioned procedure must be performed in the management mode or higher in the security mode (authorization).

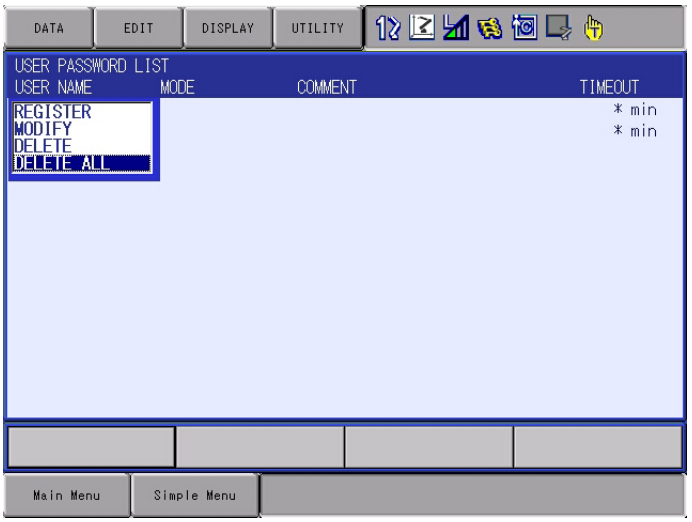
6.19.4.4 Deletion of All User Accounts

To delete all the user accounts, follow the procedure below.

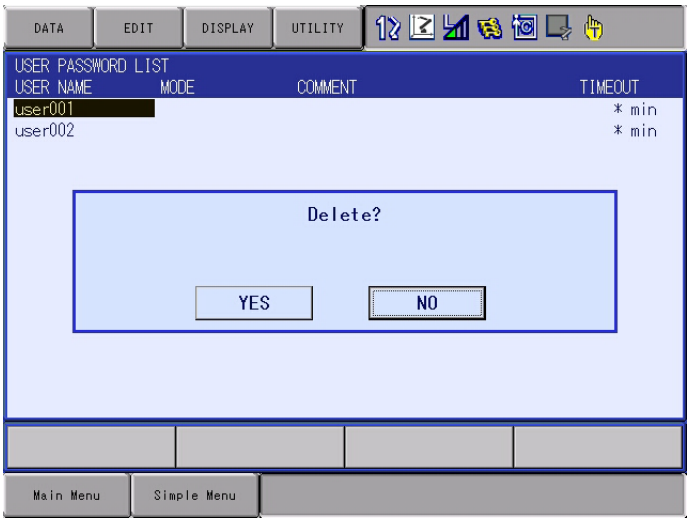
1. Select {SYSTEM INFO} - {USER PASSWORD} under the Main Menu.



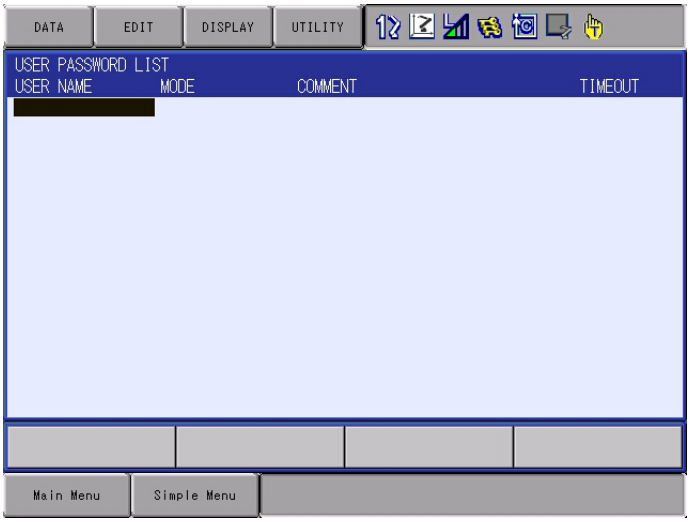
2. Move the cursor to “USER NAME”, and press [SELECT].
3. The selection list appears.
   Move the cursor to “DELETE ALL”, and press [SELECT].



4. The confirmation dialog “Delete?” appears.
   Select {YES}.



5. All the user accounts are deleted.



NOTE The above-mentioned procedure must be performed in the management mode or higher in the security mode (authorization).

6.19.5 Start-Up of the Remote Pendant

6.19.5.1 Start-Up of the Remote Server

To start up the remote server, follow the procedure below.

1. Select {REMOTE PENDANT} - {REMOTE SERVER START} under the Main Menu.



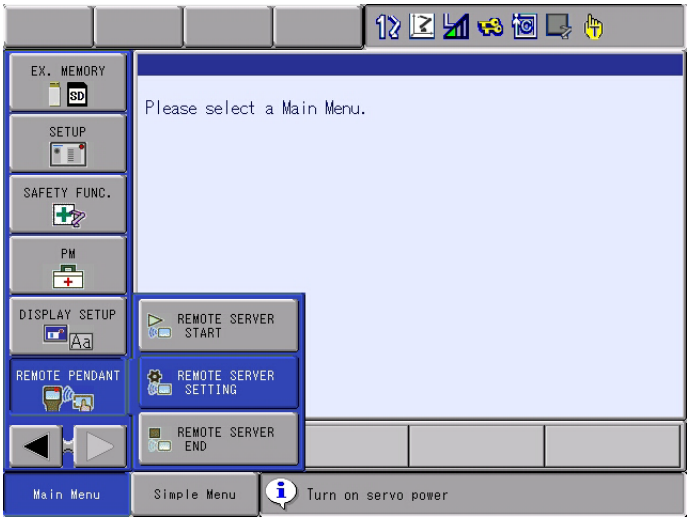
2. The confirmation dialog “Do you want to start a remote server?” appears.
   Select {Yes}.



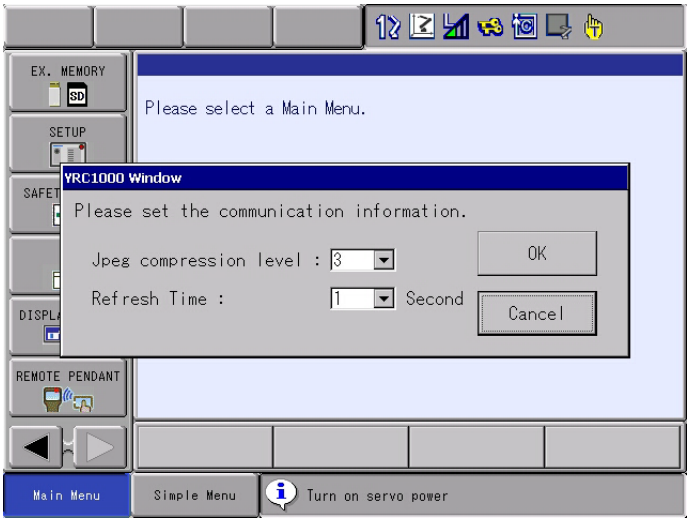
6.19.5.2 Settings for the Remote Server

To make the settings for the remote server, follow the procedure below.

1. Select {REMOTE PENDANT} - {REMOTE SERVER SETTING} under the Main Menu.



2. The settings window appears.
   Make the settings for the remote server as shown below.



   – Jpeg compression level:
     The Jpeg compression level can be specified within the range between 1 (low compression) to 5 (high compression).

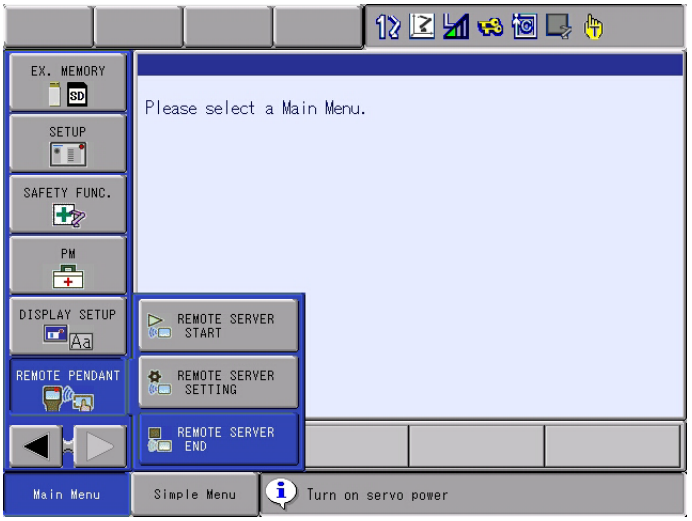
   – Refresh Time:
     The refresh interval at which the image on the display of the programming pendant is distributed to the client.

NOTE If the remote server is already started, the settings will not be reflected.

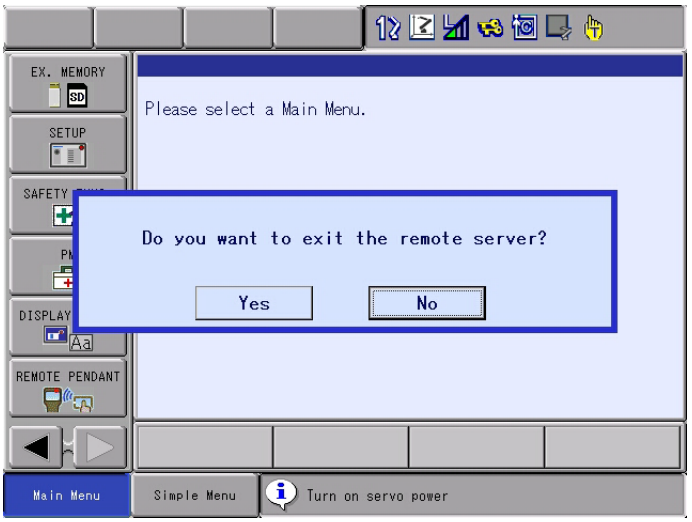
6.19.5.3 End of the Remote Server

To end the remote server, follow the procedure below.

1. Select {REMOTE PENDANT} - {REMOTE SERVER END} under the Main Menu.



2. The confirmation dialog “Do you want to exit the remote server?” appears.
   Select {Yes}.



6.19.5.4 Automatic Start-Up of the Remote Server

To activate automatic start-up of the remote server, set the parameter S2C1364 to 1.

After changing the parameter, turn the power OFF and ON again.

6.19.6 Operation of the Remote Pendant

6.19.6.1 Login

To log in, follow the procedure below.

1. Start up the web browser, and enter the following URL into the URL field.
   http://xxx.xxx.xxx.xxx:20080/
   – As “xxx.xxx.xxx.xxx”, enter the IP address specified according to *chapter 6.19.3.1 “Ethernet Cable Connections”* .
2. The Login window appears.
   Enter the user name assigned by the administrator into the “UserName” field.



3. Enter the password assigned by the administrator into the “Password” field.
4. Press “Login”.

NOTE When starting monitoring or operating the programming pendant from the client, the following message appears on the programming pendant.



– To access the programming pendant from the client, press {Yes} in the confirmation dialog box or leave the confirmation dialog as it is for a while.
If {No} is pressed, the programming pendant cannot be accessed from the client.

6.19.6.2 Monitoring

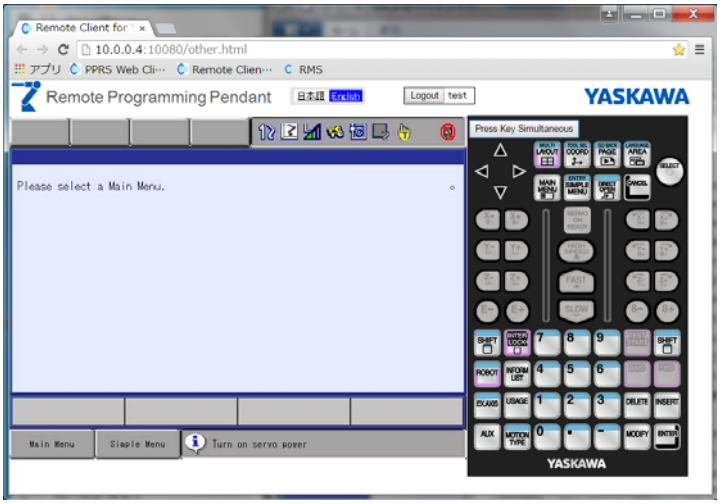
When the user without the authorization for the remote pendant operation logs in, the following window appears.



- “Logout” button
  Press the “Logout” button to end monitoring of the remote pendant and return to the Login window.

6.19.6.3 Operation

When the user with the authorization for the remote pendant operation logs in, the following window appears.



- “Press Key Simultaneous” button
  By pressing this {Press Key Simultaneous} button, 2 keys can be pressed simultaneously.
- Other buttons
  These buttons have the same functions as the keys on the programming pendant.
  Axis keys, TEST START, BWD, and FWD cannot be used.
- “Logout” button
  Press this {Logout} button to exit the remote pendant operation and return to the login window.
- Operation on the programming pendant display by using the mouse
  Touch-screen operation on the programming pendant can also be performed by using the mouse.
  The icon ○ blinks where the cursor is located.

6.20 High Accuracy Path Control Function

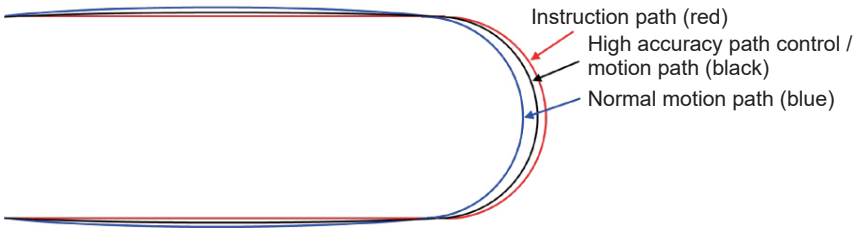
6.20.1 Description of High Accuracy Path Control Function

The high accuracy path control function allows the motion path of the manipulator to be with high accuracy by moving the motion path of the manipulator to the command path closer.

Using this function, the path difference during the linear interpolation or the inward-turning amount during the circular interpolation is reduced.

The operation command speed slows down automatically to reproduce the operation-command trajectory more faithfully during the circular interpolation. The operation command speed is adjusted automatically, therefore, the adjustment of the teaching speed does not have to be done while confirming the path and the teaching work can be reduced.

Fig. 6-6: Image of the operation-command trajectory and the motion path



NOTE

Using this function, the operation of the manipulator may vibrate depending on the teaching position or the teaching speed.

Correct the teaching position and the teaching speed when the operation of the manipulator vibrates. Or disable the high accuracy path control function.

NOTE

Using this function, the shock sensor may occur.
When the shock sensor occurs, change the shock sensor level.

For details, refer to chapter 8.7 Shock Detection Function in YRC1000micro INSTRUCTIONS (RE-CTO-A222).

6.20.2 Instruction of High Accuracy Path Control Function

The instructions, HTRAJON and HTRAJOF, are used for the function of the high accuracy path control.

The high accuracy path control will be valid in the operation of the area between the HTRAJON instruction and the HTRAJOF instruction.

The high accuracy path control function can be used for the manipulator.

NOTE

Use the high accuracy path control in the operating area where the highly accurate path is required.

■ **HTRAJON Instruction**

This is the instruction to enable the high accuracy path control.

This instruction is applied during the playback or test operation, not during the axis operation.

The additional items of the HTRAJON instruction are shown below.

HTRAJON R1 RND=1
① ②

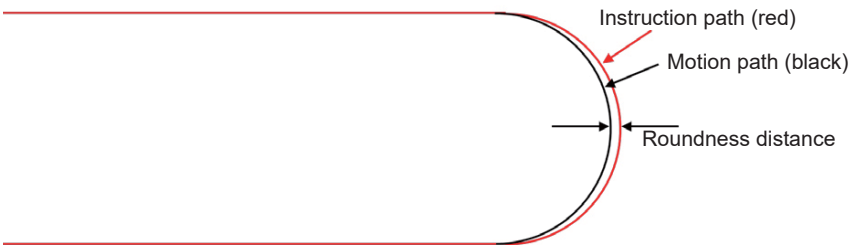
① Select robot
Select the robot to apply the high accuracy path control.
If omitted, this instruction is enabled to the robot specified by the JOB control group.

② Roundness Distance Specification
When the circular interpolation operation (or the consecutive MOVC instruction) is in the high accuracy path control area, the amount of inward turning operation (=roundness distance) of the motion path for the manipulator to the circular interpolation operation can be specified.

Unit: 0.001 mm

This specification can be omitted. If omitted, the roundness distant specification will be operated in the default value, 0.5 mm.

Fig. 6-7: Roundness Distance



■ **HTRAJOF Instruction**

This is the instruction to end the high accuracy path control.

HTRAJOF R1
①

① Select robot
Select the robot to end the high accuracy path control.

SUPPLE-MENT

In the high accuracy path control area which is between the HTRAJON instruction and the HTRAJOF instruction, the positioning zone (PL) can be used at the circular interpolation operation (the consecutive MOVC instruction) or the different kind of steps for the interpolation instruction.

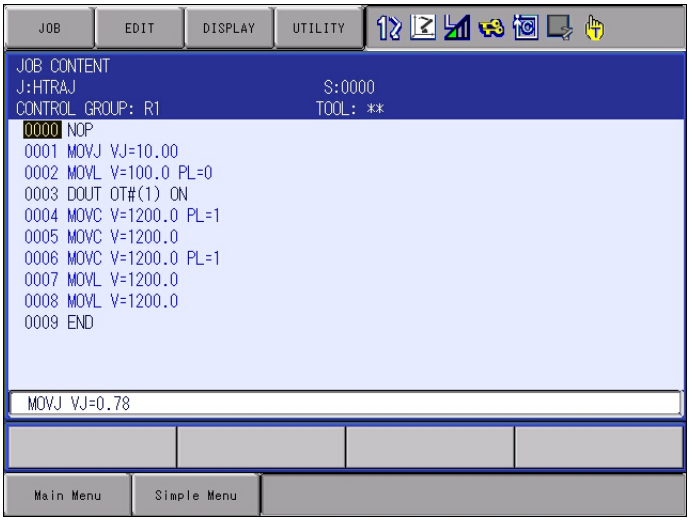
* The consecutive circular interpolation (MOVC instruction) is corresponding to only when PL=0.

For details of the positioning zone, refer to *chapter 8.2.0.8 "S1CxG033 to S1CxG040: POSITIONING ZONE"* .

6.20.3 Instruction Registration of High Accuracy Path Control Function

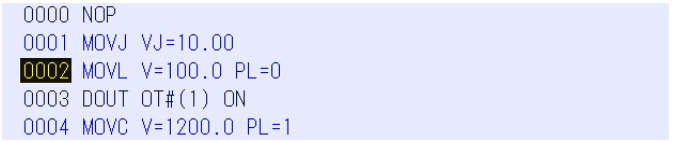
When the cursor is in the address area, the instruction can be registered by using the JOB CONTENT window. Perform following operations before registering the instruction.

1. Select {JOB} under the main menu.
2. Select {JOB CONTENT}.
3. Move the cursor to the address area.



■ **HTRAJON Instruction**

1. Move the cursor to one line above the place to register HTRAJON.



2. Press [INFORM LIST].
3. Select {OTHER}.
   – The instruction list dialog appears.



4. Select {HTRAJON}.
   – The HTRAJON instruction is indicated in the input buffer line.



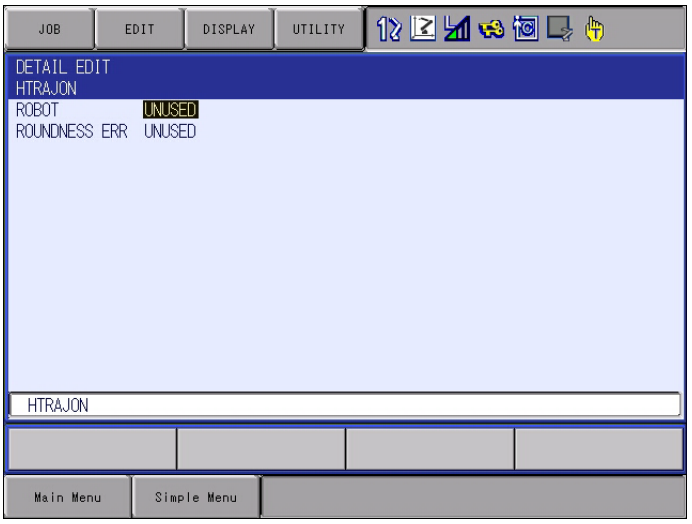
5. Change the additional item or number values.

<When nothing to be changed>

Proceed to step 6.

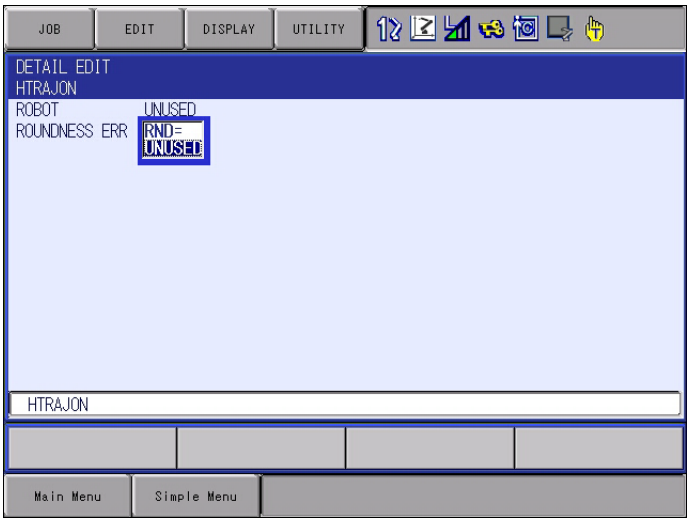
When the robot or the roundness distance specification is changed.

(1) Move the cursor to the instruction in the input buffer line and press [SELECT].
The DETAIL EDIT window appears.



(2) Move the cursor to “UNUSED” of the additional item to be changed, and then press [SELECT].
The selection dialog is displayed.

(3) Move the cursor to “UNUSED” of the additional item to be changed, and then press [SELECT].



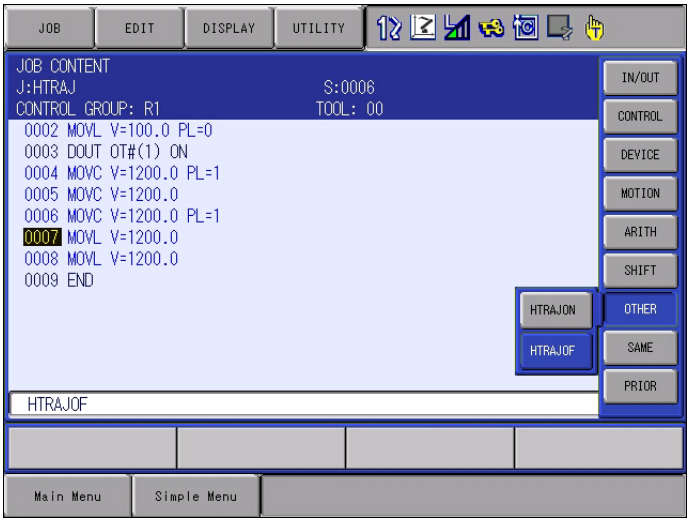
(4) When the additional item is changed, press [ENTER].
The DETAIL EDIT window closes, and the JOB CONTENT window appears.

6. Press [INSERT] and [ENTER].
   – The instruction indicated in the input buffer line is registered.

```
0001 MOVJ VJ=10.00
0002 MOVL V=100.0 PL=0
0003 HTRAJON
0004 DOUT OT#(1) ON
0005 MOVC V=1200.0 PL=1
```

■ **HTRAJOF Instruction**

1. Move the cursor to one line above the place to register HTRAJOF.
2. Press [INFORM LIST].
   – The instruction list dialog appears.



3. Select {OTHER}.
4. Select {HTRAJOF}.
   – HTRAJOF instruction appears on the input buffer line.

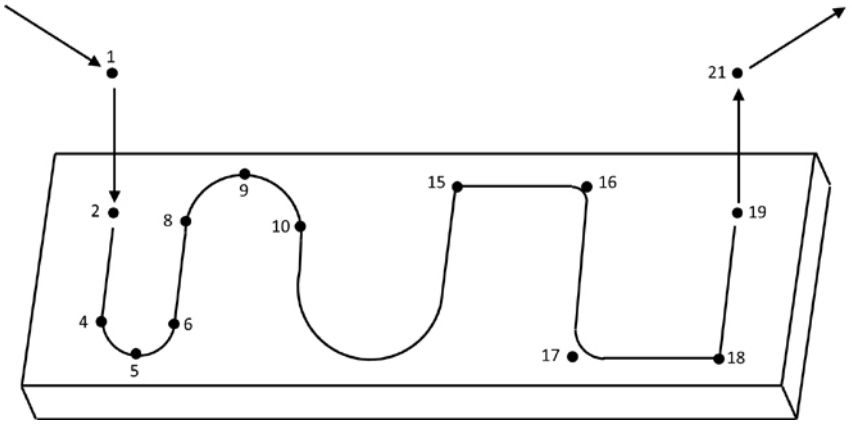


5. Press [INSERT] and [ENTER].
   – HTRAJOF instruction is registered.

```
0006 MOVC V=1200.0 PL=1
0007 MOVL V=1200.0
0008 HTRAJOF
0009 MOVL V=1200.0
0010 END
```

6.20.4 Example of High Accuracy Path Control Function

JOB examples to use the high accuracy path control function are shown below.




```
0000  NOP
0001  MOVJ VJ=10.00
0002  MOVL V=100.0 PL=0
0003  HTRAJON          …High Accuracy Path Control Function starts.
      DOUT             The operation starts.
0004  MOVC V=1200.0 PL=1
0005  MOVC V=1200.0
0006  MOVC V=1200.0 PL=1
0007  MOVL V=1200.0
0008  MOVC V=1200.0 PL=1
0009  MOVC V=1200.0
0010  MOVC V=1200.0 PL=1
0011  MOVL V=1200.0
0012  MOVC V=1200.0 PL=1
0013  MOVC V=1200.0
0014  MOVC V=1200.0 PL=1
0015  MOVL V=1200.0 PL=0
0016  MOVL V=1200.0 PL=3
0017  MOVL V=1200.0 PL=8
0018  MOVL V=1200.0 PL=0
0019  MOVL V=1200.0
0020  HTRAJOF          …High Accuracy Path Control Function ends.
0021  MOVJ VJ=10.00
0022  END
```

Circular operation can be done by teaching the consecutive circular interpolation (or the consecutive MOVC instruction).
The circular operation moves at the limited speed for the inward-turning only the specified roundness distance.

Amount of inward-turning can be adjusted by using the specified the positioning (PL).
For details of the positioning zone, refer to *chapter 8.2.0.8 "S1CxG033 to S1CxG040: POSITIONING ZONE"* .

6.21 Speed Priority Control Function

6.21.1 Speed Priority Control Function

Speed priority control function enables the manipulator to move at the specified speed even when the distance between teaching positions is short.

When the distance between teaching positions is short, the manipulator may move at the slower speed than the specified speed as shown in the figure due to the required distance is not enough to reach the specified speed.

By using the speed priority control function, the manipulator moves at the specified speed, as shown in the figure, even when the distance between teaching positions is short.

Fig. 6-8: Operating Speed When the Distance Between Teaching Positions is Short

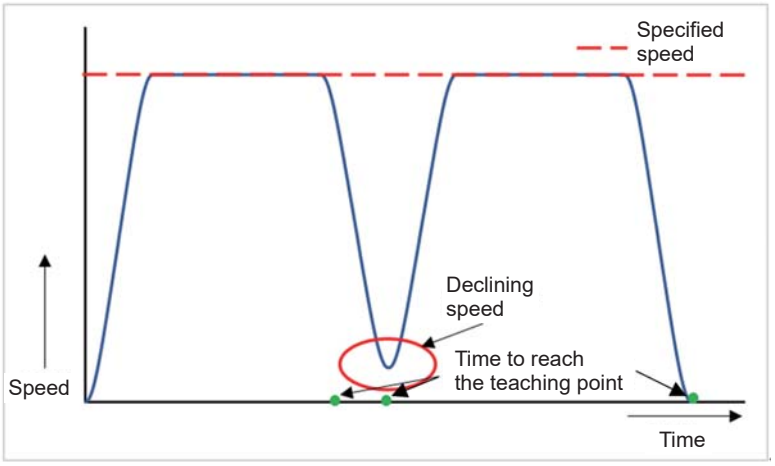
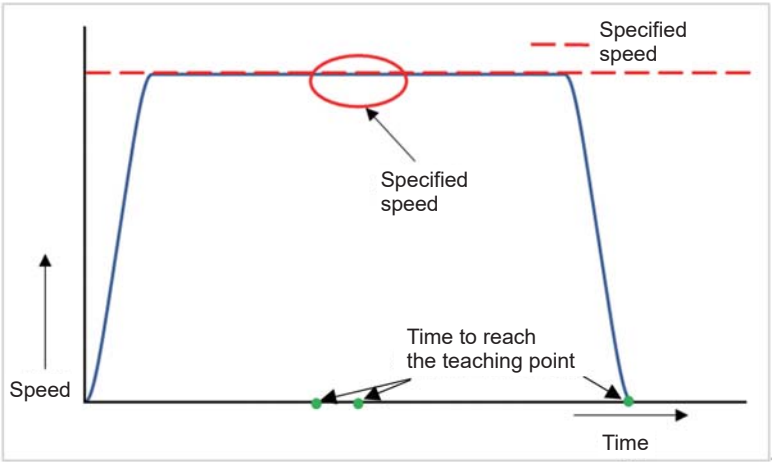


Fig. 6-9: Operating Speed When Using the Speed Priority Control Function



NOTE

This function moves the manipulator at the speed priority, therefore, the manipulator may vibrate.

When the manipulator vibrates, set the move instruction to ACC (acceleration adjustment ratio) or DEC (deceleration adjustment ratio), or review the teaching speed.

NOTE

This function may not make the teaching motion speed reach the specified speed.

When the motion speed does not reach the specified speed, review the posture or the motion speed of the manipulator.

NOTE

This function makes the manipulator move at the forcibly specified speed.

When using this function, set only the required range to the speed priority control range.

6.21.2 Instruction

6.21.2.1 Instruction of the Speed Priority Control Function

The instructions, HPVELON and HPVELOF are used for the function of the speed priority control.

- **HPVELON Instruction**
  This is the instruction to start the speed priority control.

  This instruction is executed only at the playback or the test operation, not executed during the axis operation.

  HPVELON

- **HPVELOF Instruction**
  This is the instruction to end the speed priority control.

  HPVELOF

NOTE

Even in the speed priority instruction area, in case falling under any conditions of the following, the speed priority control function is not enabled.

- In case that the current step interpolation is except for the linear interpolation (MOVL instruction) and the circular interpolation (MOVC instruction).
- In case that the motion of the previous step and the current step is not continued.
- In case that the teaching position of the previous step and the current step is matched.
- In case that the distance between steps is long.
- In case that the positioning level is set to the current step.
- In case that the angle of the previous step and the current step is larger than the reference value of the speed priority instruction angle.

θ: Angle of the previous step and the current step

→: The previous step
→: The current step



The reference value of the speed priority instruction angle is set by the parameter. For details of this parameter, described in the following *chapter 6.21.2.2 "Parameter of the Speed Priority Control Function"* .

NOTE

This function affects the step motion of the outer range, therefore, the speed priority control function is not enabled at the right after the step of the HPVELON instruction and the right before the step of the HPVELOF instruction.

6.21.2.2 Parameter of the Speed Priority Control Function

The reference value of the speed priority instruction angle is set by the following parameter.

S3C	Details
1395	Reference value of the speed priority instruction angle (Unit: 0.1 degrees) 0 (initial setting value): 25.0 degrees

6.21.2.3 Registration of the Instruction of the Speed Priority Control Function

When the cursor is in the address area, the instruction can be registered by using the JOB CONTENT window. Perform following operations before registering the instruction.

1. Select {JOB} under the main menu.
2. Select {JOB CONTENT}.
3. Move the cursor to the address area.



■ **HPVELON Instruction**

1. Move the cursor to one line above the place to register HPVELON.



2. Press [INFORM LIST].
3. Select {OTHER}.
   – The instruction list dialog box appears.



4. Select {HPVELON}.
   – The HPVELON instruction is indicated in the input buffer line.



5. Press [INSERT] and [ENTER].
   – HPVELON instruction is registered.



■ **HPVELOF Instruction**

1. Move the cursor to one line above the place to register HPVELOF.



2. Press [INFORM LIST].
3. Select {OTHER}.
   – The instruction list dialog box appears.



4. Select {HPVELOF}.
   – The HPVELOF instruction is indicated in the input buffer line.



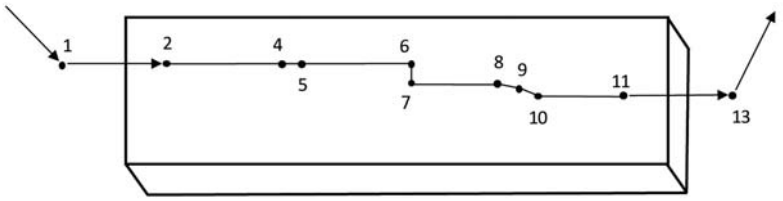
5. Press [INSERT] and [ENTER].
   – HPVELOF instruction is registered.



6.21.3 Example

6.21.3.1 Motion Example of the Speed Priority Control

JOB examples to use the speed priority control function are shown below.



Line	Instruction	
0000	NOP	
0001	MOVJ VJ=10.00	
0002	MOVL V=320.0	
0003	HPVELON	: Speed priority control function starts.
0004	MOVL V=320.0	: ①
0005	MOVL V=320.0	
0006	MOVL V=320.0	
0007	MOVL V=320.0	: ②
0008	MOVL V=320.0	
0009	MOVL V=320.0	: ③
0010	MOVL V=320.0	: ④
0011	MOVL V=320.0	
0012	HPVELOF	: Speed priority control function ends.
0013	MOVJ VJ=10.00	
0014	END	

When the manipulator moves at the slower speed than the specified speed due to the distance to the teaching position such as the motion instruction ① to ④ is short, the motion can be executed at the specified constant speed.

6.22 Alarm Contents Customize Function

With the alarm contents customize function, the user alarm file (CSV file) created and registered by the user is displayed on the alarm contents window when the user alarm (8000s) and the user I/O alarm (9000s) occurs.

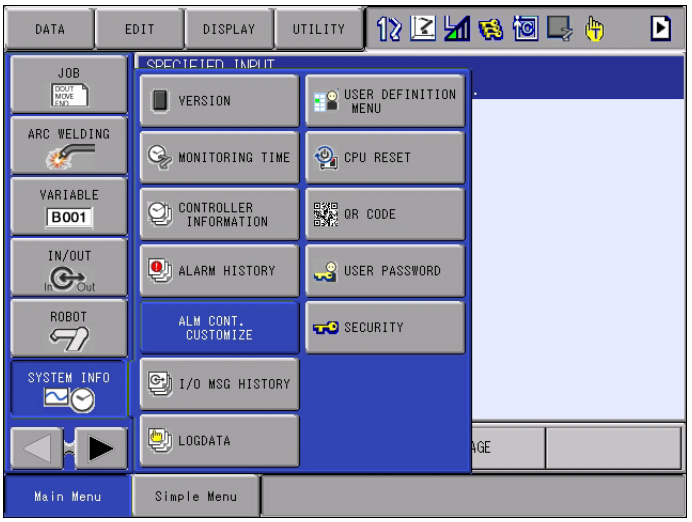
This function is available for YBS2.10-00 or later.

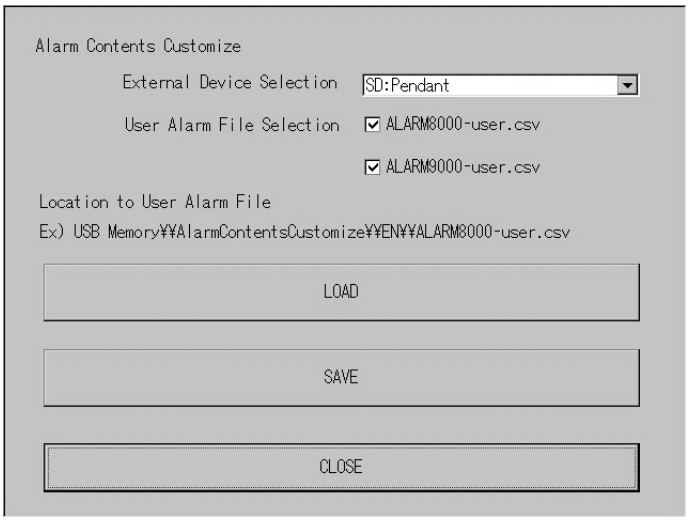
Operation procedures (overview) are described in this chapter.

- Save the default user alarm file to the external device from the alarm contents customize window.
- Edit the user alarm file on PC.
- Load the user alarm file to the programming pendant from the alarm contents customize window.

6.22.1 Alarm Contents Customize Window

1. Set the security to the management mode or higher.
2. Select {SYSTEM INFO} - {ALM CONT. CUSTOMIZE} under the main menu.
   – The Alarm Contents Customize window appears.





3. Perform loading and saving operations of the user alarm file on the Alarm Contents Customize window.

   • External Device Selection
   Select either “SD:Pendant” or “USB:Pendant” from the pull-down menu. (“SD:Pendant” is set by default.)
   Processing is performed for the selected device.

   • User Alarm File Selection
   Select a user alarm file to load and save.
   (All files are checked and enabled by default.)
   If no files are checked, they will be disabled and an error will be displayed.

   • LOAD
   Load the targeted user alarm file to the programming pendant from the external device.
   User alarm files of all the languages stored in the external device are all saved.
   If a user alarm file is not stored in the programming pendant, save the default user alarm file.

   • CLOSE
   Close the alarm contents customize window.

6.22.2 Storage Location of the User Alarm File of the External Device

When loading a user alarm file, correctly set the folder configuration and the file storage location of the external device.

Storage Card / USB Memory	
|-- AlarmContentsCustomize	Storage folder of the user alarm file
|-- Default	Storage folder of the default user alarm file
|-- ALARM8000-user.csv	Default user alarm file (Used for saving only)
|-- ALARM9000-user.csv	
|-- XX	Language name folder (JP, EN, CN, etc. Multiple setting is available)
|-- ALARM8000-user.csv	Created user alarm file
|-- ALARM9000-user.csv	

Language name folder

JP	…	Japanese
EN	…	English
DE	…	German
SE	…	Swedish
FR	…	French
FI	…	Finnish
IT	…	Italian
ES	…	Spanish
KR	…	Korean
CN	…	Simplified Chinese
TW	…	Traditional Chinese
CZ	…	Czech
PL	…	Polish
RU	…	Russian
TH	…	Thai
NL	…	Dutch
ID	…	Indonesian
PT	…	Portuguese
TR	…	Turkish
SL	…	Slovene
RO	…	Romanian
SK	…	Slovak

6.22.3 Rules for Creating User Alarm File (CSV File)

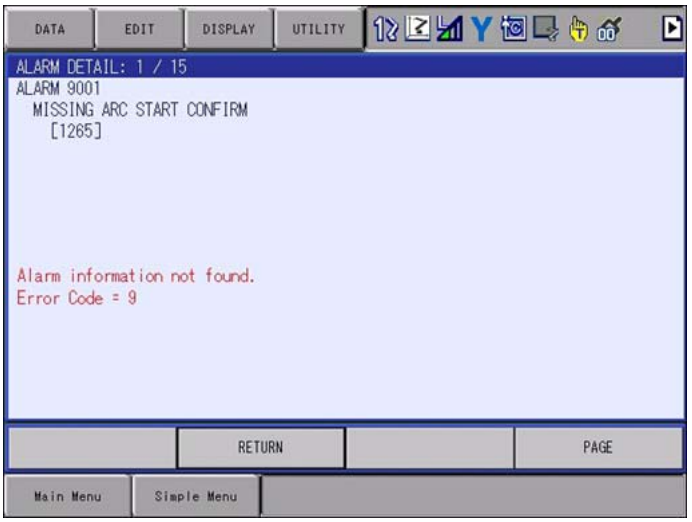
Create the user alarm file according to the following rules.

- Edit with a text editor.
- Use a comma (,) for delimiter between items.
- When using a double quotation mark (“) as a character, write two consecutive double quotations.
- When using a comma (,) as contents of the item, enclose the corresponding entire characters in double quotations.
- If the number of characters used for the contents of Cause increase, insert a line feed code.
- Do not use ‘0’ in the sub code.
- It is also possible not to specify a sub code value.
- To set multiple sub codes for one alarm, write to multiple lines.
- When setting multiple sub codes for one alarm, the data for setting the sub code value and the data without setting the sub code value cannot be mixed.
- When setting multiple sub codes for one alarm code, set “Alarm Number”, “Alarm Name/Message”, and “Contents” only for the first data.
- Insert a line feed code at the end of each data.
- When "Notes"of the last data has multiple lines, enclose the entire characters for Notes in double quotations.

6.22.4 Error Code List of the Alarm Detail Window

If the user alarm file is not set correctly, the error message and the error code will be displayed when the ALARM DETAIL window appears.

Set the user alarm file correctly in this case.



Error Code	CAUSE	MEASURE
9	Alarm Number is not found.	Check that the described contents of the Alarm Number and the format are correct.
10 13	Sub code is not found.	Check that the described contents of the Sub Code and the format are correct.
11	Cause and Remedy are not found.	Check that the described contents of the Cause or later and the format are correct.
14 21	When there are multiple Cause and Remedy, the second and subsequent Cause and Remedy are not found.	Check that the described contents of the Cause or later and the format are correct.
15 18	When there are multiple Sub Code, the second and subsequent Alarm Name/Message, Contents, and Sub Code are not found.	Check that the described contents of the Alarm Number/Message or later and the format are correct.
19	When there are multiple Meaning, the second and subsequent Meaning are not found.	Check that the described contents of the Meaning or later and the format are correct.

■ **Error Code=10**

Example: A comma is not set for the Sub Code.

```
Alarm Number,Alarm Name/Message,Contents,Sub Code,Meaning,Cause,Remedy,Figure1,Figure2,Detail,Notes
9001,PNOZMULTI BASE UNIT FAULT,PNOZMULTI BASE UNIT FAULT
,1265
```

Correction method: Set a comma for the Sub Code.

```
Alarm Number,Alarm Name/Message,Contents,Sub Code,Meaning,Cause,Remedy,Figure1,Figure2,Detail,Notes
9001,PNOZMULTI BASE UNIT FAULT,PNOZMULTI BASE UNIT FAULT
,1265,INSTALLATION FAULT,"NOT PROPERLY INSTALLED.","NOT PROPERLY INSTALLED.REPLACE PNOZMULTI MODULE.",,,,
```

■ **Error Code=13**

Example: Sub Code is not correct. (1266 has been set instead of 1265.)

```
Alarm Number,Alarm Name/Message,Contents,Sub Code,Meaning,Cause,Remedy,Figure1,Figure2,Detail,Notes
9001,PNOZMULTI BASE UNIT FAULT,PNOZMULTI BASE UNIT FAULT,1266,EM1000PNOZM1P INSTALLATION FAULT,"THE
PNOZMULTI MODULE IN THE ROBOT CONTROLLER IS NOT PROPERLY INSTALLED.","THE PNOZMULTI MODULE IN THE ROBOT
CONTROLLER IS NOT PROPERLY INSTALLED.REPLACE PNOZMULTI MODULE.",,,,
```

Correction method: Set 1265 for the Sub Code.

```
Alarm Number,Alarm Name/Message,Contents,Sub Code,Meaning,Cause,Remedy,Figure1,Figure2,Detail,Notes
9001,PNOZMULTI BASE UNIT FAULT,PNOZMULTI BASE UNIT FAULT,1265,EM1000PNOZM1P INSTALLATION FAULT,"THE
PNOZMULTI MODULE IN THE ROBOT CONTROLLER IS NOT PROPERLY INSTALLED.","THE PNOZMULTI MODULE IN THE ROBOT
CONTROLLER IS NOT PROPERLY INSTALLED.REPLACE PNOZMULTI MODULE.",,,,
```

■ **Error Code=15**

Example: No line feed code at the last line.

```
Alarm Number,Alarm Name/Message,Contents,Sub Code,Meaning,Cause,Remedy,Figure1,Figure2,Detail,Notes
9001,PNOZMULTI BASE UNIT FAULT,PNOZMULTI BASE UNIT FAULT,1265,EM1000PNOZM1P INSTALLATION FAULT,THE
PNOZMULTI MODULE IN THE ROBOT CONTROLLER IS NOT PROPERLY INSTALLED.,"THE PNOZMULTI MODULE IN THE ROBOT
CONTROLLER IS NOT PROPERLY INSTALLED.REPLACE PNOZMULTI MODULE.",,,,
,,,,,"NOT PROPERLY INSTALLED.","NOT PROPERLY INSTALLED.REPLACE PNOZMULTI MODULE.",,,,
```

Correction method: Insert a line feed code at the last line.

■ **Error Code=19**

Example: The data of the Meaning or later is not set.

```
Alarm Number,Alarm Name/Message,Contents,Sub Code,Meaning,Cause,Remedy,Figure1,Figure2,Detail,Notes
9001,PNOZMULTI BASE UNIT FAULT,PNOZMULTI BASE UNIT FAULT,1265,EM1000PNOZM1P INSTALLATION FAULT,THE
PNOZMULTI MODULE IN THE ROBOT CONTROLLER IS NOT PROPERLY INSTALLED.,"THE PNOZMULTI MODULE IN THE ROBOT
CONTROLLER IS NOT PROPERLY INSTALLED.REPLACE PNOZMULTI MODULE.",,,,
,,,
```

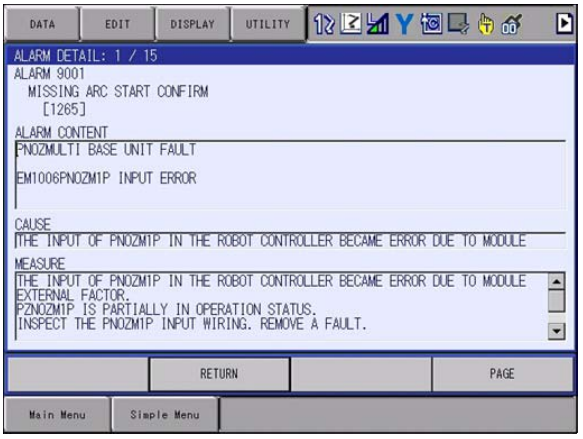
Correction method: Set the data of the Meaning or later and insert a line feed code.

```
Alarm Number,Alarm Name/Message,Contents,Sub Code,Meaning,Cause,Remedy,Figure1,Figure2,Detail,Notes
9001,PNOZMULTI BASE UNIT FAULT,PNOZMULTI BASE UNIT FAULT,1265,EM1000PNOZM1P INSTALLATION FAULT,THE
PNOZMULTI MODULE IN THE ROBOT CONTROLLER IS NOT PROPERLY INSTALLED.,"THE PNOZMULTI MODULE IN THE ROBOT
CONTROLLER IS NOT PROPERLY INSTALLED.REPLACE PNOZMULTI MODULE.",,,,
,,,EM1000PNOZM1P INSTALLATION FAULT,"THE PNOZMULTI MODULE IN THE ROBOT CONTROLLER IS NOT PROPERLY
INSTALLED.","THE PNOZMULTI MODULE IN THE ROBOT CONTROLLER IS NOT PROPERLY INSTALLED.REPLACE PNOZMULTI
MODULE.",,,,
```

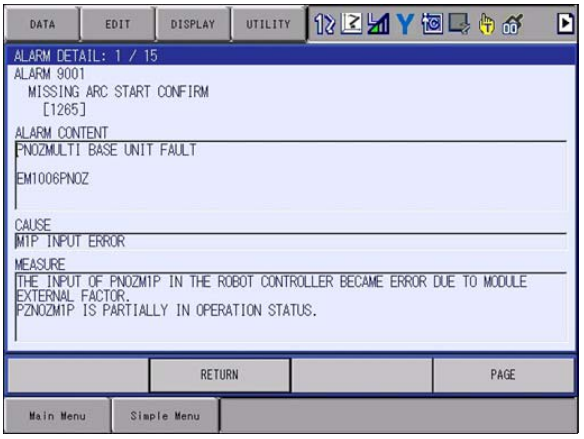
If the described contents of the user alarm file have an error, the error message is not displayed when the ALARM DETAIL window appears, or may be displayed incorrectly.

In this case, check the described contents of the user alarm file and load the corrected user alarm file.

■ **Example: Comma is used as a character without using double quotation.**



Normal display



Error display

NOTE

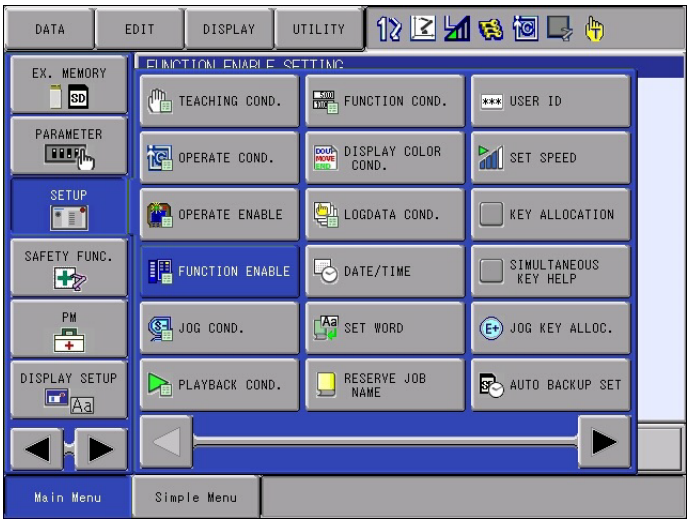
- The user alarm file is only stored in the programming pendant.
  Load the user alarm file again when the programming pendant is replaced.
- When setting the user alarm file in the multiple functions, correct the user alarm file already loaded.
- When deleting the user alarm file, load the user alarm that set empty data.

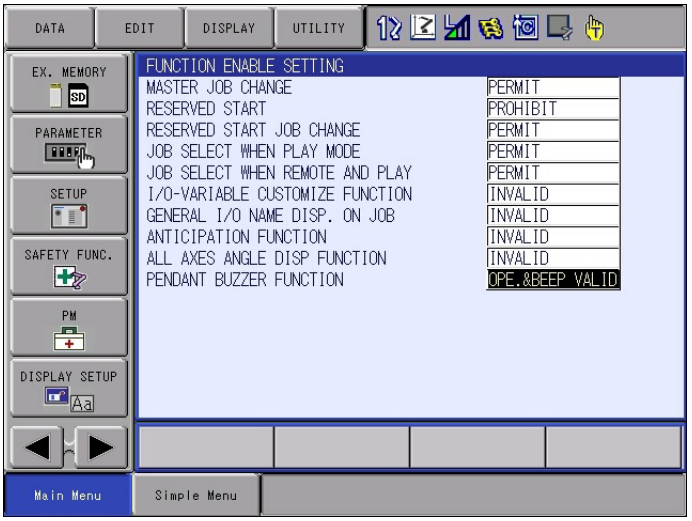
6.23 Pendant Buzzer Function

The pendant buzzer function controls operation sounds (touch sounds and key tones) of the programming pendant and beep sounds (alarms, errors, registration) after connecting to the controller.

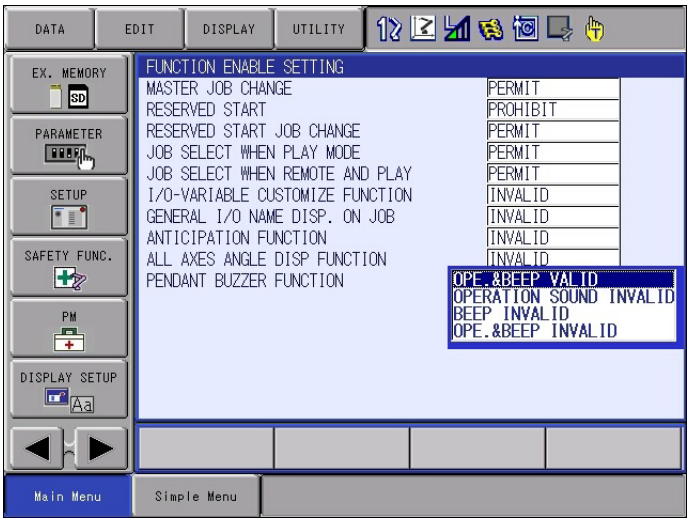
This function is available for YBS2.10-00 (pendant OS 1.06 or later).

1. Set the security to the management mode or higher.
2. Select {SETUP} - {FUNCTION ENABLE} under the main menu.
   – The FUNCTION ENABLE SETTING window appears.

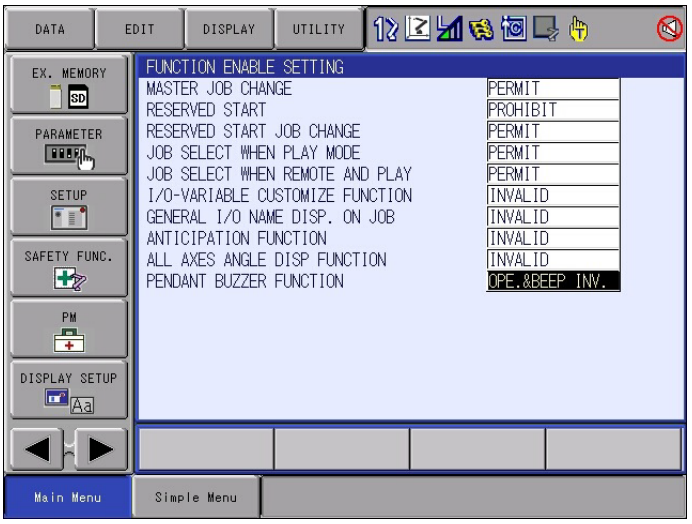




3. Select the setting item {PENDANT BUZZER FUNCTION}.
   – The selection list appears.



4. When OPERATION SOUND INVALID, BEEP INVALID, or OPE.&BEEP INVALID is set, the pendant buzzer invalid icon appears in the status area.



NOTE The operation sounds of the programming pendant and the beep sounds cannot be controlled before connecting to the controller. (Operation and beep sounds cannot be disabled.)

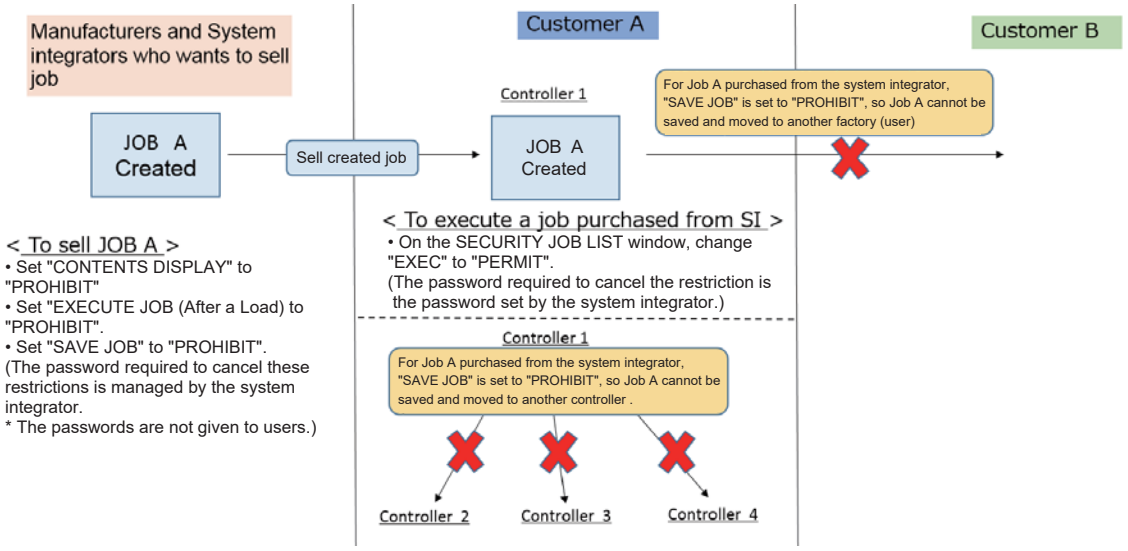
6.24 Job Security Function

The job security function allows a password to be set for each target job so that created jobs cannot be easily distributed to other controllers.

This function is available for YBS2.35-00 or later.

This function can be set and changed when the security mode is management mode or higher.

Example Usage: Selling a Job Created by a System Integrator



Each target job can be managed by setting password information (4 to 16 half-width alphanumeric characters) for the following three types of security settings.

- Display/hide job contents
- Execute job after loading
- Permit/prohibit job saving

Parameter	Details and Setting Values	Default Value
S2C1560	Shows or hides the permit save setting item. 0: Hide the permit save setting item. 1: Show the permit save setting item.	0

The loss of jobs can be prevented by managing jobs with passwords to hide the contents of jobs, to prevent jobs from being executed on other controllers after loading, and to prevent saving jobs to external memory devices.

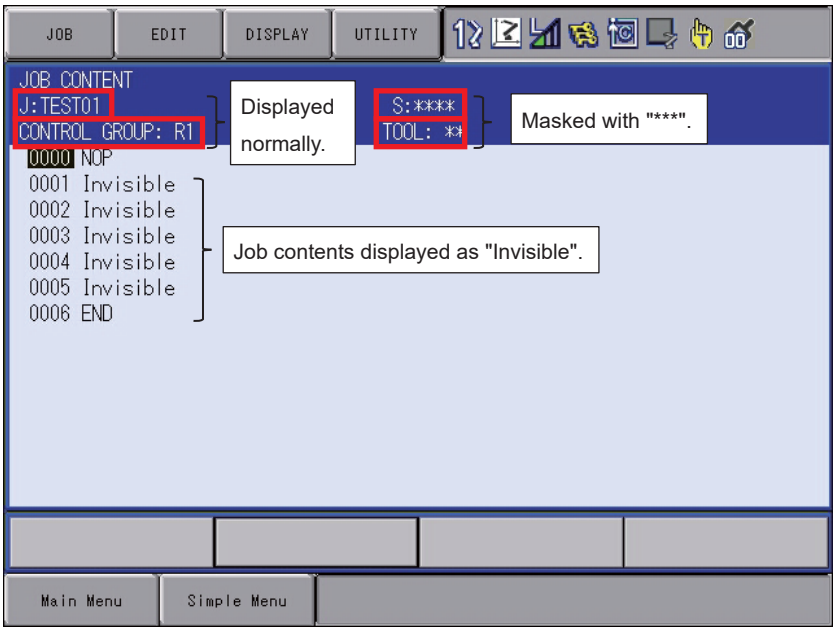
The security settings ("CONTENTS DISPLAY", "EXECUTE JOB (After a Load)", and PERMIT/PROHIBIT for "SAVE JOB") can be set for jobs, macro jobs, and system jobs. However, the security settings cannot be set for the job edit function during playback.

6.24.1 Prohibiting the Display of Job Contents

You can prohibit displaying the contents of each job in order to hide the contents of those jobs. For a job with "CONTENTS DISPLAY" set to "PROHIBIT", all instructions on the JOB CONTENT window are displayed as "Invisible" except for the NOP and END instructions.

For a job with "CONTENTS DISPLAY" set to "PROHIBIT", only the job name and control group are displayed.

- Job with "CONTENTS DISPLAY" Set to "PROHIBIT"



The following operations are restricted for jobs with "CONTENTS DISPLAY" set to "PROHIBIT".

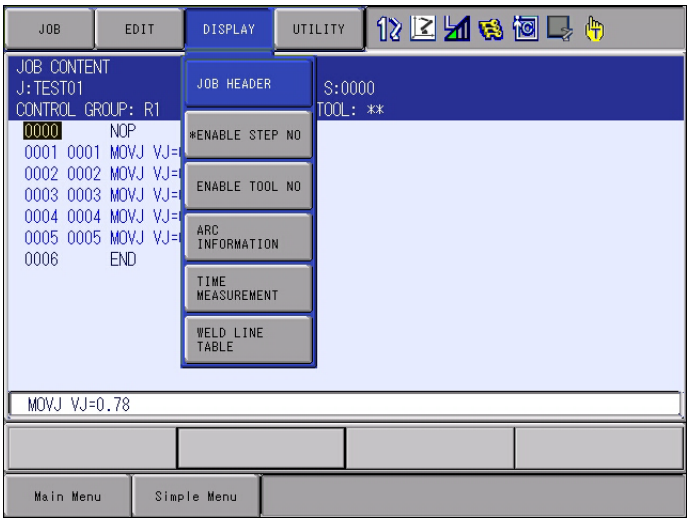
- The job cannot be edited (adding, changing, and deleting instructions).
- The job cannot be deleted, renamed, or copied.
- The contents of instructions cannot be displayed with direct open.
- The command position are not displayed on the COMMAND POSITION window.
- The job cannot be set as a target for conversion.
- Job operations cannot be performed during playback.
- All display colors are reset. (All items are displayed in black.)
- The step number and tool of subtitles are all displayed as "*".
- The UNDO and REDO functions cannot be used.
- Search, copy, cut, paste and reverse paste cannot be used.

On the JOB HEADER window for each job, set "CONTENTS DISPLAY" to "PERMIT" or "PROHIBIT".

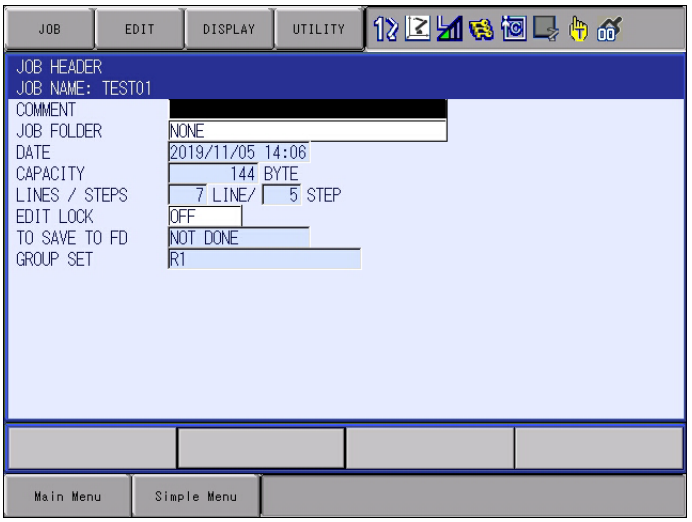
1. Select {JOB} under the main menu.
2. Select {JOB}.



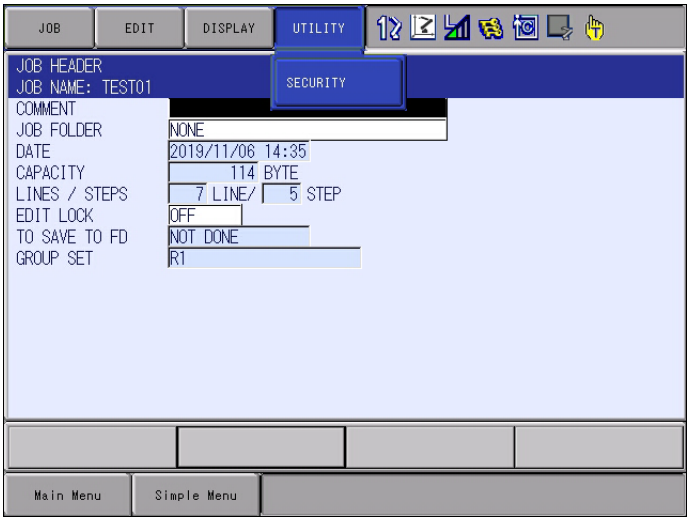
3. Select {DISPLAY} under the pull-down menu.



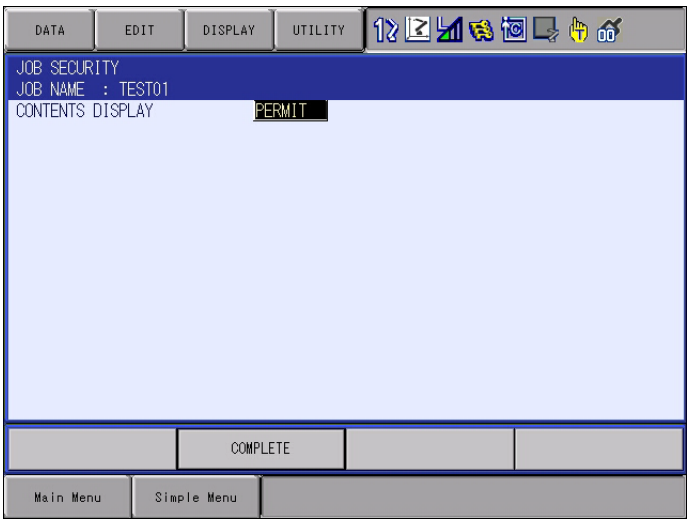
4. Select {JOB HEADER}.
   – The JOB HEADER window appears.



5. Select {UTILITY} under the pull-down menu.

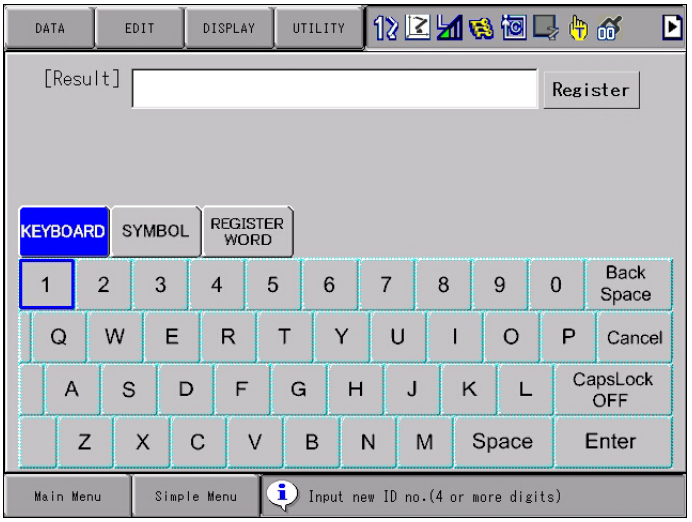


6. Select {SECURITY}.
   – The JOB SECURITY window appears.

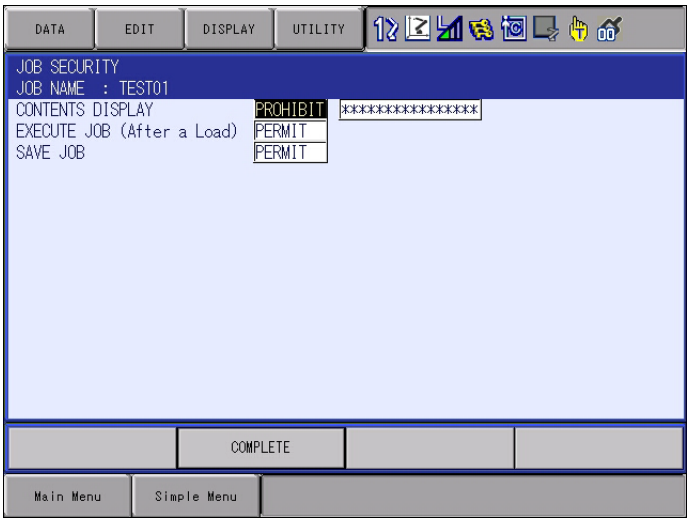


7. Select "CONTENTS DISPLAY".

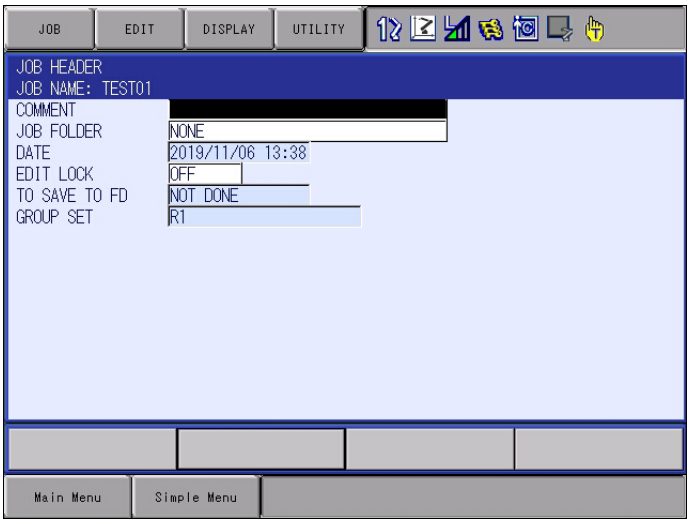
– Press [SELECT] to display the "PERMIT" and "PROHIBIT" list. Select "PROHIBIT" to display the set password window. Set the password.
(* Set the password between 4 and 16 characters.)



– The JOB SECURITY window appears when you finish entering the password.



8. Select {COMPLETE}.
   – The window returns to the JOB HEADER window.

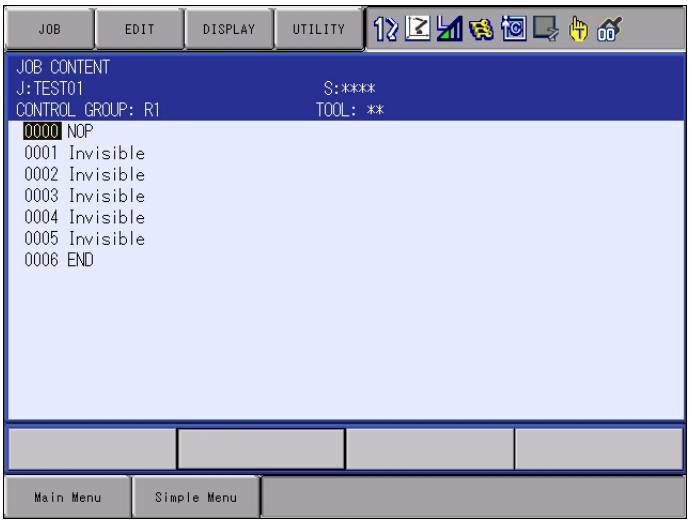


NOTE

When “PROHIBIT” is set for “CONTENTS DISPLAY”, the contents of capacity, lines, steps and the number of local variables (Only when expanding the “INSTRUCTION LEVEL”) are not displayed on the JOB HEADER window.

Even if “PROHIBIT” is set for “CONTENTS DISPLAY”, comment, job folder, edit lock and save job can be changed when the edit lock is “ON”.

9. Select {DISPLAY} under the pull-down menu.
10. Select {JOB}.
    – The JOB CONTENT window appears. All instructions except for first NOP instruction and last END instruction are displayed as "Invisible". The instructions are displayed in black regardless of the display color settings. (For display color settings, refer to *chapter 6.11 "Instruction Display Color Setting Function"*)
    The step number and tool number in the title area are masked with asterisks (*).



NOTE

Jobs with "CONTENTS DISPLAY" set to "PROHIBIT" cannot be edited.
Operations that change the contents of jobs during playback execution, such as changing the speed of move instructions with speed override, can change the contents of jobs even if "CONTENTS DISPLAY" is set to "PROHIBIT". (For information on speed override, refer to *chapter 4.4 "Modifying Play Speed"* .)
To prohibit changing a job during playback execution, set "EDIT LOCK" to "ON". (To prohibit editing of jobs, refer to *chapter 5.6 "Setting Edit Lock on Individual Job Units"* .)

To prohibit saving jobs with "CONTENTS DISPLAY" set to "PROHIBIT" to an external memory device, set "SAVE JOB" to "PROHIBIT". For the setting to prohibit saving a job, refer to *chapter 6.24.3 "Prohibiting Saving a Job"* .

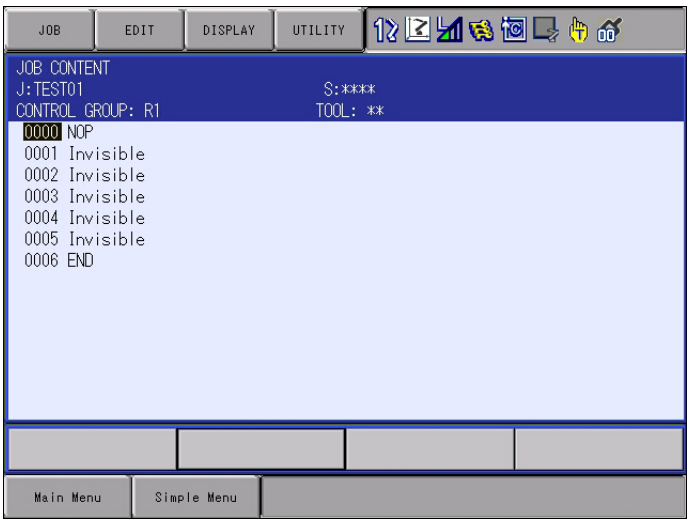
6.24.2 Prohibiting Job Execution after Loading

To prohibit created jobs from being executed after being loaded on other controllers, you can set "EXECUTE JOB (After a Load)" to "PROHIBIT" for each job. For a job with "EXECUTE JOB (After a Load)" set to "PROHIBIT", the job does not appear on the JOB LIST window after it is loaded on another controller. Instead, it appears on the SECURITY JOB LIST window.

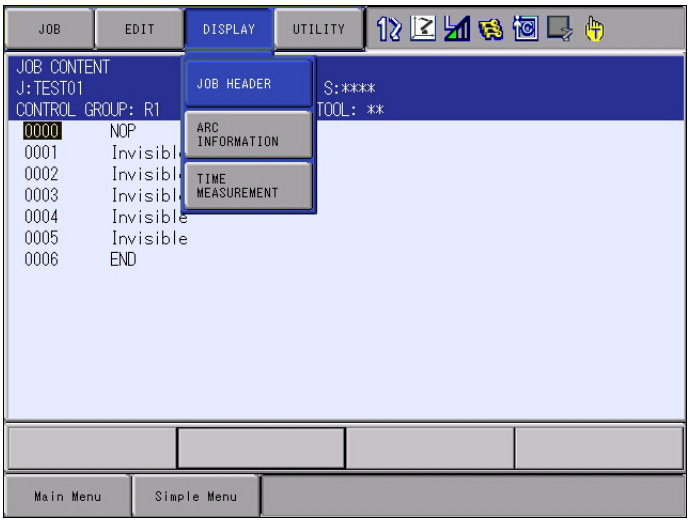
To execute a prohibited job, you must enter the registered password on the SECURITY JOB LIST window and change the setting from "PROHIBIT" to "PERMIT".

On the JOB HEADER window for each job, set "EXECUTE JOB (After a Load)" to "PERMIT" or "PROHIBIT".

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

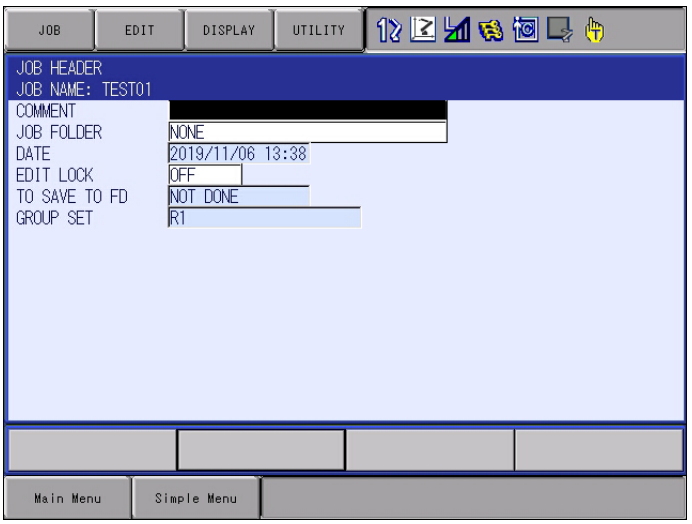


3. Select {DISPLAY} under the pull-down menu.

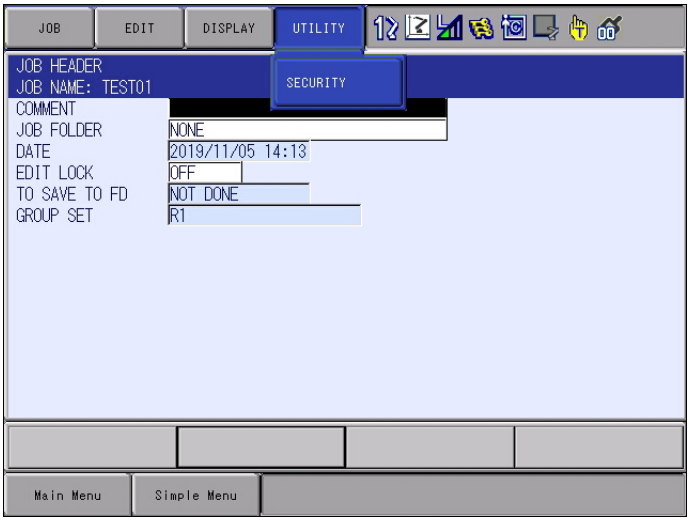


4. Select {JOB HEADER}.

   – The JOB HEADER window appears.

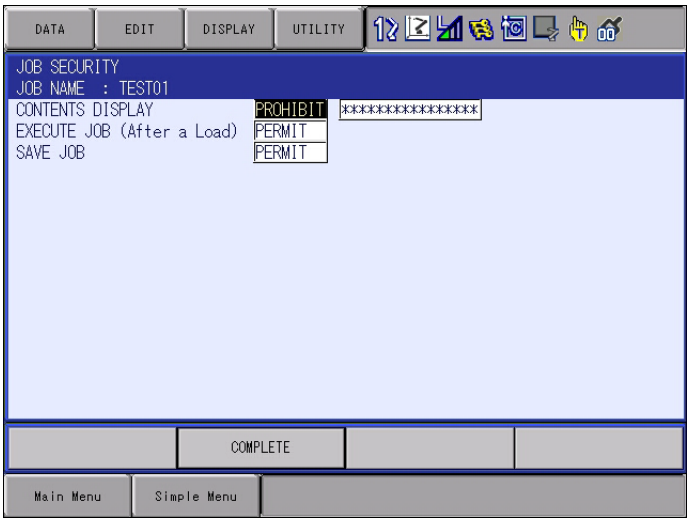


5. Select {UTILITY} under the pull-down menu.



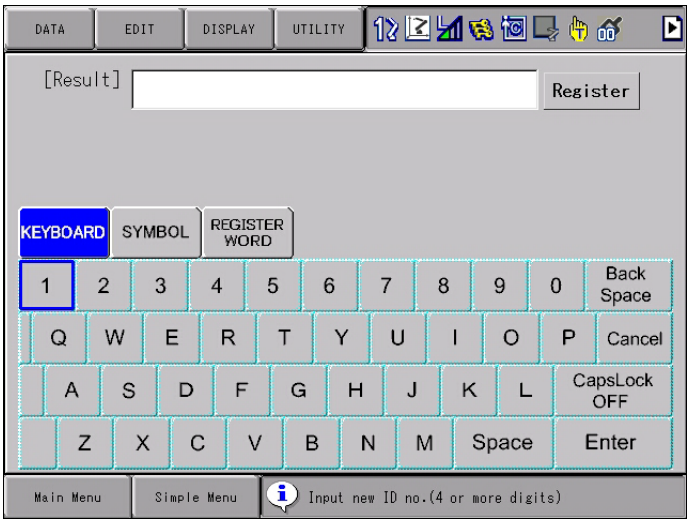
6. Select {SECURITY}.

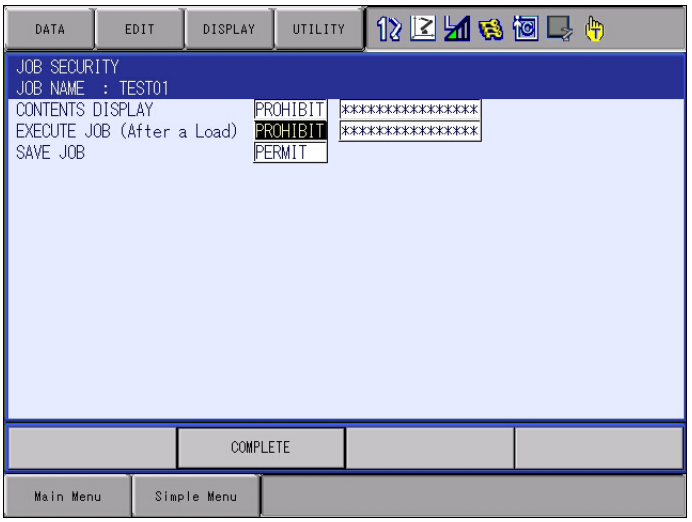
   – The JOB SECURITY window appears.
   When "CONTENTS DISPLAY" is set to "PROHIBIT", "EXECUTE JOB (After a Load)" and "SAVE JOB" appear.



7. Select "EXECUTE JOB (After a Load)".

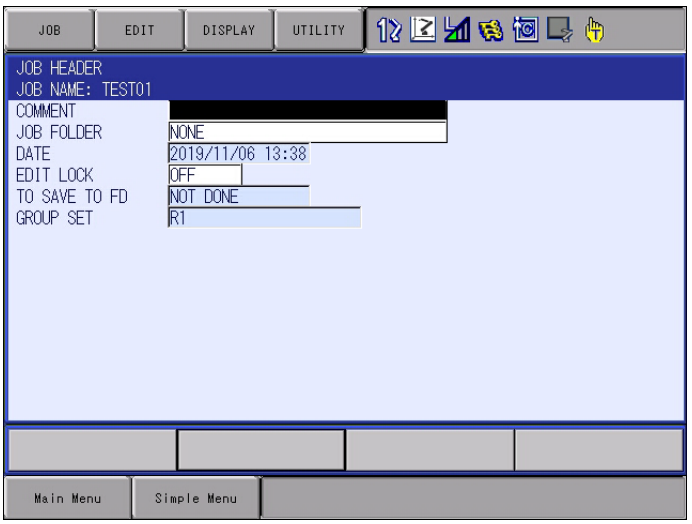
   – Press [SELECT] to display the "PERMIT" and "PROHIBIT" list.
   A password can be set when "PROHIBIT" is selected.
   Set the password between 4 and 16 characters.





8. Select {COMPLETE}.

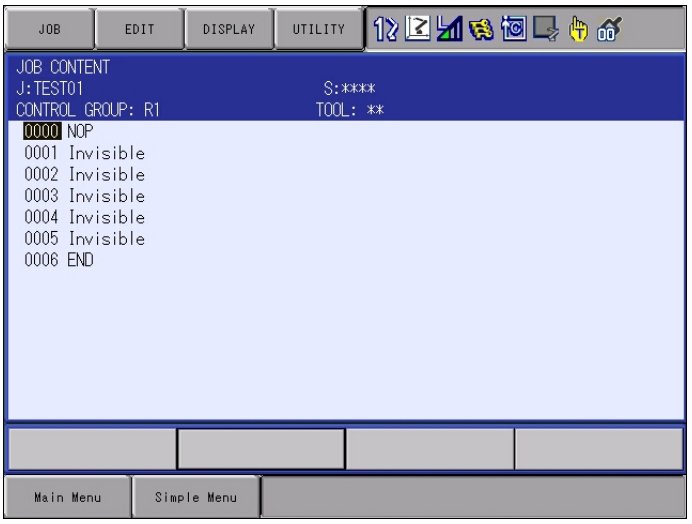
   – The setting is completed and the window returns to the JOB HEADER window.



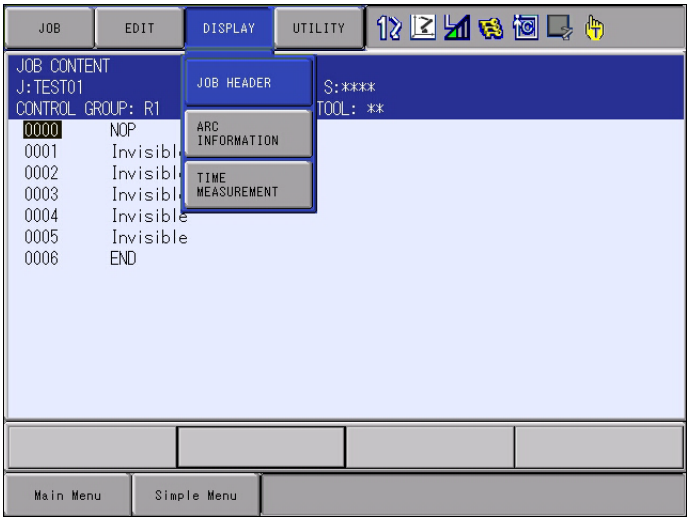
6.24.3 Prohibiting Saving a Job

To prohibit saving a created job to an external memory device, you can set "SAVE JOB" to "PROHIBIT" for each job.

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

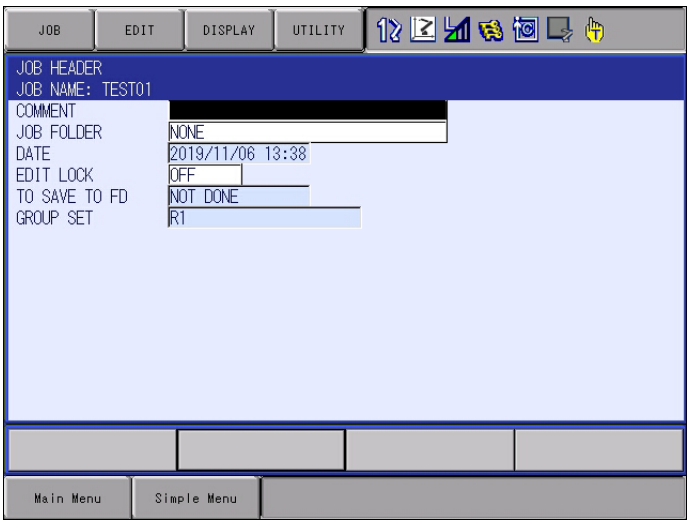


3. Select {DISPLAY} under the pull-down menu.

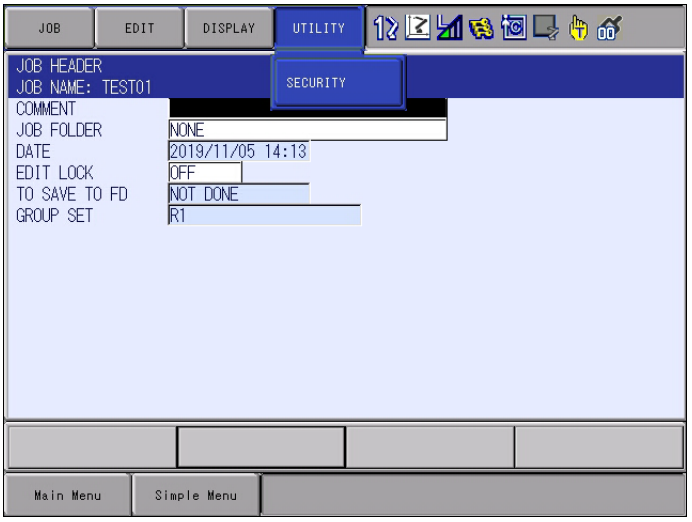


4. Select {JOB HEADER}.

   – The JOB HEADER window appears..

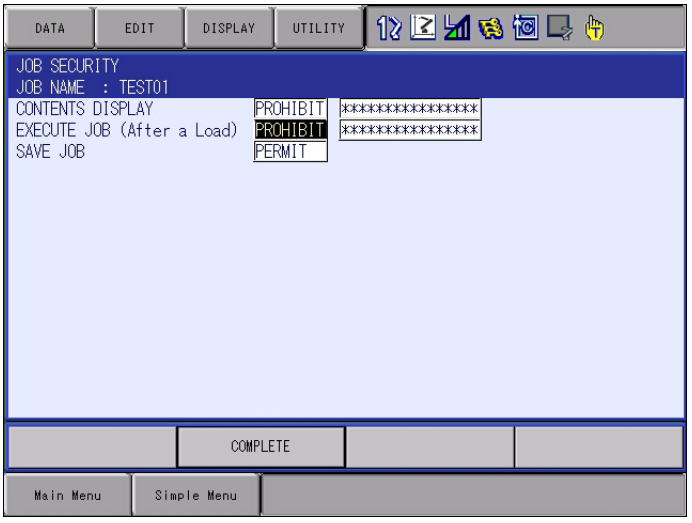


5. Select {UTILITY} under the pull-down menu.



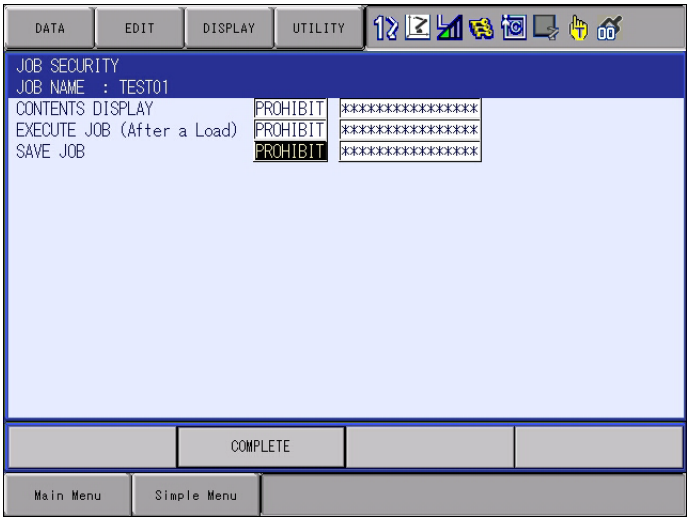
6. Select {SECURITY}.

   – The JOB SECURITY window appears.
   When "CONTENTS DISPLAY" is set to "PROHIBIT", "EXECUTE JOB (After a Load)" and "SAVE JOB" appear.



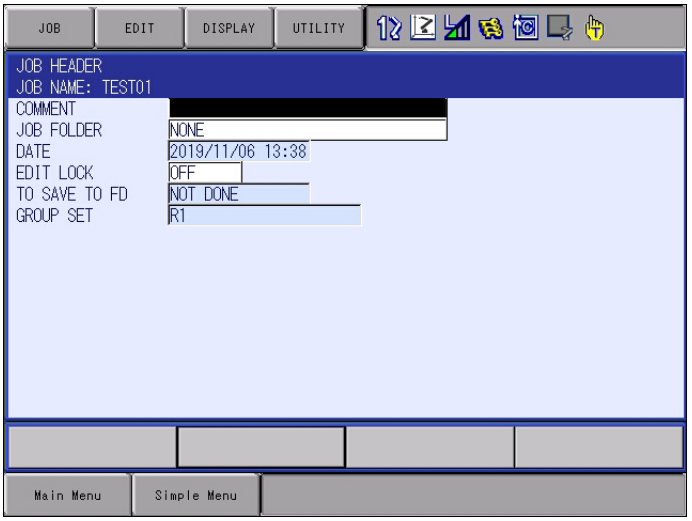
7. Select "SAVE JOB".

   – Press [SELECT] to display the "PERMIT" and "PROHIBIT" list.
   A password can be set when "PROHIBIT" is selected.
   Set the password between 4 and 16 characters.
   A job with "SAVE JOB" set to "PROHIBIT" cannot be saved to an external memory device.
   For the operation to save data to an external memory device, refer to *chapter 7.3.0.3 "Saving Data"*
   If an attempt is made to save a job with "SAVE JOB" set to "PROHIBIT" to an external memory device
   using the data transfer function, high-speed Ethernet server function, FTP function, or MotoPlus function,
   an error occurs and the save cannot be completed.
   Error code: 2110 "This data cannot be accessed"



8. Select {COMPLETE}.

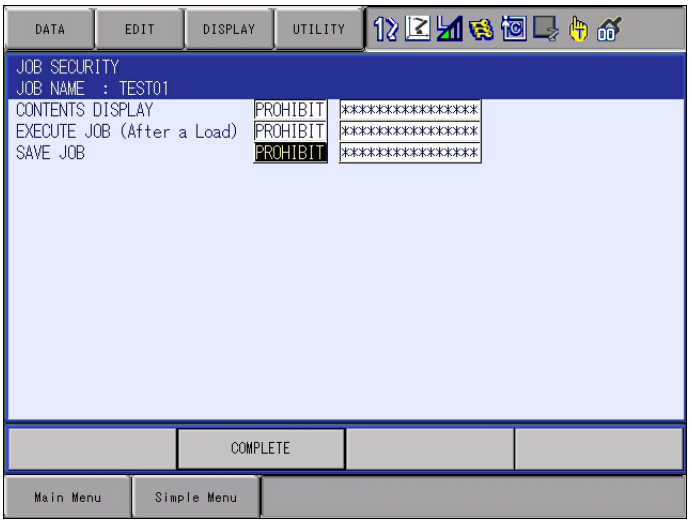
   – The window returns to the JOB HEADER window.



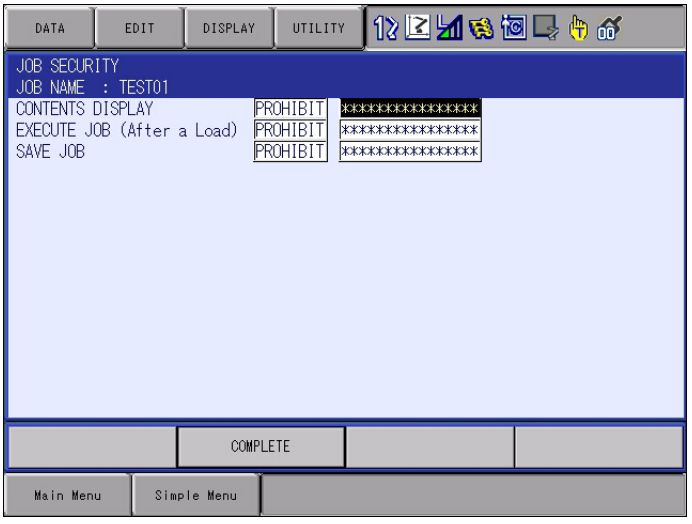
6.24.4 Changing Security Settings

■ **Changing Passwords**

On the JOB HEADER window, access the {UTILITY} - {SECURITY} pull-down menu, and then use the JOB SECURITY window to change the settings related to job security.

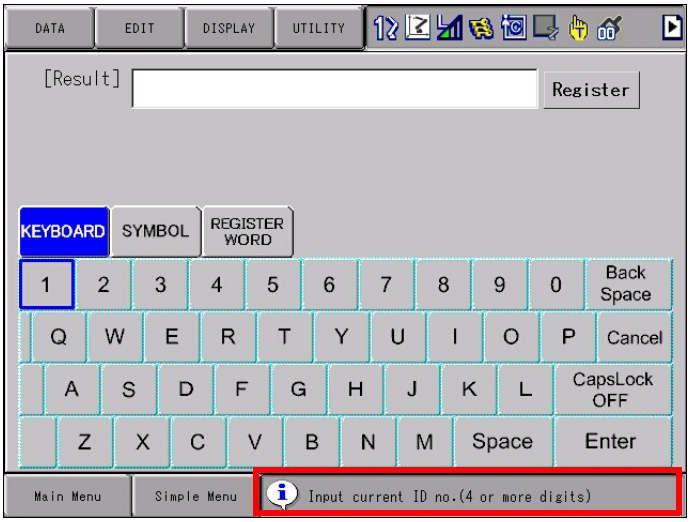


1. Move the cursor to the password input item to change and press [SELECT].

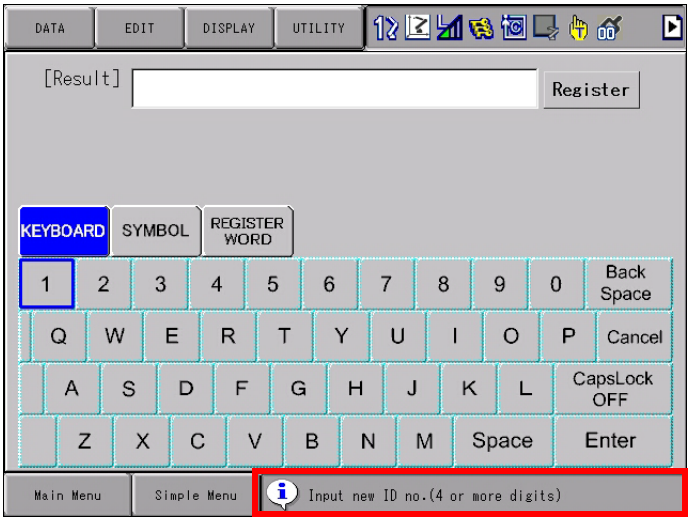


2. The character input keypad appears.

   – Enter the current password (4 characters or longer).
   If the password is wrong, error code: 1030 "Unauthorized ID No." appears.



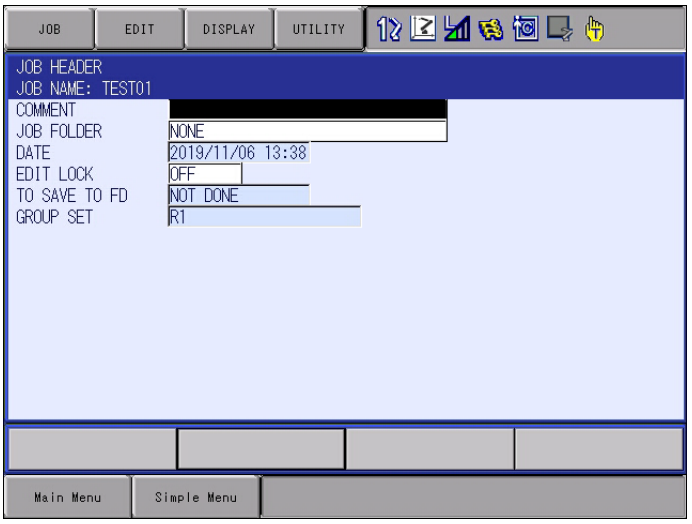
3. Enter the new password.



4. The new password is enabled.

5. Select {COMPLETE}.

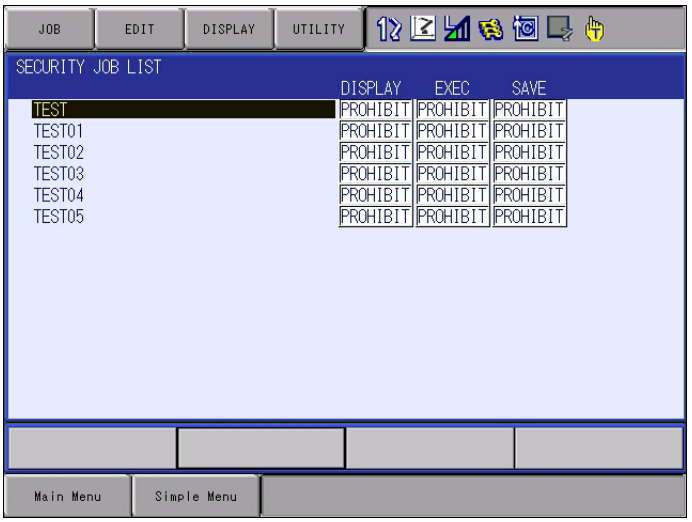
   – The window returns to the JOB HEADER window.



6.24.5 Security Settings Job List

The SECURITY JOB LIST window displays the list of jobs with "CONTENTS DISPLAY", "EXECUTE JOB (After a Load)", and "SAVE JOB" set to "PROHIBIT".

1. Select {JOB} under the main menu.
2. Select {SECURITY JOB LIST}.



■ **Selecting One Job**

On the SECURITY JOB LIST window, press [SELECT] on each setting item to switch to its password input window.

If the entered password matches the registered password, a dialog box "All restriction cancel?" appears. Select "YES" to cancel the restriction. Select "NO" to keep the restriction.

⇨ If the password for "CONTENTS DISPLAY: PROHIBIT" is entered, "CONTENTS DISPLAY: PROHIBIT", "EXECUTE JOB (After a Load): PROHIBIT", and "SAVE JOB: PROHIBIT" are canceled.

⇨ If the password for "EXECUTE JOB (After a Load): PROHIBIT" is entered, only "EXECUTE JOB (After a Load): PROHIBIT" is canceled.

⇨ If the password for "SAVE JOB: PROHIBIT" is entered, only "SAVE JOB: PROHIBIT" is canceled.

Conditions for Showing Items on the SECURITY JOB LIST Window

	JOB LIST	**SECURITY JOB LIST**
CONTENTS DISPLAY: PROHIBIT EXECUTE JOB: PROHIBIT	Hide	Show
CONTENTS DISPLAY: PROHIBIT EXECUTE JOB: PERMIT	Show	Show
CONTENTS DISPLAY: PERMIT EXECUTE JOB: PROHIBIT	Hide	Show
CONTENTS DISPLAY: PERMIT EXECUTE JOB: PERMIT	Show	Hide

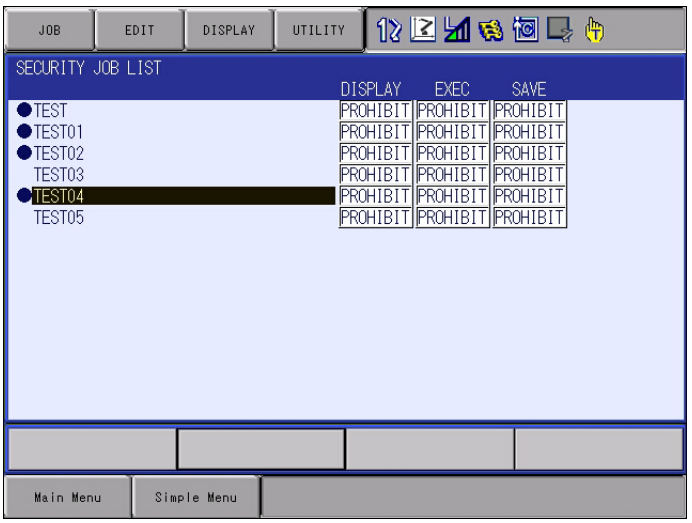
NOTE

Jobs with "EXECUTE JOB (After a Load)" set to "PROHIBIT" are set in the list only when loaded.

The job cannot be executed unless "EXEC" is set to "PERMIT" on the SECURITY JOB LIST window.

■ **Selecting Multiple Jobs**

On the SECURITY JOB LIST window, press [SHIFT] + [SELECT] to select multiple jobs.



With the items selected, press the {UTILITY} pull-down menu, and then press "DISPLAY CANCEL", "EXECUTE CANCEL" or "SAVE CANCEL". The password input window appears. Enter the contents display prohibition, job execution restriction, and save restriction passwords.

If the entered passwords match the passwords for all selected jobs, a dialog box "All restriction cancel?" appears. Select "YES" to batch cancel all the restrictions for the selected jobs. Select "NO" to keep the restrictions for the selected jobs.

NOTE

If you forgot the passwords, contact your YASKAWA representative.

6.24.6 Saving/Loading/Verifying Jobs

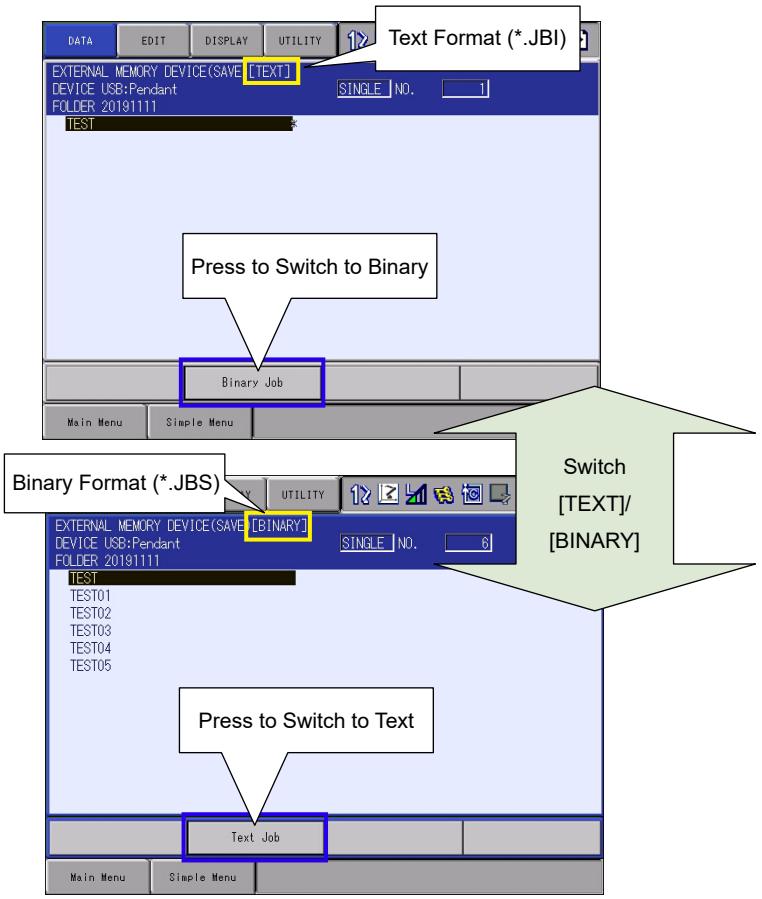
Jobs with "CONTENTS DISPLAY" set to "PROHIBIT" are output as security jobs in a binary format so that the contents cannot be understood from the format output to an external memory device.

On the SAVE/LOAD windows of the external memory device menu, switch between the text format (JBI) and binary format (JBS) with the function key.

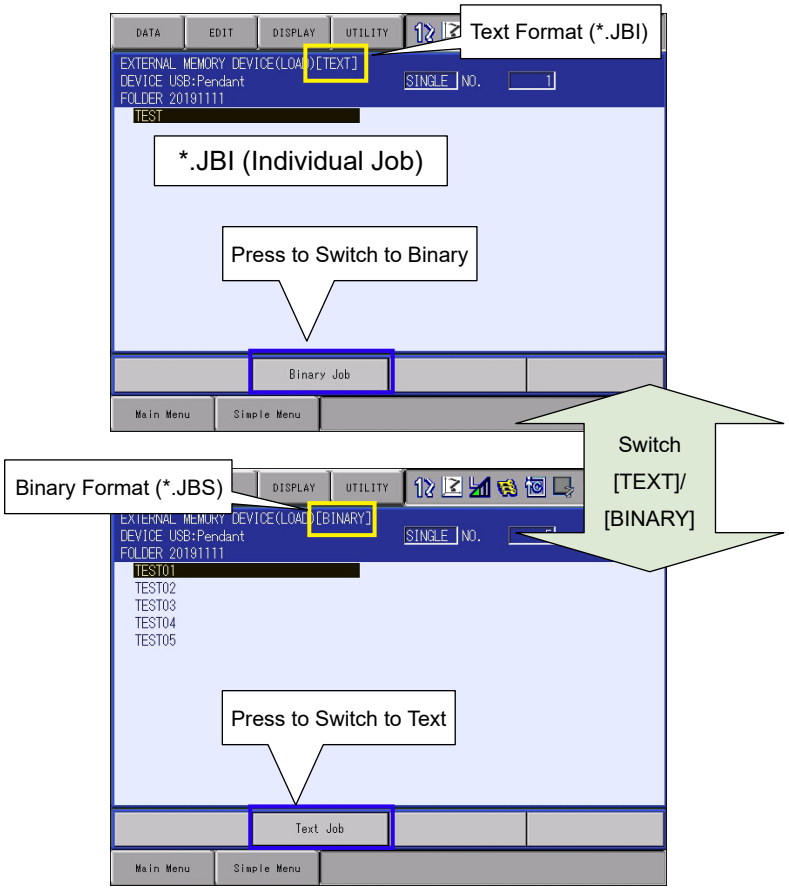
JBS: Security job (binary format)

Verification cannot be performed on jobs set with security (JBS).

- SAVE Window



• LOAD Window


Text Format (*.JBI)
DATA
EDIT
DISPLAY
UTILITY
EXTERNAL MEMORY DEVICE(LOAD)[TEXT]
DEVICE USB:Pendant
FOLDER 20191111
SINGLE NO. 1
TEST
*.JBI (Individual Job)
Press to Switch to Binary
Binary Job
Main Menu
Simple Menu
Switch
[TEXT]/
[BINARY]
Binary Format (*.JBS)
DISPLAY
UTILITY
EXTERNAL MEMORY DEVICE(LOAD)[BINARY]
DEVICE USB:Pendant
FOLDER 20191111
SINGLE NO.
TEST01
TEST02
TEST03
TEST04
TEST05
Press to Switch to Text
Text Job
Main Menu
Simple Menu

6.25 Multi-Move Function

6.25.1 Multi-Move Function

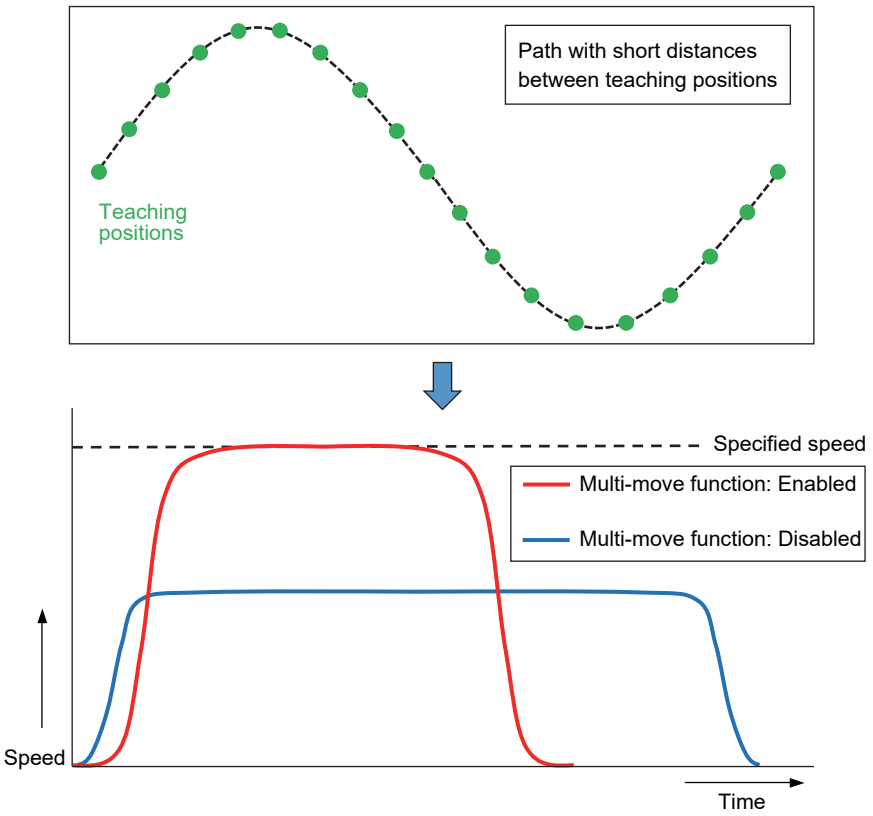
The multi-move function is a new acceleration/deceleration control function that can generate an acceleration/deceleration pattern spanning multiple steps.

This function is available in YBS2.31-00 or later.

When the distance between teaching positions is short, the manipulator may operate at a slower speed than the specified speed. This happens because the necessary distance to reach the specified speed is insufficient.

By using the multi-move function, the manipulator moves at the specified speed, as shown in the figure, even when the distance between teaching positions is short.

Fig. 6-10: Operating Speed When Distance between Teaching Positions is Short



NOTE

The following restrictions apply when using the multi-move function.

- This function can be applied to move instructions in jobs with the R1 control group only (This function cannot be applied to move instructions in coordinated jobs).
- This function can be applied to the MOVL and IMOV move instructions only.
- This function can be used with the following instructions inside a multi-move section only.
  DOUT, DIN, PULSE, CALL (no conditions specified), JUMP (no conditions specified), LABEL,COMMENT, INC, DEC, SET, ADD, SUB, MUL, DIV, SQRT, SIN, COS, ATAN, MULMAT, INVMAT, SFTON, and SFTOF
- If the VMAX, CR, PD, or PL tag is added to a move instruction in the multi-move section and VMAX, CR, PD, or PL ≠ 0, alarm "4295 HPMMV CTRL FAILED" will occur.

NOTE

This function may cause the manipulator to vibrate, depending on the teaching position or teaching speed.

When the manipulator vibrates, set ACC = (acceleration adjustment ratio) or DEC = (deceleration adjustment ratio) to the HPMMVON instruction, or review the teaching speed.

6.25.2 Instructions

6.25.2.1 Instructions of the Multi-Move Function

The instructions HPMMVON and HPMMVOF are used for the multi-move function.

■ **HPMMVON Instruction**

This is the instruction to start the multi-move operation.

This instruction is executed only at the playback or the test operation. It is not executed during the axis operation.

Additional items for the HPMMVON instruction are as follows:

HPMMVON V=100.0 ACC=20 DEC=20 APPR=50.00
① ② ③ ④

①Control speed

Specify the control point speed in the multi-move section.
When this speed is specified, the speed specified by the move instruction in the multi-move section will be ignored. In the same manner, the speed specified by the SPEED instruction will also be ignored.
Specify the speed unit on the OPERATE CONDITION SETTING window.

②Acceleration adjustment ratio: 20% to 100%

Specify the acceleration adjustment ratio.
The acceleration adjustment ratio controls the acceleration slope at the specified ratio of normal acceleration.

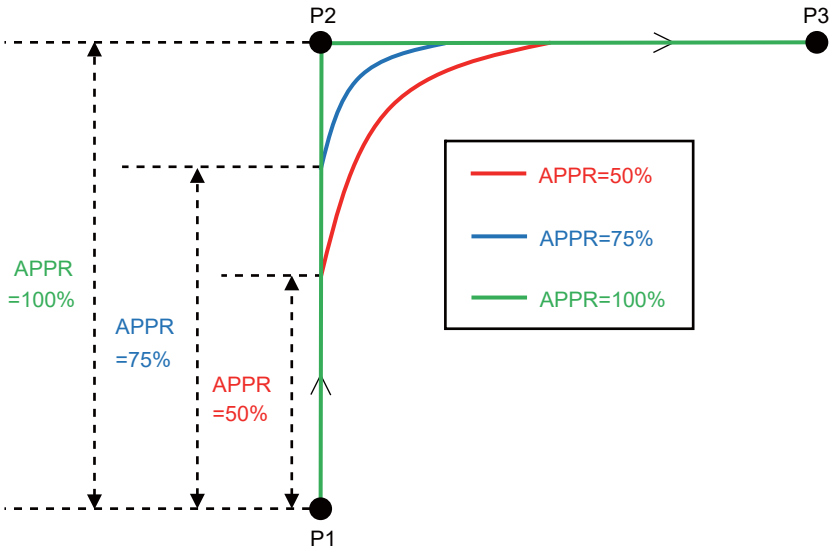
③Deceleration adjustment ratio: 20% to 100%

Specify the deceleration adjustment ratio.
The deceleration adjustment ratio controls the deceleration slope at the specified ratio of normal deceleration.

④Degree of approximation: 50% to 100%

Specify the degree of approximation.
The degree of approximation represents how close the manipulator passes through the teaching position.
As shown in the figure, when 100% is specified, the manipulator completely reaches the target position. When 50% is specified, the manipulator approaches halfway between the start position of the move instruction and the target position.
When the degree of approximation is specified, if PL=0 is added to the move instruction in the multi-move section, alarm "4295 HPMMV CTRL FAILED" will occur.

Fig. 6-11: Differences in Path by Degree of Approximation



■ **HPMMVOF Instruction**

This is the instruction to end the multi-move operation.

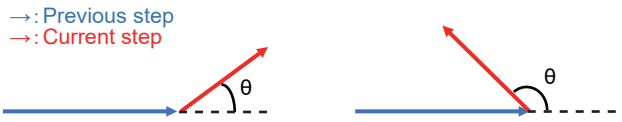
HPMMVOF

NOTE

If any of the following conditions is satisfied, even when the manipulator is in a multi-move section, the multi-move section is canceled at that path and restarted from the next path.

- When the teaching position for the previous step and current step are the same.
- When it is determined that torque saturation of any axis will occur by executing multi-move operation.
- When the angle between the previous step and current step is larger than the reference value of the multi-move instruction angle.

Angle between the previous step and current step θ



The reference value of the multi-move angle is set by the parameter. Details on this parameter are described in *chapter 6.25.3 "Parameter of the Multi-Move Function"* .

NOTE

The manipulator control method differs before and after the HPMMVON instruction. For this reason, the manipulator first decelerates due to normal control in the step immediately before HPMMVON, and then it accelerates due to multi-move control in the step immediately after HPMMVOF. In the same manner, the manipulator first decelerates due to multi-move control in the step immediately before HPMMVOF, and then it accelerates due to normal control in the step immediately after HPMMVOF.

NOTE

If one of the following operations is performed after playback is stopped in the multi-move section, multi-move control will be canceled when operation is restarted and operation will restart in normal control. In all other cases, multi-move control will continue.

- When the cursor is moved by an operation that changes the line number, etc., on the programming pendant when the manipulator is stopped.
- When another job is called.
- When an edit (add, modify, delete) operation is performed using the programming pendant.

6.25.3 Parameter of the Multi-Move Function

The reference value of the multi-move angle is set by the following parameter.

S3C	Details
1405	Reference value of the multi-move angle (Unit: 0.1 degrees) 0 (initial setting value): 25.0 degrees

6.25.4 Specific Output Signals During Multi-Move Operation

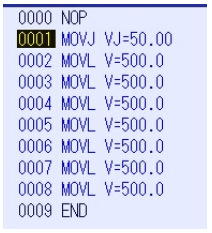
During multi-move operation, the following specific output signals are turned ON for each control group (manipulator). When operation is stopped, the specific output signals are turned OFF.

53407	53406	53405	53404	53403	53402	53401	53400
During HPMMVON	During HPMMVON	During HPMMVON	During HPMMVON	During HPMMVON	During HPMMVON	During HPMMVON	During HPMMVON
SOUT #2720	SOUT #2719	SOUT #2718	SOUT #2717	SOUT #2716	SOUT #2715	SOUT #2714	SOUT #2713
R8	R7	R6	R5	R4	R3	R2	R1

6.25.5 Registration of the Instruction of the Multi-Move Function

When the cursor is in the address area, the instruction can be registered by using the JOB CONTENT window of teach mode. Perform following operations before registering the instruction.

1. Select {JOB} under the main menu.
2. Select {JOB CONTENT}.
3. Move the cursor to the address area.



■ **HPMMVON Instruction**

1. Move the cursor to one line above the place to register HPMMVON.



2. Press [INFORM LIST].
3. Select {OTHER}.
4. Select {HPMMVON}.
   – The HPMMVON instruction is displayed in the input buffer line.



   Change the numeric value of V at this time to adjust the speed in the section.

5. Press [INSERT] and [ENTER].
   – The HPMMVON instruction is registered.



■ **HPMMVOF Instruction**

1. Move the cursor to one line above the place to register the HPMMVOF instruction.



2. Press [INFORM LIST].
3. Select {OTHER}.
4. Select {HPMMVOF}.
   – The HPMMVOF instruction is displayed in the input buffer line.

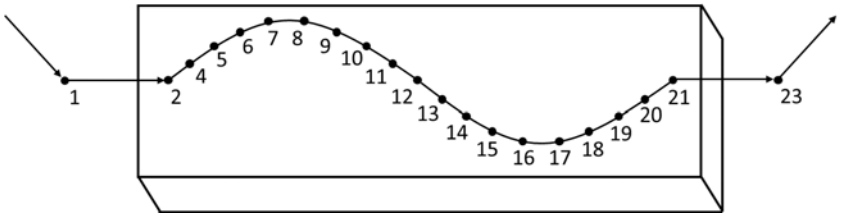


5. Press [INSERT] and [ENTER].
   – The HPMMVOF instruction is registered.



6.25.6 Motion Example of the Multi-Move

An example of a job that performs multi-move operation is shown below.



Line	Instruction	
0000	NOP	
0001	MOVJ VJ=10.00	
0002	MOVL V=200.0	
0003	HPMMVON V=200.0	⋯Multi-move operation starts.
0004	MOVL	Even when the distance between teaching positions is short and the manipulator operates at a slower speed than the specified speed, operation can be executed that maintains the specified speed.
0005	MOVL	
0006	MOVL	
0007	MOVL	
0008	MOVL	
0009	MOVL	
0010	MOVL	
0011	MOVL	
0012	MOVL	
0013	MOVL	
0014	MOVL	
0015	MOVL	
0016	MOVL	
0017	MOVL	
0018	MOVL	
0019	MOVL	
0020	MOVL	
0021	MOVL	
0022	HPMMVOF	⋯Multi-move operation ends.
0023	MOVJ VJ=10.00	
0024	END	

6.26 Manipulator Motion Filter Setting Function

6.26.1 Outline

When the manipulator vibrates, using this function to set the manipulator motion filter can make the manipulator move smoothly and reduce vibrations.

This function is available in YBS2.49-00 or later.

NOTE

The following restrictions apply when using the manipulator motion filter setting function.

- This function can be applied jobs in which the control group is the manipulator itself. This function cannot be applied to jobs with multiple control groups.
  If the SMOOTH instruction is executed in a job with multiple control groups, alarm "4429: WRONG SPECIFIED CONTROL GROUP [27]" will occur.
- When the SMOOTH instruction is executed consecutively, only the last instruction is valid.
  SMOOTH ADDRATIO=100
  SMOOTH ADDRATIO=70
  SMOOTH ADDRATIO=60
  MOVL V=* ← This instruction operates with a 60% manipulator motion filter.
- When the SMOOTH instruction is executed, the manipulator first stops.

NOTE

If one of the following operations is performed after playback is stopped in the manipulator motion filter setting section, the manipulator motion filter that was set will be disabled when operation is restarted. In all other cases, the manipulator motion filter that was set will be maintained.

- When the cursor is moved by an operation that changes the line number, etc., on the programming pendant when the manipulator is stopped.
- When another job is called.
- When an edit operation is performed (add, modify, delete) using the programming pendant.

NOTE

This function will increase the inward-turning amount, depending on the teaching position or teaching speed.

For this reason, always check the operating path of the manipulator after the function is applied.

6.26.2 Instructions

6.26.2.1 Instructions of the Manipulator Motion Filter Setting Function

This function uses the SMOOTH instruction to specify the move instruction section for which the manipulator motion filter will be set and the manipulator motion filter ratio.

If the ADDRATIO=*** tag (*** is the motion filter ratio) is added to the SMOOTH instruction, the manipulator motion filter with the ratio specified by *** is applied from the motion by subsequent move instructions.

To end the application of the manipulator motion filter, add the NEUTRAL tag to the SMOOTH instruction.

■ **SMOOTH ADDRATIO=**
This is the instruction to start the application of the manipulator motion filter.

```
SMOOTH  ADDRATIO=100
                ①
```

①**Manipulator motion filter ratio**
Specify the manipulator motion filter ratio to apply (setting range: 0% to 300%).

■ **SMOOTH NEUTRAL**
This is the instruction to end the application of the manipulator motion filter.

6.26.3 Parameters of the Manipulator Motion Filter Setting Function

The manipulator motion filter setting function is enabled or disabled by the following parameter.

S2C	Details
1596	Enable manipulator motion filter setting function 0: Disable 1: Enable

The setting value when the manipulator motion filter ratio is 100% can be changed with the following parameters (when the initial value is "0", the setting value is automatically calculated for each model).

S1CxG	Details
1550 to 1559	Filter setting value for the manipulator motion filter setting function 0: Manufacturer setting value (automatically calculated for each model) Other than 0: Applies the setting value.

7 External Memory Device

7.1 Memory Device

The following memory devices can be used in the YRC1000micro to save and load data such as jobs and parameters.

Device	Function	Media (destination of saved/loaded data)	Optional function requirement
SD: Pendant	Standard	SD card	No requirement. Programming pendant is equipped with a slot.
USB: Pendant	Standard	USB memory stick	No requirement. Programming pendant is equipped with a connector.
FC1 (YRC)	Optional[1)]	Personal computer (FC1 emulator)	Personal computer with “FC1 emulator”
PC	Optional[1)]	Personal computer (MOTOCOM32 host)	Via RS-232C: “Data transmission function” and “MOTOCOM32” Via Ethernet: “Ethernet function” plus above two requirements
FTP	Optional[1)]	FTP server such as personal computer	“Data transmission function”, “MOTOCOM32”, and “FTP function”
USB1: Controller	Standard	USB memory stick	No requirement. CA board (JANCD-ACP31) is equipped with a connector.

1 For the operation, refer to instruction manuals for each optional function.

7.1.1 SD Card

The programming pendant is equipped with the SD card slot. Use a FAT16 or FAT32 formatted SD card.

SD/SDHC/SDEX cards are usable.

7.1.1.1 Recommended SD Card

Refer to “YRC1000micro INSTRUCTIONS (RE-CTO-A222) 9.1.2 Device” for the recommended products used for external memory of YRC1000micro. Model numbers are subject to be updated due to termination of product and new addition. Contact YASKAWA representative when necessary.

7.1.1.2 Notes on Handling SD Card

- Do not drop, bend, or otherwise exert any shock or strong force onto the SD card.
- Keep away from water, oil, organic solvent, dust, dirt, etc.
- Do not use or keep the SD card in places where strong static electricity or electronic noise may occur.
- Do not insert or remove the SD card or turn OFF the power when accessing the SD card (writing-in or reading-out the data).
- To protect the data, back up the data regularly on other media. Dam-ages or loss of data due to operation errors or accidents can be min-imized.

*An SD card has a limited life span.

The life span differs depending on products or status of use. However, normal use of SD card as an external memory device for the YRC1000micro does not adversely affect the SD card. For details, refer to instruction manuals for each medium.

7.1.1.3 Inserting an SD Card

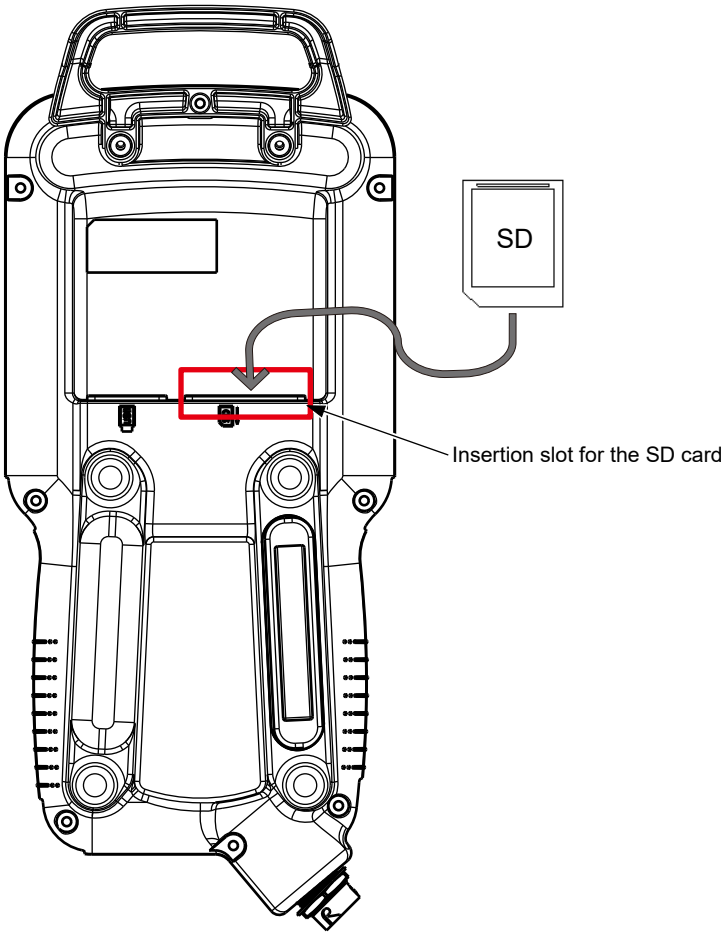
When inserting an SD card, take note of insertion direction.

Keep the programming pendant with its back side up. Keep the SD card with its top surface up and with its connector downward, and insert it into the SD card slot on the back side of the programming pendant.

Forcible insertion may result in damage to the SD card or the SD card slot.

After inserting the card, be sure to close the cover of the slot before starting operation.

Fig. 7-1: Using an SD Card



Back Side of Programming Pendant

7.1.2 USB Memory Stick

The programming pendant or the CA board (JANCD-ACP31) is equipped with a USB connector. Use the FAT16 or FAT32 formatted USB memory stick.

7.1.2.1 Recommended USB Memory Stick

Refer to in “YRC1000micro INSTRUCTIONS (RE-CTO-A222) 9.1.2 Device” for the recommended products used for external memory of the YRC1000micro. Model numbers are subject to be updated due to termination of product and new addition. Contact YASKAWA representative when necessary.

7.1.2.2 Notes on Handling USB Memory Stick

- Do not drop, bend, or otherwise exert any shock or strong force onto the USB memory stick.
- Keep away from water, oil, organic solvent, dust, dirt, etc.
- Do not use or keep the USB memory stick in places where strong static electricity or electronic noise may occur.
- Do not insert or remove the USB memory stick or turn OFF the power when accessing the USB memory stick (writing-in or reading-out the data).
- To protect the data, back up the data regularly on other media. Dam-ages or loss of data due to operation errors or accidents can be min-imized.

*USB memory stick has a limited life span.

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 YRC1000micro does not adversely affect the USB memory stick. For details, refer to instruction manuals for each medium.

7.1.2.3 Rules for USB Connector and USB Memory Stick

The following are the rules for using the USB connector on the CA board (JANCD-ACP31) and inserting the USB memory stick.

1. **Prohibition of insertion/removal of the USB memory stick during control power ON**
   The device recognition process is executed when the USB memory stick is inserted. Do not insert or remove the USB memory stick while the control power supply is ON. Failure to observe this rule may affect the operation of the manipulator (cycle time).
2. **Prohibition of disconnection of the control power and insertion/removal of USB memory stick during file access**
   Do not disconnect the control power or insert/remove the USB memory stick during file access.
   Failure to observe this rule may breakdown the FAT.
3. **Operating temperature range of USB memory stick**
   Use a USB memory stick that is guaranteed to work in the range of temperature of the YRC1000micro.
4. **USB memory stick's falling off by controller vibration**
   Prevent the USB memory stick from falling off by the vibration of the controller.
   (Countermeasure example)
   ・Fix the USB memory stick with jigs not to fall off, etc.
5. **USB connector on the front surface of the CA board (JANCD-ACP31)**
   The USB connector on the front surface of the CA board (JANCD-ACP31) accepts only the USB memory stick.
   Do not connect a USB hub or other USB devices.

7.1.2.4 Inserting a USB Memory Stick in Programming Pendant

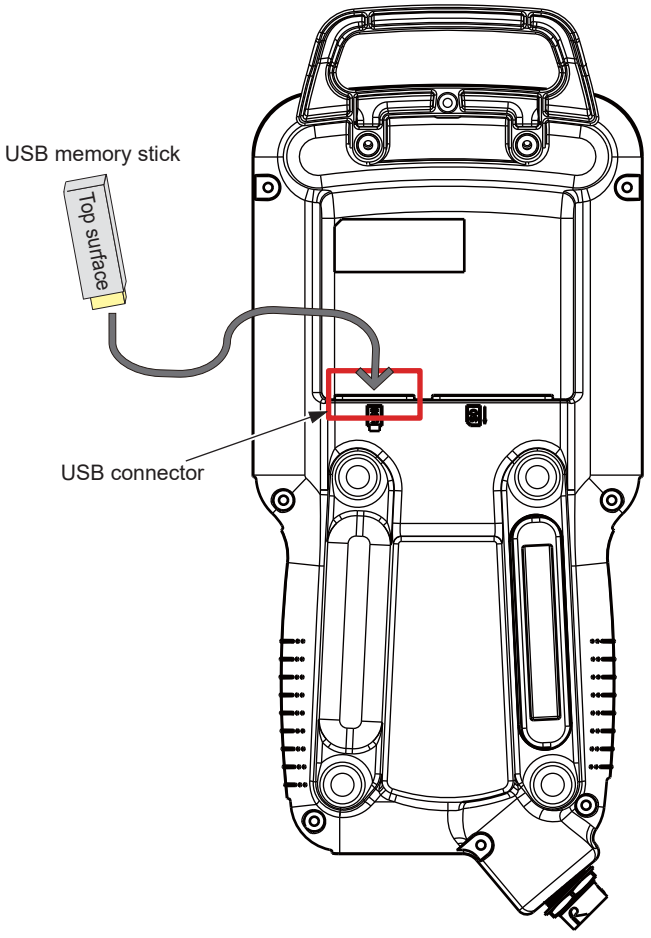
When inserting a USB memory stick, take note of insertion direction.

Keep the programming pendant with its back side up. Keep the USB memory card with its top surface up and with its connector downward, and insert it into the USB memory stick connector on the back side of the programming pendant.

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



Back Side of Programming Pendant

NOTE

When a USB memory stick is used, the waterproof property of the 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.

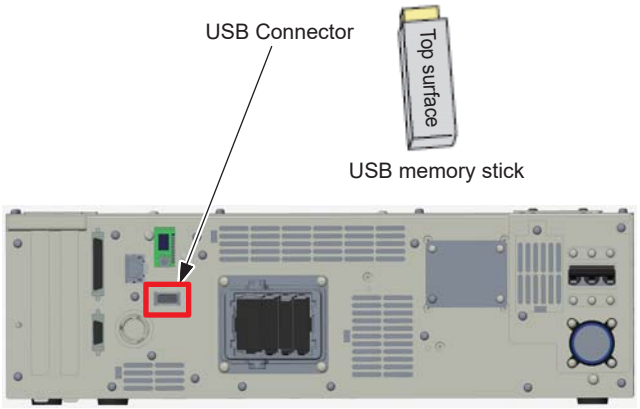
If it is impossible to maintain the waterproof property of the programming pendant or to prevent the USB memory stick from falling out of the programming pendant, use an SD card instead.

7.1.2.5 Inserting a USB Memory Stick in the CA Board (JANCD-ACP31)

Make sure to insert the USB memory stick with its connector kept in the correct direction: Keep the USB memory stick with its top surface right, and insert it slowly into the connector on the CA board.

Forcible insertion may result in damage to the USB memory stick or USB connector.

Fig. 7-3: Using a USB Memory Stick on the CA Board



7.2 Handling Data

7.2.1 Data Classification

For the YRC1000micro, data that can be saved online are classified into seven categories.

1. JOB
2. FILE/GENERAL DATA
3. PARAMETER[1)]
4. I/O DATA
5. SYSTEM DATA
6. PENDANT LOG
7. SYSTEM BACKUP (CMOS.BIN)

Data saved on the external memory device can be loaded again into the YRC1000micro.

Each data in the seven categories varies depending on applications or options.

When the device is set to “PC” or “FTP”, data cannot be handled other than “1. JOB” and “2. FILE/GENERAL DATA”.

Also, the “1. JOB” whose name consists of more than nine letters cannot be handled at “FC1”.

The pendant log is available for YBS2.10-00 or later. The only devices available are “SD:Pendant” and “USB:Pendant”. When the pendant application error does not occur, the pendant log is not output. It is not included in the system backup.



PARAMETER, SYSTEM DATA, I/O DATA, and SYSTEM BACKUP (CMOS.BIN), which includes the data of the former three data, have inherent information of each controller.

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.

1 “PARAMETER BATCH” includes all “3. PARAMETER”.

Table 7-1: Data List (Sheet 1 of 2)

Data Classification			File Name (Saved Data)	Save				Load			
				OPN	EDT	MNG	SFT	OPN	EDT	MNG	SFT
6. SYSTEM BACKUP (CMOS.BIN)			CMOS.BIN	○	○	○	○	X	X	X	X
	1. JOB	Single job	JOBNAME.JBI	○	○	○	○	X	○	○	○
		Related job (Job+Condition)	JOBNAME.JBR	○	○	○	○	X	○	○	○
	2 FILE/ GENERAL DATA	Tool data	TOOL.CND	○	○	○	○	X	○	○	○
		Weaving data	WEAV.CND	○	○	○	○	X	○	○	○
		User coordinate data	UFRAME.CND	○	○	○	○	X	○	○	○
		Variable data	VAR.DAT	○	○	○	○	X	○	○	○
		Shock detection level data	SHOCKLVL.CND	○	○	○	○	X	○	○	○
		Interference area file	CUBEINTF.CND	○	○	○	○	X	○	○	○
		User menu data	USERMENU.DAT	○	○	○	○	X	○	○	○
		Timer variable data	TMVAR.DAT	○	○	○	○	X	○	○	○
	3. PARAMETER		ALL.PRM	○	○	○	○	X	X	○	○
	3. PARA-METER	Robot matching parameter	RC.PRM	○	○	○	○	X	X	○	○
		System definition parameter	SD.PRM	○	○	○	○	X	X	○	○
		Coordinate home position parameter	RO.PRM	○	○	○	○	X	X	○	○
		System matching parameter	SC.PRM	○	○	○	○	X	X	○	○
		CIO parameter	CIO.PRM	○	○	○	○	X	X	○	○
		Function definition parameter	FD.PRM	○	○	○	○	X	X	○	○
		Application parameter	AP.PRM	○	○	○	○	X	X	○	○
		Transmission (general) parameter	RS.PRM	○	○	○	○	X	X	○	○
		Sensor parameter	SE.PRM	○	○	○	○	X	X	○	○
		Servo parameter	SV.PRM	○	○	○	○	X	X	○	○
		Servomotor parameter	SVM.PRM	○	○	○	○	X	X	○	○
		Operation control parameter	AMC.PRM	○	○	○	○	X	X	○	○
		Servo power block parameter	SVP.PRM	○	○	○	○	X	X	○	○
		Motion function parameter	MF.PRM	○	○	○	○	X	X	○	○
		SERVOPACK parameter	SVS.PRM	○	○	○	○	X	X	○	○
		Converter parameter	SVC.PRM	○	○	○	○	X	X	○	○
		Robot control expand parameter	RE.PRM	○	○	○	○	X	X	○	○
		Safety function parameter	FMS.PRM	○	○	○	○	X	X	○	○

* ○: Can be done, X: Cannot be done
OPN: Operation mode, EDT: Edit mode, MNG: Management mode, SFT: Safety mode

Table 7-1: Data List (Sheet 2 of 2)

Data Classification			File Name (Saved Data)	Save				Load			
				OPN	EDT	MNG	SFT	OPN	EDT	MNG	SFT
6	4. I/O DATA	CIO program	CIOPRG.LST	○	○	○	○	X	X	○	○
		I/O name data	IONAME.DAT	○	○	○	○	X	X	○	○
		Pseudo input signals	PSEUDOIN.DAT	○	○	○	○	X	X	○	○
		External I/O name data	EXIONAME.DAT	○	○	○	○	X	X	○	○
		Register name data	IOMNAME.DAT	○	○	○	○	X	X	X	X
		YSF logic file	YSFLOGIC.DAT	○	○	○	○	X	X	○	○
	5. SYSTEM DATA	Second home position	HOME2.DAT	○	○	○	○	X	X	○	○
		User word	UWORD.DAT	○	○	○	○	X	X	○	○
		SV monitor signal	SVMON.DAT	○	○	○	○	X	X	○	○
		Variable name	VARNAME.DAT	○	○	○	○	X	X	○	○
		Alarm history data	ALMHIST.DAT	○	○	○	○	X	X	X	X
		Home position calibrating data	ABSO.DAT	○	○	○	○	X	X	○	○
		System information	SYSTEM.SYS	○	○	○	○	X	X	X	X
		Controller information	PANELBOX.LOG	○	○	○	○	X	X	X	X
		Work home position data	OPEORG.DAT	○	○	○	○	X	X	○	○
		I/O message history data	IOMSGHST.DAT	○	○	○	○	X	X	X	X
		Function key allocation data	KEYALLOC.DAT	○	○	○	○	X	X	○	○
		External IO ALLOC data	EIOALLOC.DAT	○	○	○	○	X	X	○	○
		Max/ Min torque data	TRQDAT.DAT	○	○	○	○	X	X	○	○
		Logdata	LOGDATA.DAT	○	○	○	○	X	X	X	X
		PM (reducer) file	PMTRQDB.DAT	○	○	○	○	X	X	○	○
		PM (reducer) condition	PMCOND.CND	○	○	○	○	X	X	○	○
		Encoder maintenance	ENCHEAT.DAT	○	○	○	○	X	X	X	X
		Inspection record file	PMLOG.DAT	○	○	○	○	X	X	X	X
		Robot stop FACTR file	RBSTPFCT.DAT	○	○	○	○	X	X	X	X
		SETTM setup file	SETTM.DAT	○	○	○	○	X	X	○	○
		Timer variable name	TMNAME.DAT	○	○	○	○	X	X	○	○

* ○: Can be done, X: Cannot be done
OPN: Operation mode, EDT: Edit mode, MNG: Management mode, SFT: Safety mode

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 (○) appears when the folder does not have the same name file.

SUPPLE-MENT

Whether the job after editing is saved or not can be judged by checking “TO SAVE TO FD” in the JOB HEADER window.

Fig. 7-4: Example of JOB

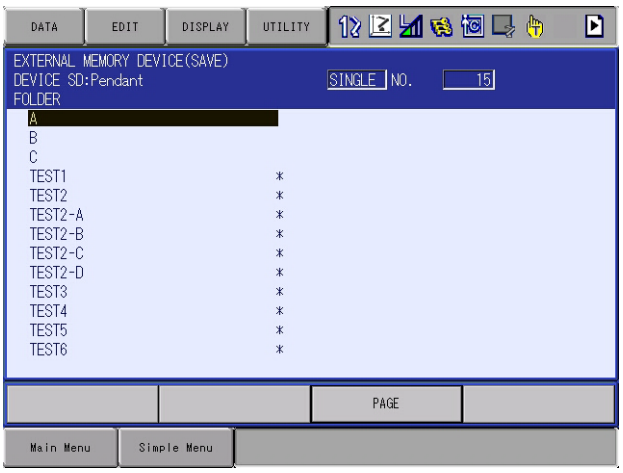
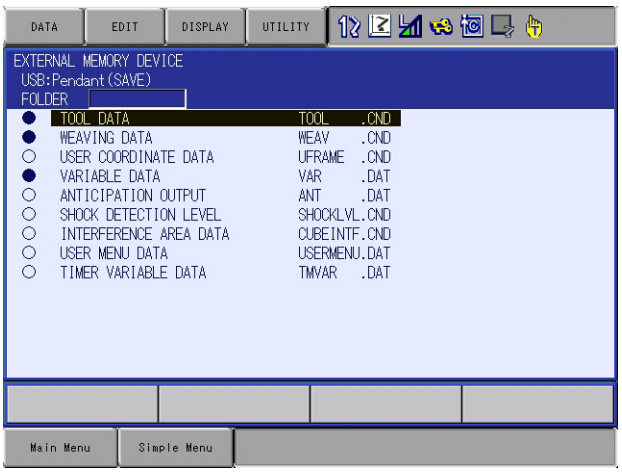


Fig. 7-5: Example of FILE/GENERAL DATA



7.2.2.1 Saving by Overwriting

“6. PENDANT LOG” and “7. SYSTEM BACKUP (CMOS.BIN)” can be overwritten.

As for “1. JOB”, “2. FILE/GENERAL DATA”, “3. PARAMETER”, “4. I/O DATA”, and “5. SYSTEM DATA”, those data can be overwritten if overwrite mode is valid when saving files. However, those data cannot be overwritten if overwrite mode is invalid when saving files. If the mode is invalid, delete the target file in the device before the saving operation.

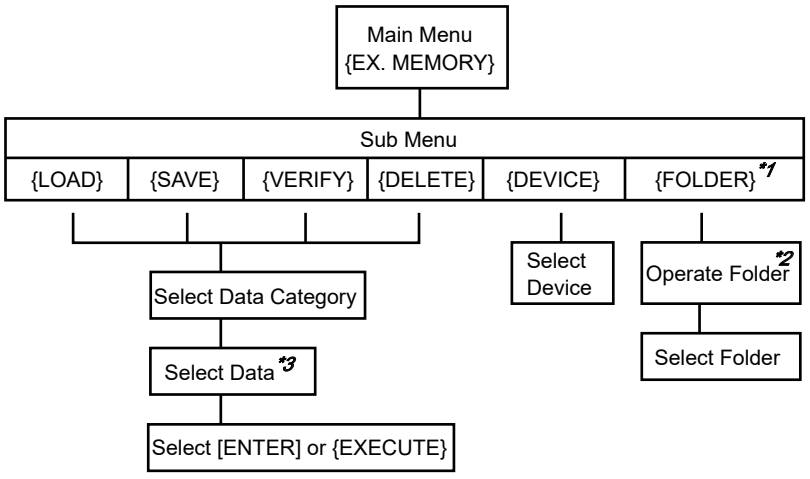
For details on the settings for overwriting when saving a file, refer to *chapter 7.3.0.4 “Overwriting When Saving a File”* .

If “SD: Pendant”, “USB: Pendant”, or “USB1: Controller” is used as the device, another folder can be created to save the data. For details on folders, refer to *chapter 7.3.0.2 “Folder Operation”* .

7.3 Operation Flow

The following description is the operation flow for external memory devices.

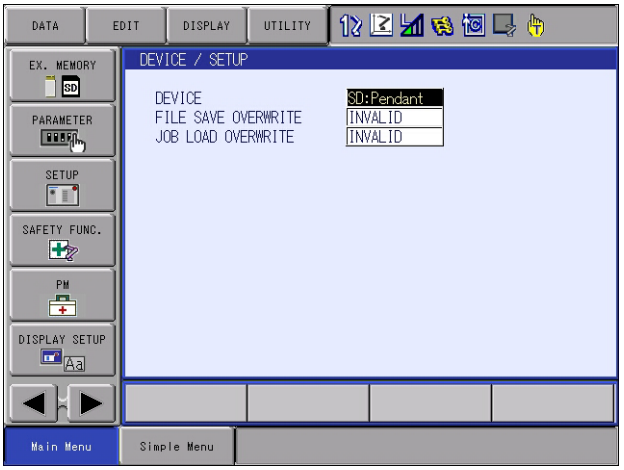
- SELECT DEVICE
  Select {EX. MEMORY} → {DEVICE}, and the destination device for saving.
  The device selected is valid after turning the power supply ON again.
- SELECT FOLDER
  Select {EX. MEMORY} → {DEVICE}, and the destination folder for saving.
  The folder selected is invalid after turning the power supply ON again.
  *1: {FOLDER} appears when using the “SD: Programming pendant”, “USB: Programming pendant” or “USB1: Controller” as a device.
  *2 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}, {VERIFY}, and {DELETE}.
- SELECT DATA CATEGORY
  Select the target data category.
- SELECT DATA
  Select the target data.
  “7. SYSTEM BACKUP (CMOS.BIN)” does not require this operation.
  *3 Individual selection, batch selection, marker (*) selection, and canceling selection can be performed.
- EXECUTE
  Select [ENTER] or {EXECUTE}.



7.3.0.1 Selecting the Device

Select the device used as an external memory for saving and loading data.

1. Select {EX. MEMORY} under {Main Menu}.
2. Select {DEVICE}.
   – The DEVICE / SETUP screen appears.



• DEVICE
Select the device used as an external memory for saving and loading data. The selected device is valid after turning the power supply ON again.
SD: Pendant
USB: Pendant
USB1: Controller

• FILE SAVE OVERWRITE
Set overwrite mode when saving files to invalid/valid.
INVALID: Prohibits overwriting when saving files.
VALID: Permits overwriting when saving files.

• JOB LOAD OVERWRITE
Set overwrite mode when loading jobs to invalid/valid.
INVALID: Prohibits overwriting when loading a file.
VALID: Permits overwriting when loading a file.

NOTE

If overwriting when loading jobs is set to valid:

When overwriting is executed, jobs stored in the controller are deleted.

Before overwriting, check whether backup of the jobs is necessary.

7.3.0.2 Folder Operation

Folders can be used in order to classify and sort out the data such as jobs and condition files when using the “SD: Programming pendant”, “USB: Programming pendant” or “USB1: Controller”. The folders can be created in hierarchical structure positioning a root folder at the top.

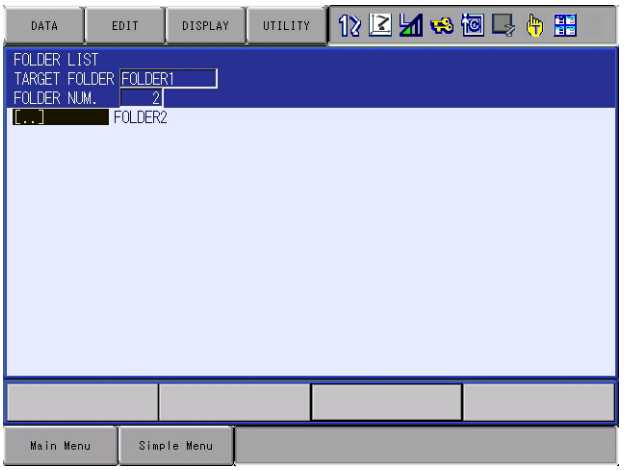
■ **Restrictions**

Folder name: Up to 8 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: 48 characters
*”ERROR 3360: INVALID FOLDER” appears when selecting the folder of which name exceeds the maximum path length.

■ **Selecting a Folder**

1. Select {EX. MEMORY} under the main menu.
2. 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**

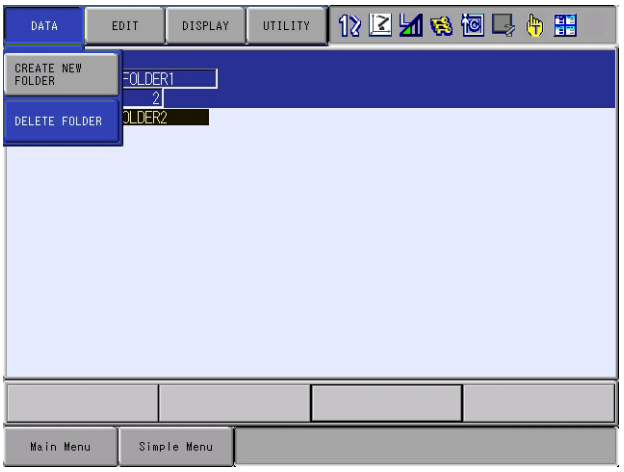
1. Set the security mode to the management mode or higher. Select {EX. MEMORY} under the main menu.
2. Select {FOLDER}.
   – The FOLDER LIST window appears.
3. Move the cursor to a folder and press [SELECT].
   – Select the higher-level folder where a new folder to be created should be contained.
   – When creating a folder in top-level, this step is unnecessary.
4. Select {DATA} → {CREATE NEW FOLDER} under the pull-down menu. Enter the folder name by using the keyboard on the screen and press [ENTER].
   – A folder is created.

■ **Deleting a Folder**

1. Set the security mode to the management mode or higher. Select {EX. MEMORY} 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.

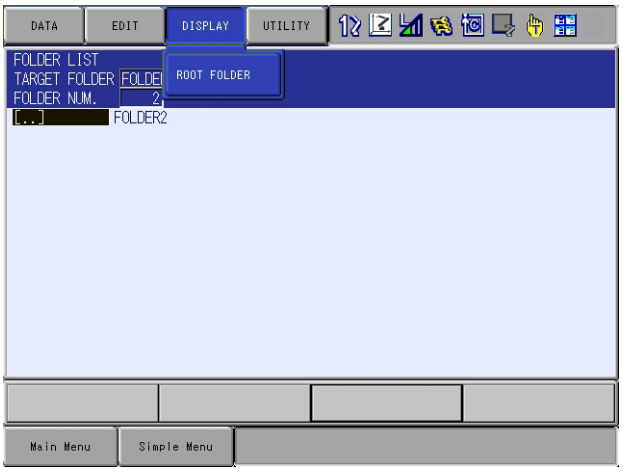


■ **Initial Folder Setting**

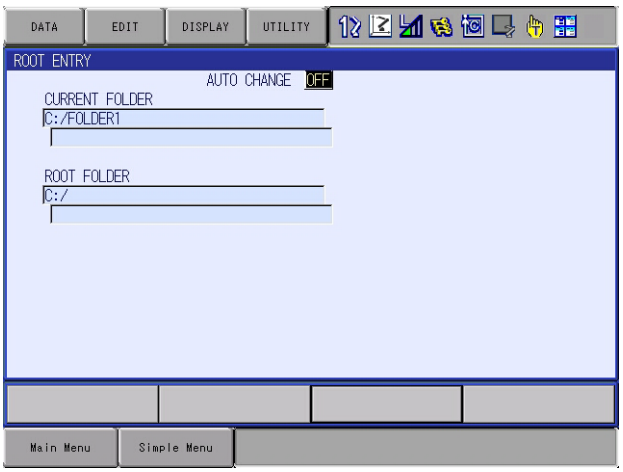
The folder that is contained in a deep hierarchy can be selected in a shortened operation.

When selecting {LOAD}, {SAVE}, {VERIFY}, or {DELETE} from the sub menu of {EX. MEMORY}, the folder that has been set as an initial folder becomes a current folder.

1. Set the security mode to the management mode or higher. Select {EX. MEMORY} 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.

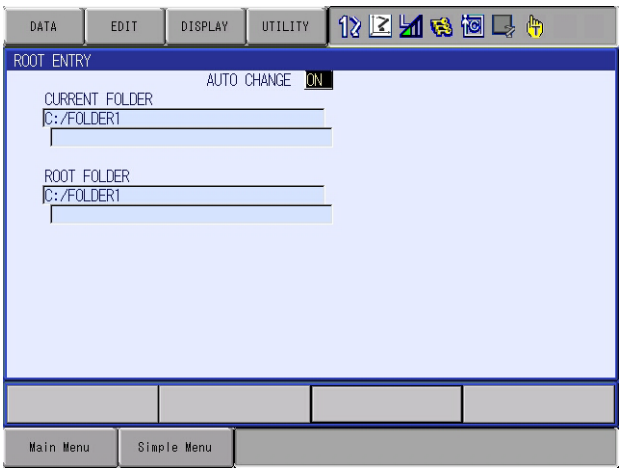


   – A folder currently selected appears in “CURRENT FOLDER” and the initial folder appears in “ROOT FOLDER”.



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 {EX. MEMORY} → {FOLDER} is selected, the initial folder that has been set becomes a current folder.

SUPPLE -MENT

When the initial folder is missing due to exchange of the SD card, etc., “ERROR 3360: INVALID FOLDER” appears when selecting {LOAD}, {SAVE}, {VERIFY}, {DELETE} or {FOLDER} menu from {EX. MEMORY}, and simultaneously the initial folder becomes invalid. Set “ON” in “AUTO CHANGE” when the initial folder setting needs to be valid.

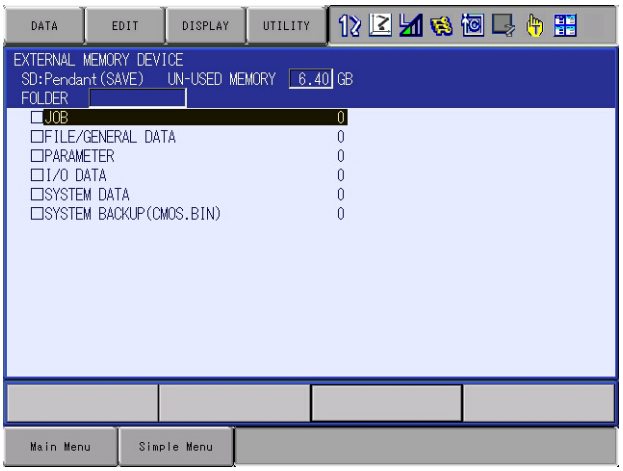
7.3.0.3 Saving Data

To download data from the memory of the YRC1000micro to the external memory device, perform the following procedure.

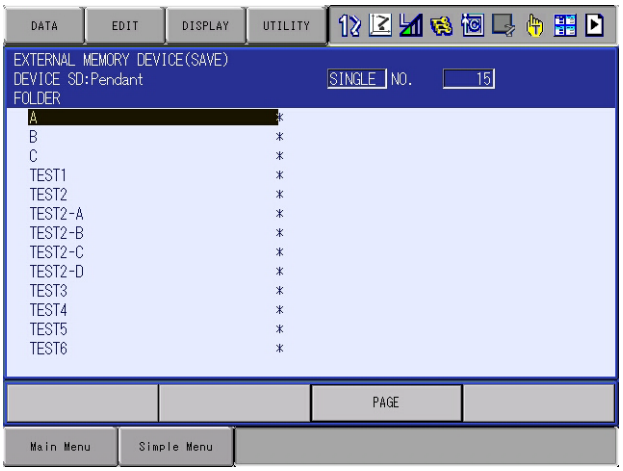
NOTE After modifying data, save the data individually.

■ **Saving a Job**

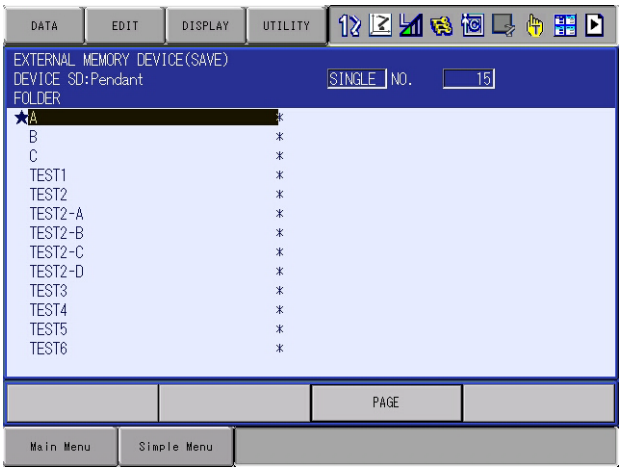
1. Select {EX. MEMORY} under the main menu.
2. Select {SAVE}.
   – The following window appears.



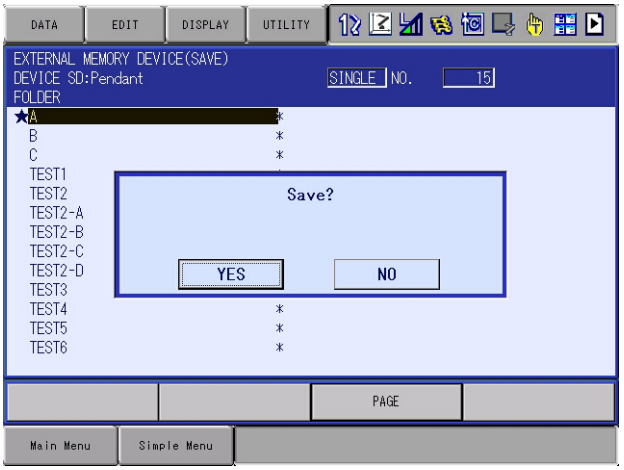
3. Select “JOB”.
   – The JOB LIST window appears.



4. Select a job to be saved.
   – The selected job is marked with “★”.



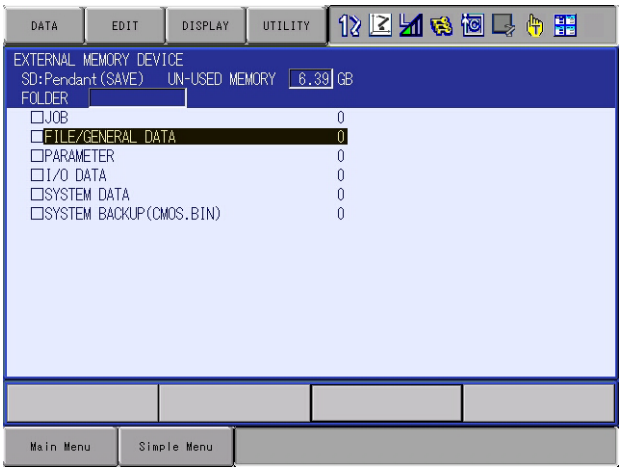
5. Press [ENTER].
   – The confirmation dialog box appears.



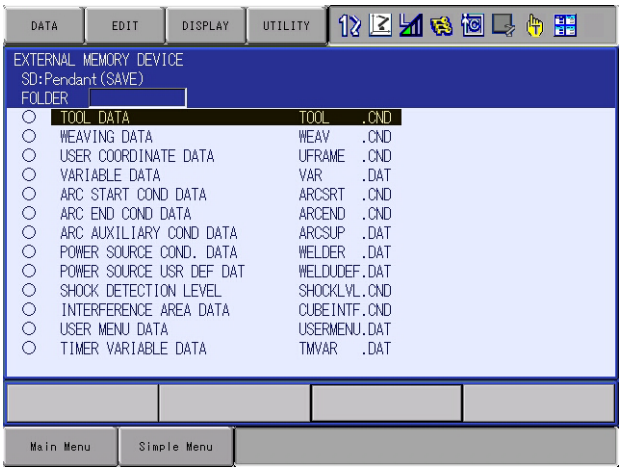
6. Select “YES”.
   – The selected job is saved.

■ Saving a Condition File or General Data

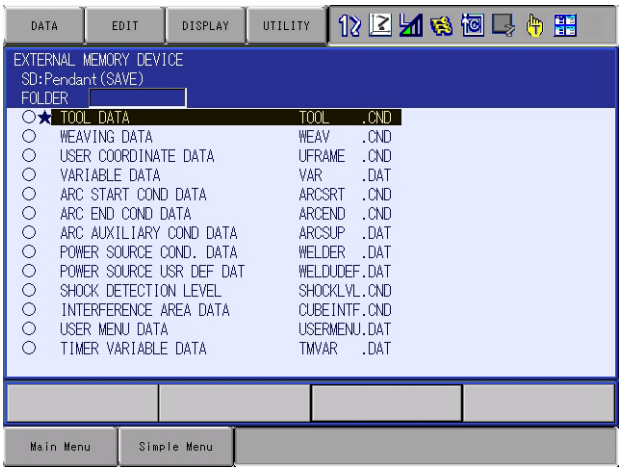
1. Select {EX. MEMORY} under the main menu.
2. Select {SAVE}.
   – The following window appears.



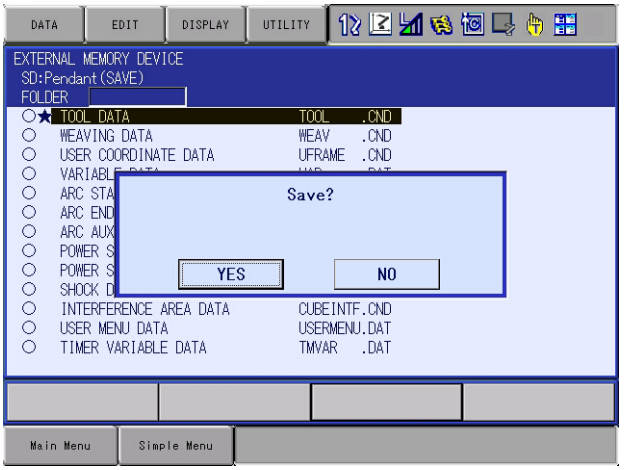
3. Move the cursor to “FILE/GENERAL DATA” and select.
   – The selection window appears.
   – The content of the display varies in accordance with applications and options.



4. Select condition files or general data to be saved.
   – The selected files are marked with “★”.



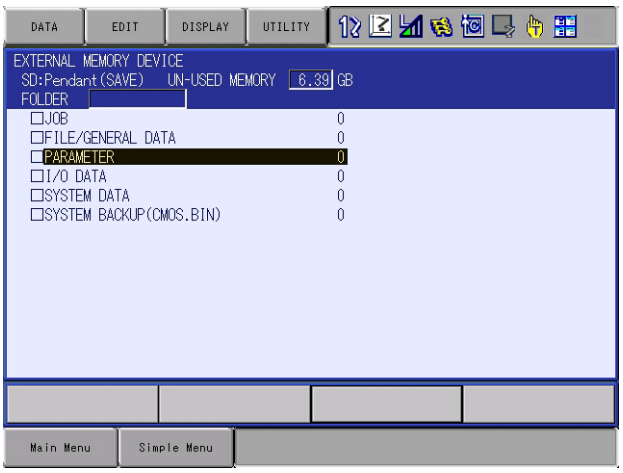
5. Press [ENTER].
   – The confirmation dialog box appears.



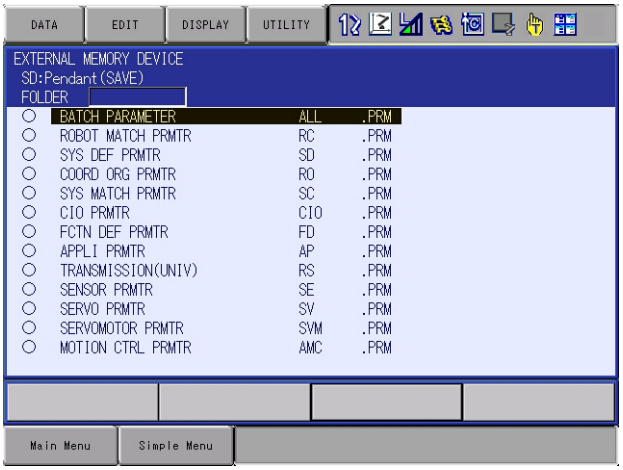
6. Select “YES”.
   – The selected files are saved.

■ Saving a Parameter

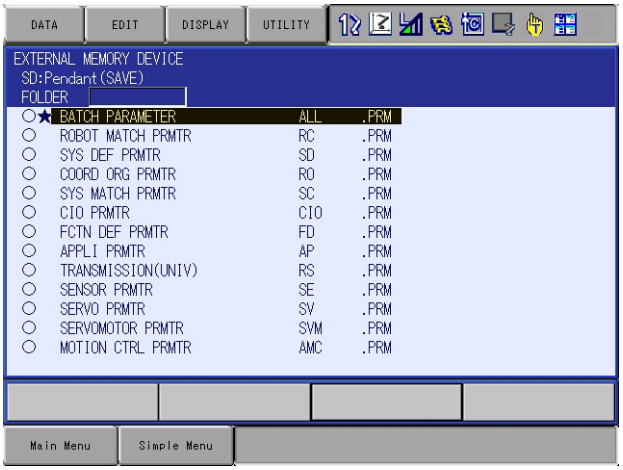
1. Select {EX. MEMORY} under the main menu.
2. Select {SAVE}.
   – The following window appears.



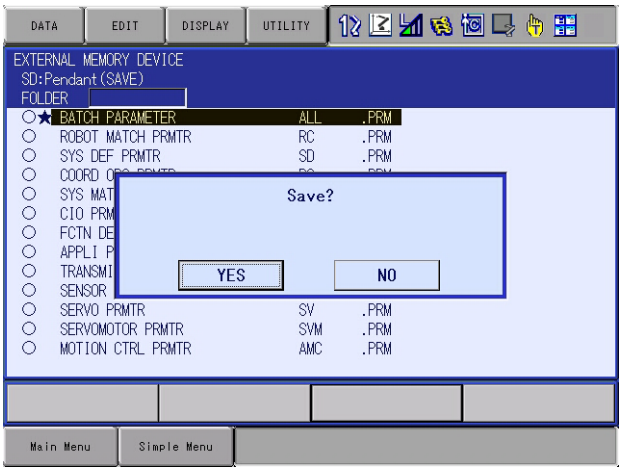
3. Move the cursor to “PARAMETER” and select.
   – The selection window for parameters appears.



4. Select parameters to be saved.
   – The selected parameters are marked with “★”.



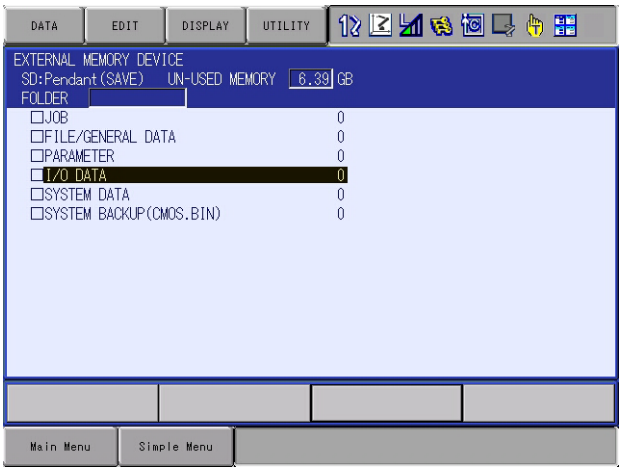
5. Press [ENTER].
   – The confirmation dialog box appears.



6. Select “YES”.
   – The selected parameters are saved.

■ Saving I/O Data

1. Select {EX. MEMORY} under the main menu.
2. Select {SAVE}.
   – The following window appears.



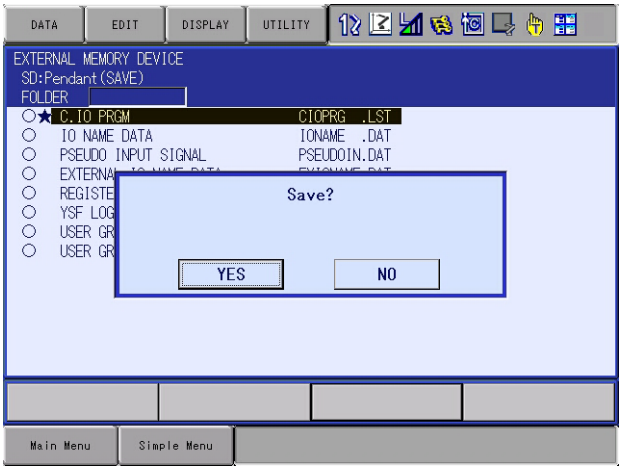
3. Move the cursor to “I/O DATA” and select.
   – The selection window for I/O data appears.



4. Select I/O data to be saved.
   – The selected I/O data are marked with “★”.



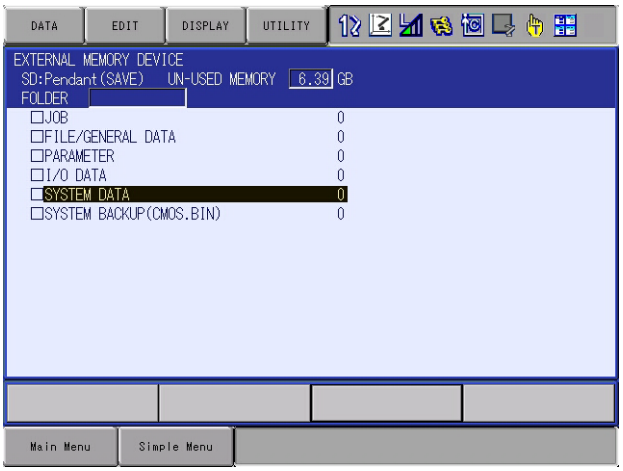
5. Press [ENTER].
   – The confirmation dialog box appears.



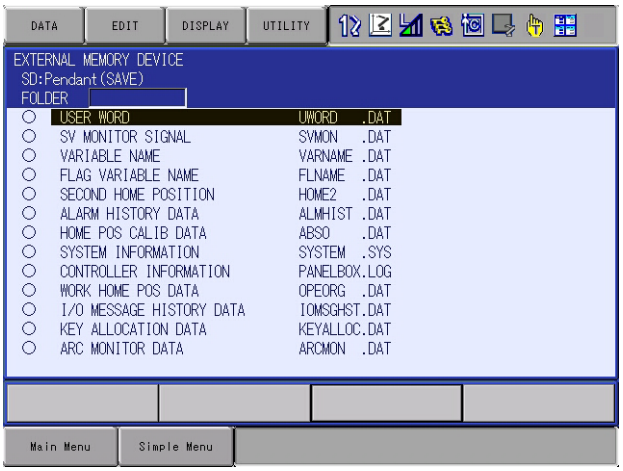
6. Select “YES”.
   – The selected I/O data are saved.

■ Saving System Data

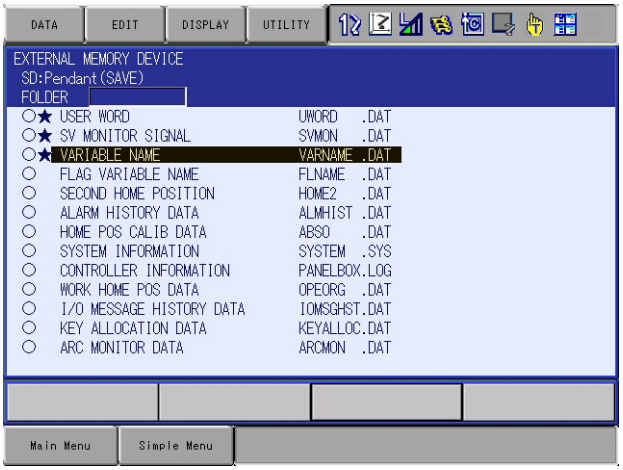
1. Select {EX. MEMORY} under the main menu.
2. Select {SAVE}.
   – The following window appears.



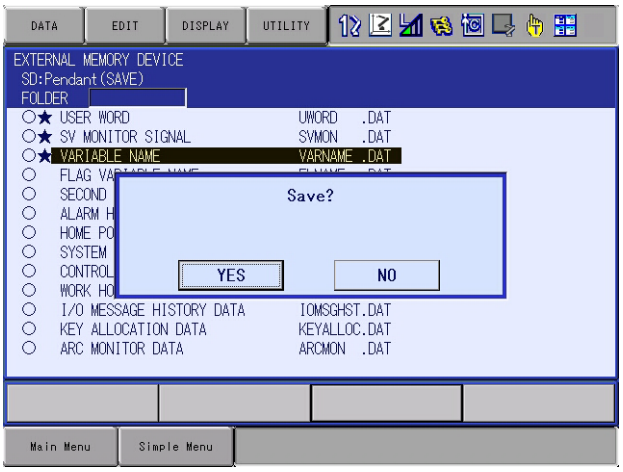
3. Move the cursor to {SYSTEM DATA} and select.
   – The selection window for system data appears.



4. Select system data to be saved.
   – The selected system data are marked with “★”.



5. Press [ENTER].
   – The confirmation dialog box appears.



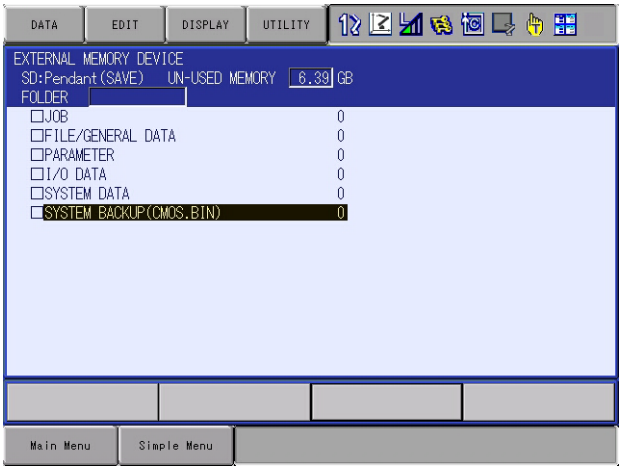
6. Select “YES”.
   – The selected system data are saved.

SUPPLE-MENT

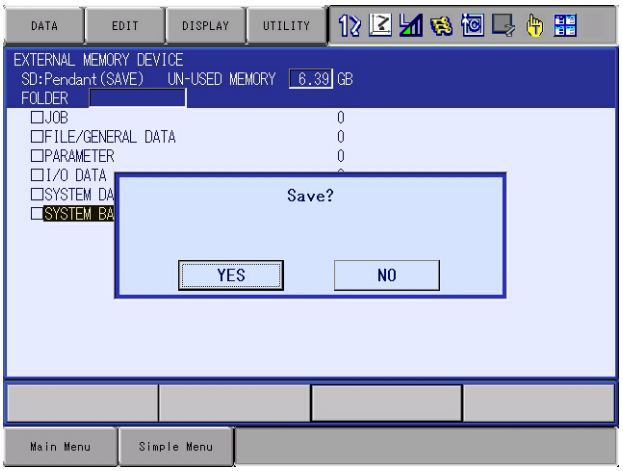
As for “JOB”, “FILE/GENERAL DATA”, “PARAMETER”, “SYSTEM DATA”, and “I/O DATA”, the data cannot be over-written. In this case, delete the file of the same name in the folder beforehand or create a new folder so that the data can be stored inside.

■ Saving SYSTEM BACKUP (CMOS.BIN)

1. Select {EX. MEMORY} under the main menu.
2. Select {SAVE}.
   – The following window appears.

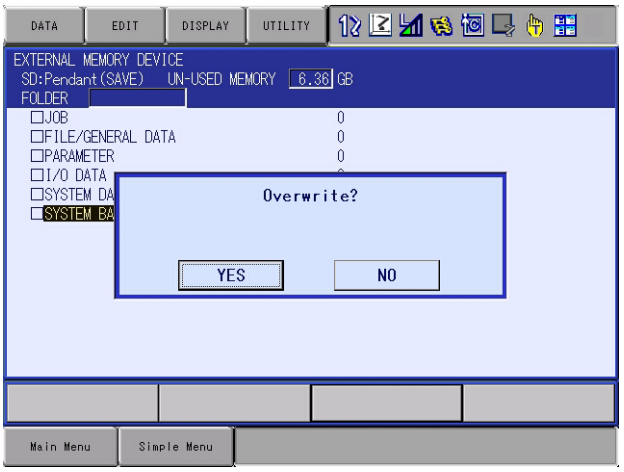


3. Select “SYSTEM BACKUP(CMOS.BIN)”.
   – The confirmation dialog box appears.



4. Select “YES”.
   – Saving operation of SYSTEM BACKUP(CMOS.BIN) starts in case CMOS.BIN does not exist where this data is saved.
   Or proceed to the following step (step 5) when CMOS.BIN is already equipped.

5. The confirmation dialog box appears.



6. Select “YES”.
   – Saving of SYSTEM BACKUP (CMOS.BIN) starts.

NOTE

Saving of SYSTEM BACKUP (CMOS.BIN) cannot be performed while servo is turned ON, data is transmitted together with data modification, automatic backup, or when the media free space is less than 35 MB.

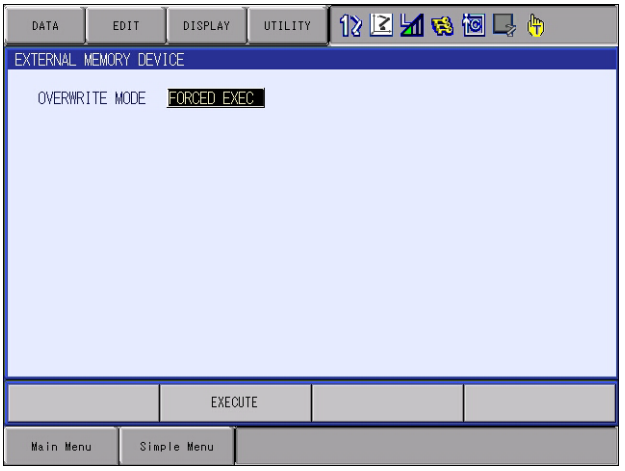
For about 2 seconds right after SYSTEM BACKUP (CMOS.BIN) saving is started, the hourglass icon appears at the center of the window and all the operations become invalid. Operations become valid when the hourglass disappeared.

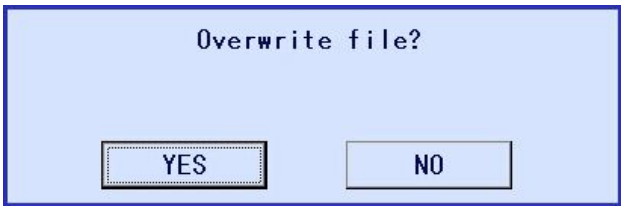
Do not turn OFF the power supply because SYSTEM BACKUP (CMOS.BIN) is being saved in the saving device while the hourglass is appeared in the status area.

7.3.0.4 Overwriting When Saving a File

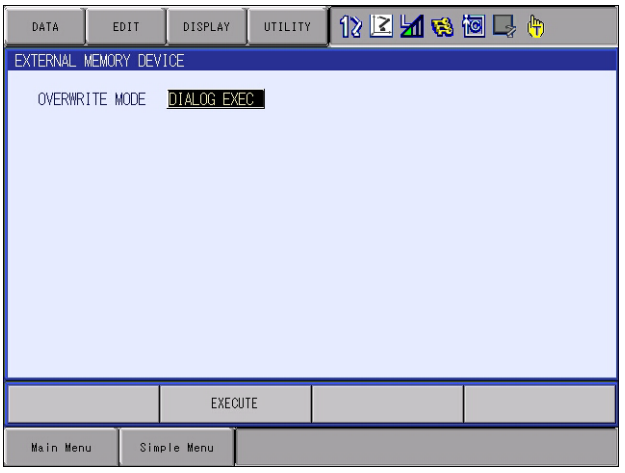
If a data is saved in the external memory while “FILE SAVE OVERWRITE” is valid, the OVERWRITE MODE selection screen appears.

- FORCED EXEC: When performing a saving operation by means of selecting all the target files at a time, if you select “EXECUTE” while “FORCED EXEC” is selected, a confirmation dialog asking whether to overwrite the files will appear. If you select "YES", all the files are saved at a time.

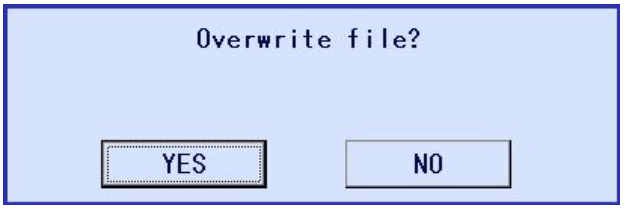




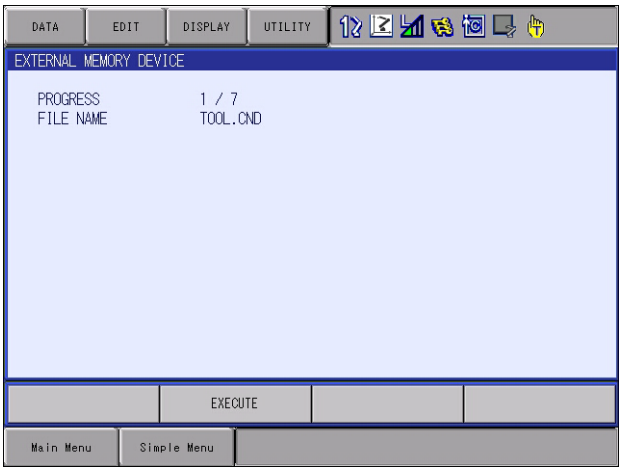
- DIALOG EXEC: The saving operation is executed one file by one file with a confirmation message asking whether to overwrite it or not.



If you select “EXECUTE”, a confirmation dialog asking whether to overwrite the file appears.



If you select “YES”, the dialog execution screen appears.



- PROGRESS: Displays the progress of saving.
- FILE NAME: Displays the name of currently selected file.
- EXECUTE: Pressing this button displays the confirmation dialog. When “YES” is selected, the currently selected file is saved.



SUPPLE -MENT

Even if “DIALOG EXEC” is selected, confirmation for each file is not performed on the dialog execution screen when there is no existing file.

7.3.0.5 Loading Data

To upload data from the external memory device to the memory of the YRC1000micro, follow the procedure in the following.

NOTE

PARAMETER, SYSTEM DATA, I/O DATA, and SYSTEM BACKUP (CMOS.BIN) including the information of the former three data, contain unique information of the controller. These data are prepared as backups for reloading into the same controller where the data have been saved.

If the data saved in a different controller is loaded, the system data may be damaged or lost, or the system may perform an unexpected operation or may not start up normally.

Do not load the backup data into a different controller.

Even if the same job is loaded into two different controllers, paths of the manipulators will be different because of the differences in their home positions and mechanical components.

Make sure to check the operation with due care before actual operations.

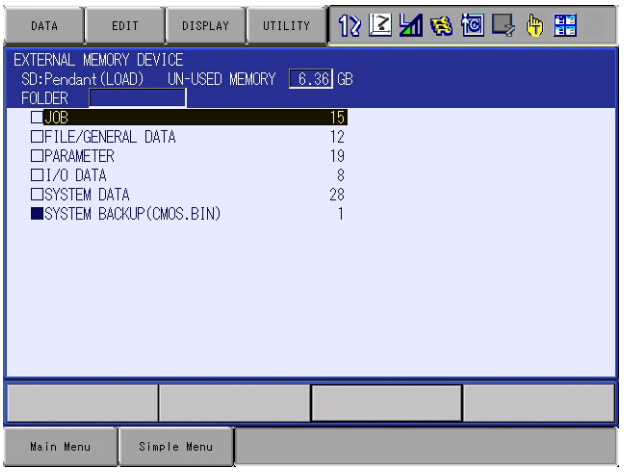
Be careful in managing the saved data.

NOTE

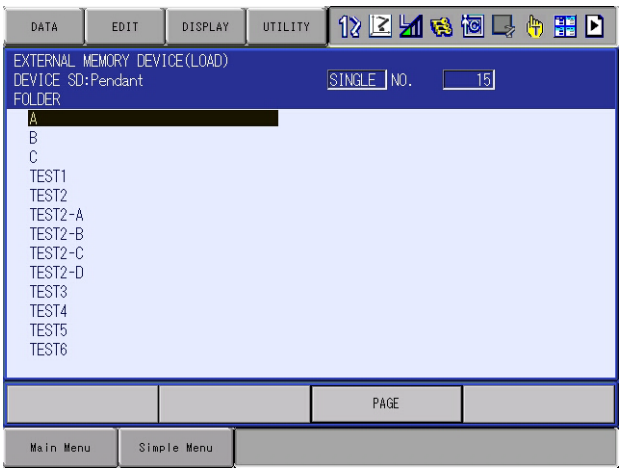
- When the ladder program of the DX200 is tried to be loaded into the YRC1000micro, the confirmation dialog “Load the CIOPRG of past product?” is displayed. Select “YES” to load the ladder program of the DX200. If [CANCEL] is pressed or “NO” is selected while this dialog is displayed, the ladder program is not loaded.
- Before loading the ladder program of the DX200 into the YRC1000micro, make sure to confirm that the application(s) of the DX200 and the application(s) of the YRC1000micro are the same.
  Load the ladder program only when the kinds and the numbers of the application(s) of the DX200 and the YRC1000micro are the same. (For example, “Material handling, press tending, cutting, and other applications” and “Material handling, press tending, cutting, and other applications + Material handling, press tending, cutting, and other applications” are recognized as different applications.)
- The ladder program of the DX100 can also be loaded into the YRC1000micro.
- In order to use a new function added for the DX200 or later, reflect the content edited in the DX100/DX200 in the ladder program of the YRC1000micro. Do not load the ladder program of the DX100/DX200 into the YRC1000micro.

■ Loading a Job

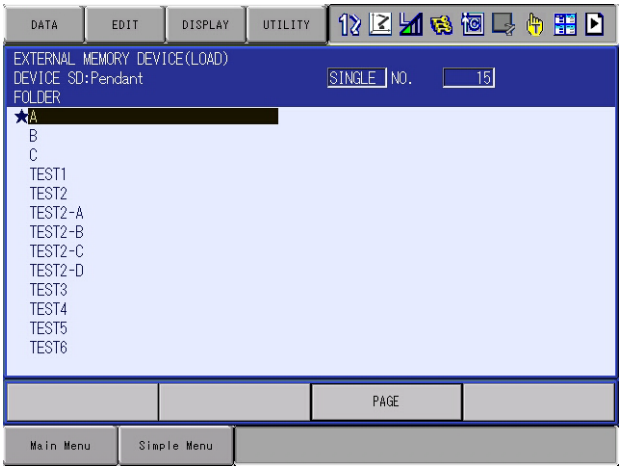
1. Select {EX. MEMORY} under the main menu.
2. Select {LOAD}.
   – The following window appears.



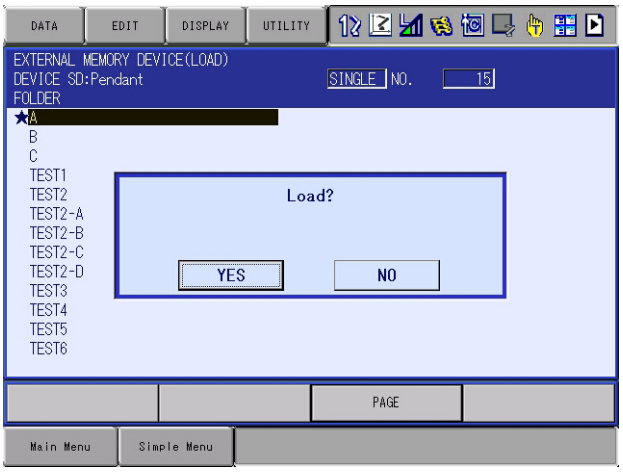
3. Select {JOB}.
   – The job selection window appears.



4. Select a job to be loaded.
   – The selected jobs are marked with “★”.



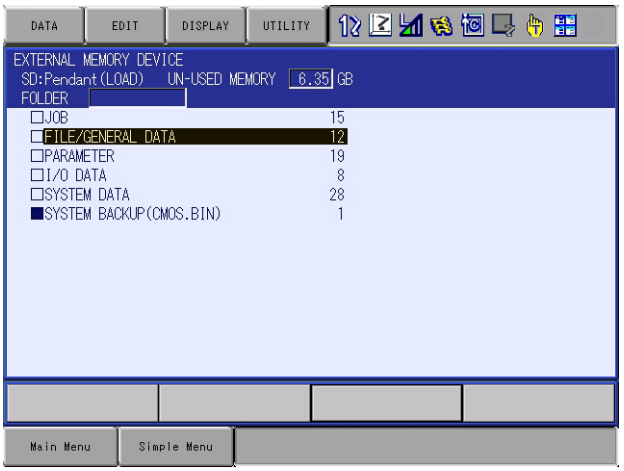
5. Press [ENTER].
   – The confirmation dialog box appears.



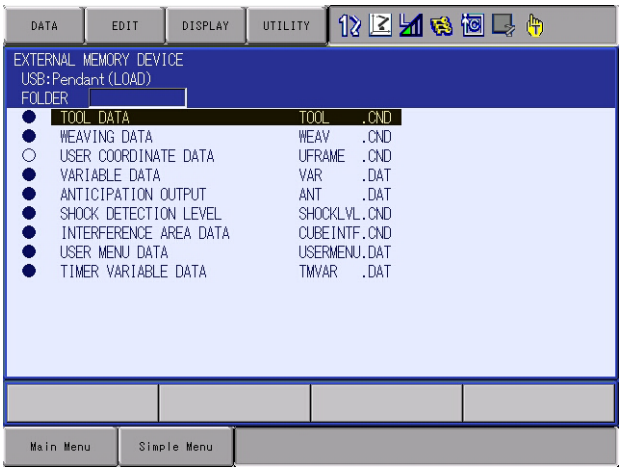
6. Select “YES”.
   – The selected jobs are loaded.

■ Loading a Condition File/General Data

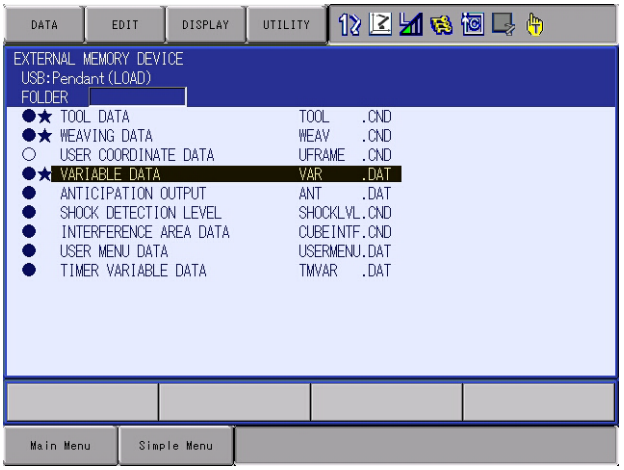
1. Select {EX. MEMORY} under the main menu.
2. Select {LOAD}.
   – The following window appears.



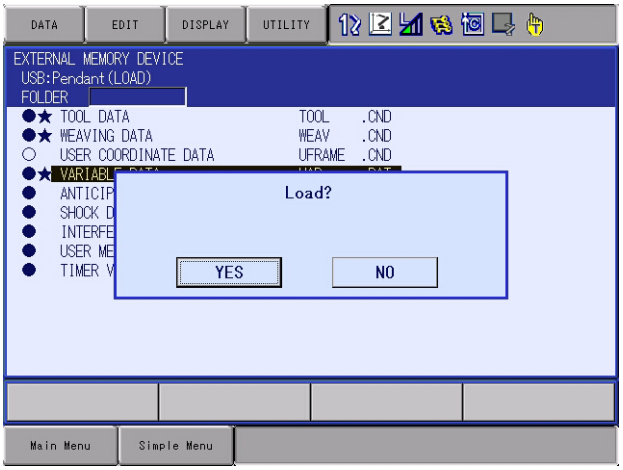
3. Move the cursor to “FILE/GENERAL DATA” and select.
   – The selection window for condition file or general data appears.



4. Select a condition file or general data to be loaded.
   – The selected files are marked with “★”.



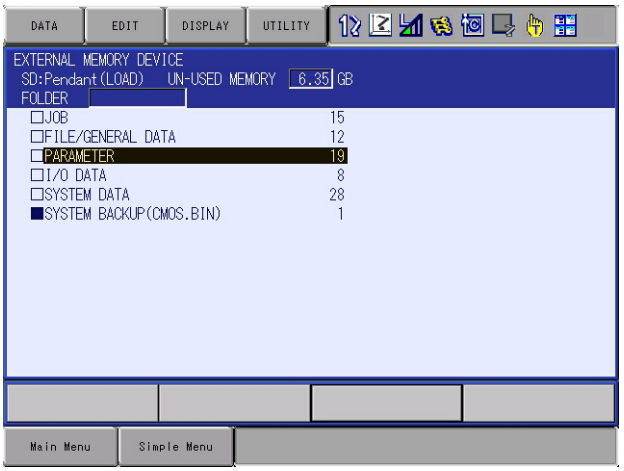
5. Press [ENTER].
   – The confirmation dialog box appears.



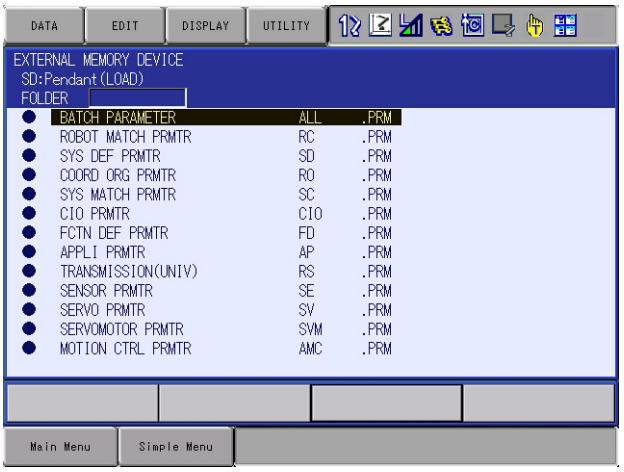
6. Select “YES”.
   – The selected files are loaded.

■ Loading a Parameter

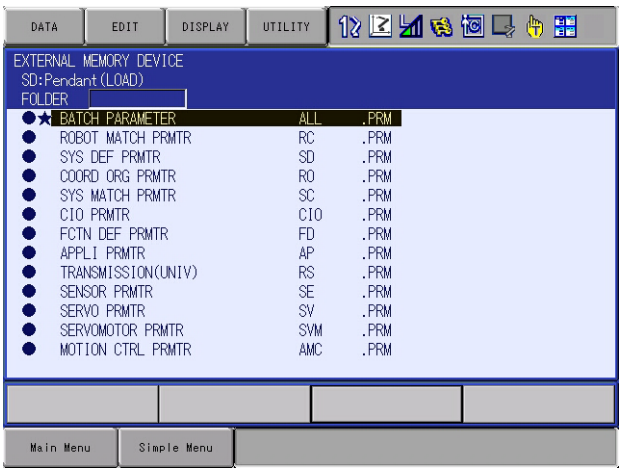
1. Select {EX. MEMORY} under the main menu.
2. Select {LOAD}.
   – The following window appears.



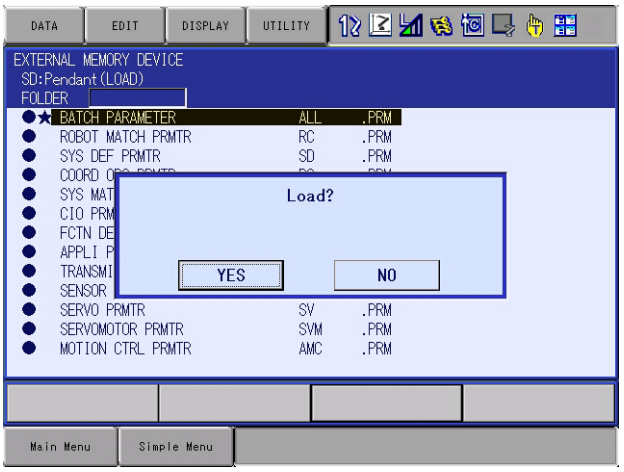
3. Move the cursor to “PARAMETER” and select.
   – The selection window for parameters appears.



4. Select parameters to be loaded.
   – The selected parameters are marked with “★”.



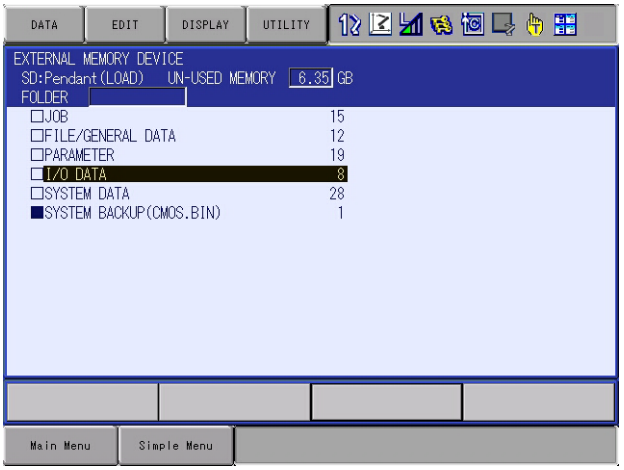
5. Press [ENTER].
   – The confirmation dialog box appears.



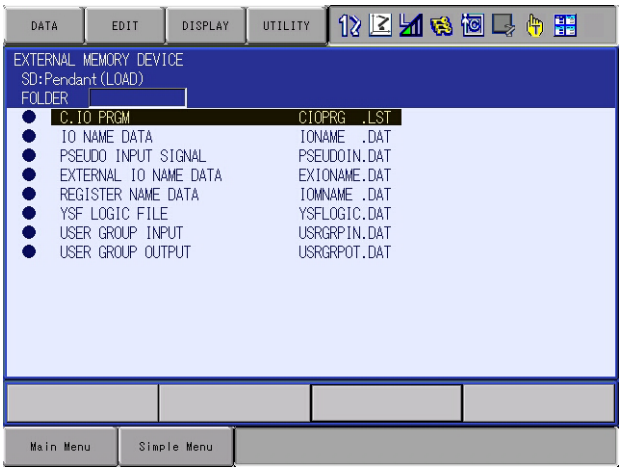
6. Select “YES”.
   – The selected parameters are loaded.

■ Loading I/O Data

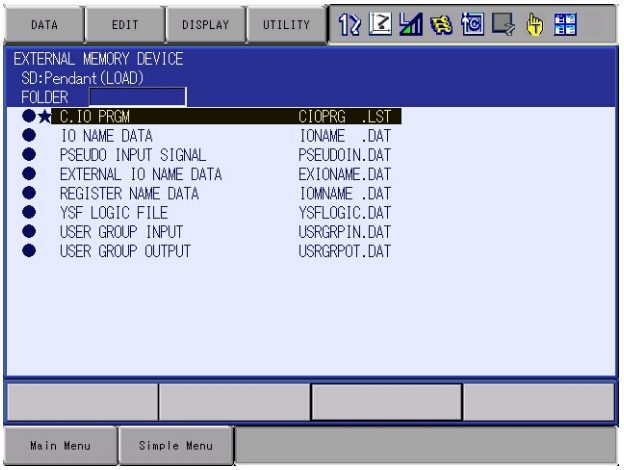
1. Select {EX. MEMORY} under the main menu.
2. Select {LOAD}.
   – The following window appears.



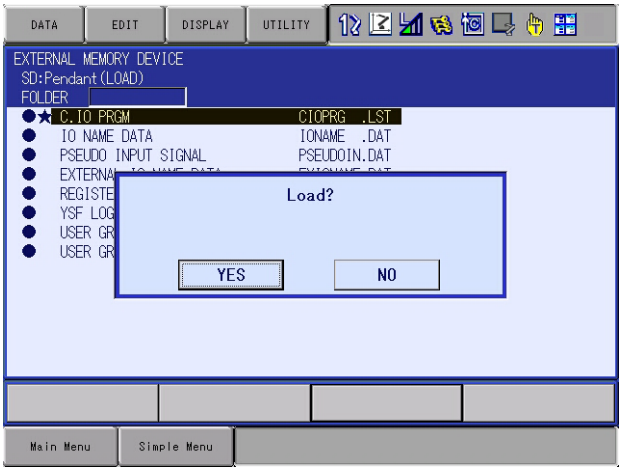
3. Move the cursor to “I/O DATA” and select.
   – The selection window for I/O data appears.



4. Select I/O data to be loaded.
   – The selected I/O data are marked with “★”.



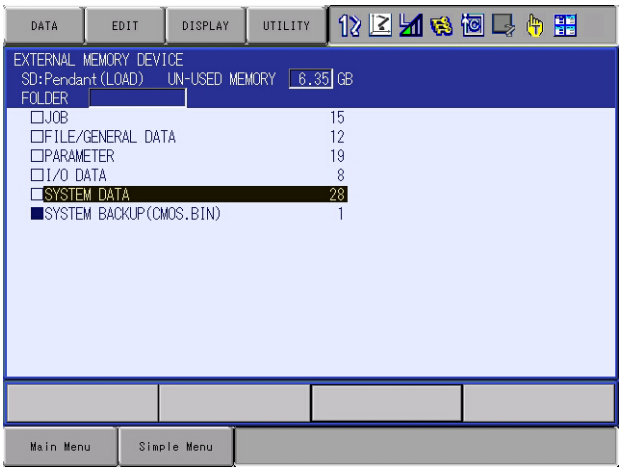
5. Press [ENTER].
   – The confirmation dialog box appears.



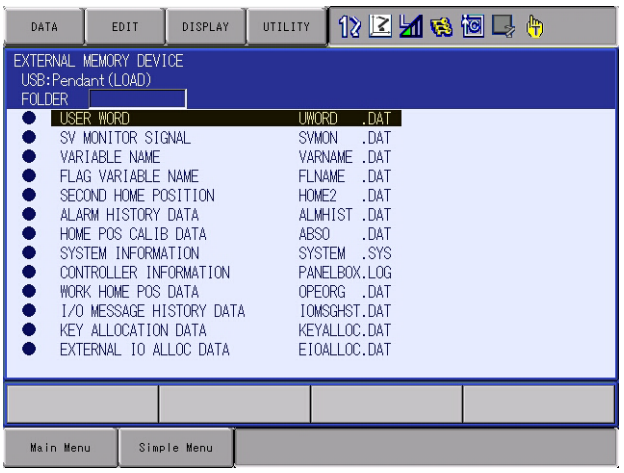
6. Select “YES”.
   – The selected I/O data are loaded.

■ Loading System Data

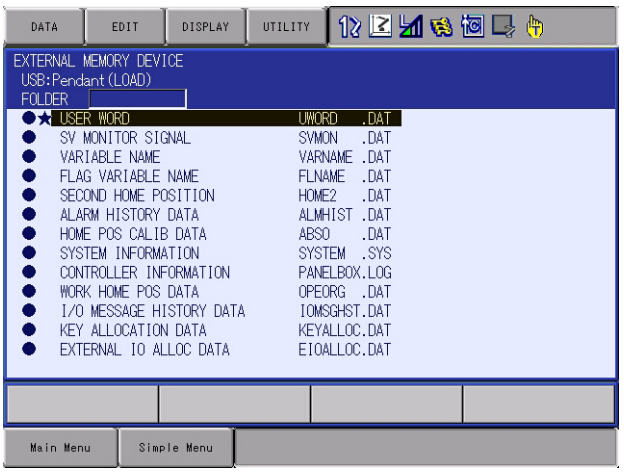
1. Select {EX. MEMORY} under the main menu.
2. Select {LOAD}.
   – The following window appears.



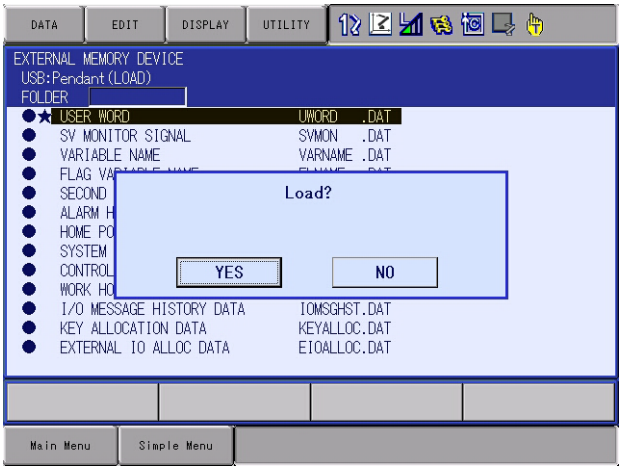
3. Move the cursor to “SYSTEM DATA” and select.
   – The selection window for system data appears.



4. Select system data to be loaded.
   – The selected system data are marked with “★”.



5. Press [ENTER].
   – The confirmation dialog box appears.

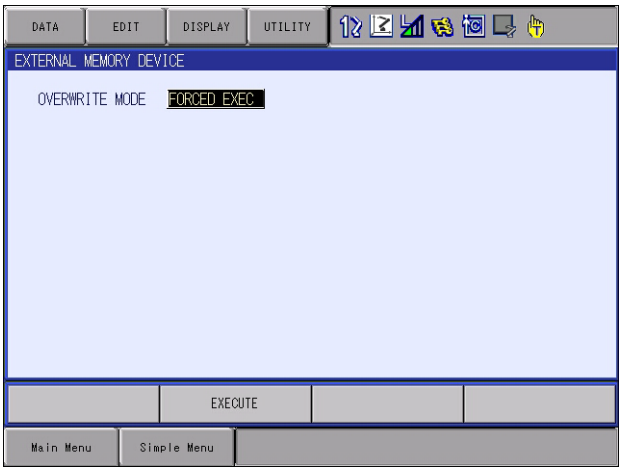


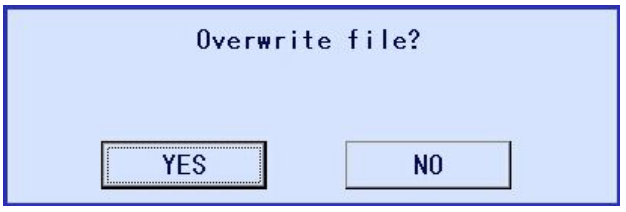
6. Select “YES”.
   – The selected system data are loaded.

7.3.0.6 Overwriting When Loading Jobs

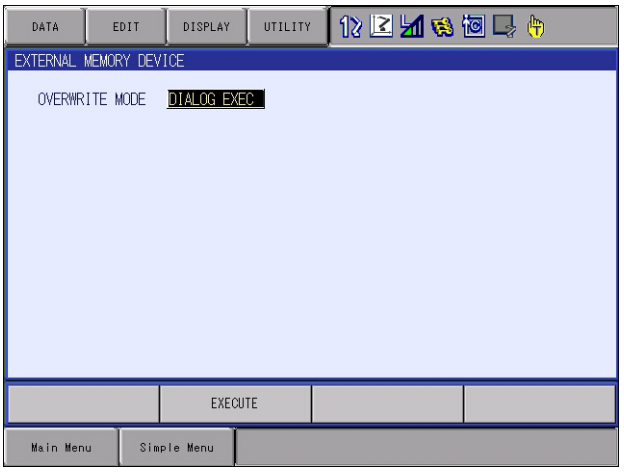
If jobs are loaded while “JOB LOAD OVERWRITE” is valid, the OVERWRITE MODE selection screen appears.

- FORCED EXEC: When performing loading operation by means of selecting all the target files at a time, if you select “EXECUTE” while “FORCED EXEC” is selected, a confirmation dialog asking whether to overwrite the files will appear.
  If you select "YES", jobs are loaded.

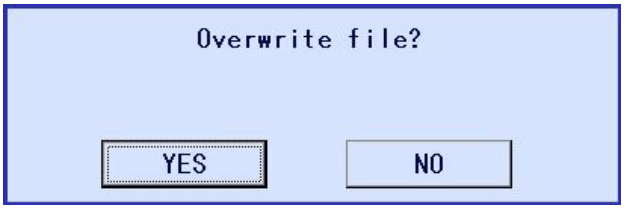




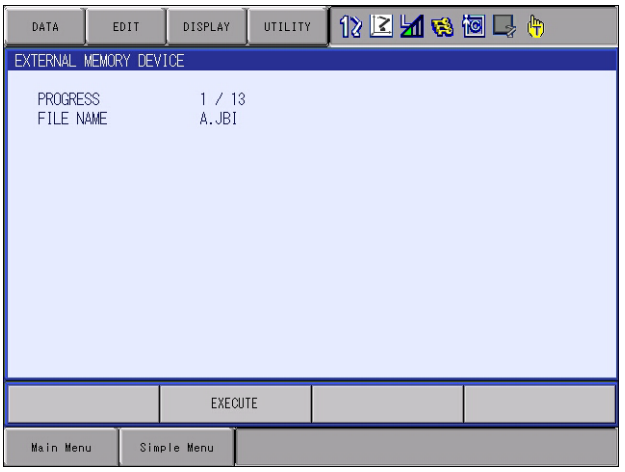
- DIALOG EXEC: The loading operation is executed one file by one file with a confirmation message asking whether to overwrite it or not.



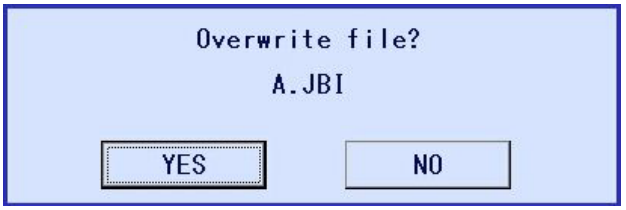
If you select “EXECUTE”, a confirmation dialog asking whether to overwrite the file appears.



If you select “YES”, the dialog execution screen appears.



- PROGRESS: Displays the progress of saving.
- FILE NAME: Displays the name of currently selected file.
- EXECUTE: Pressing this button displays the confirmation dialog. When “YES” is selected, the currently selected file is saved.



SUPPLE-MENT

Even if “DIALOG EXEC” is selected, confirmation for each file is not performed on the dialog execution screen when there is no existing file.

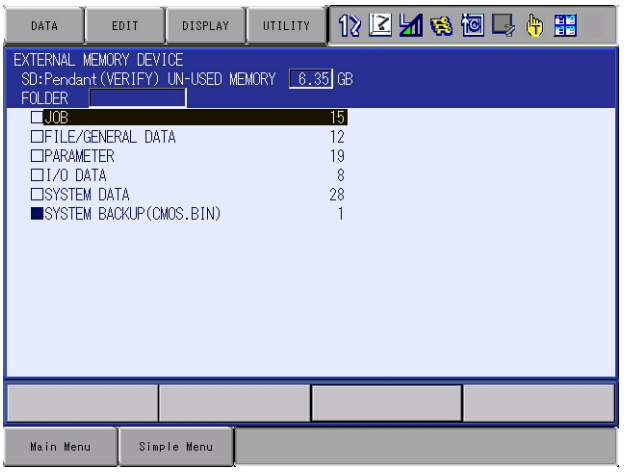
7.3.0.7 Verifying Data

Follow the procedure below to verify data in the memory of the YRC1000micro with data saved in the external memory device.

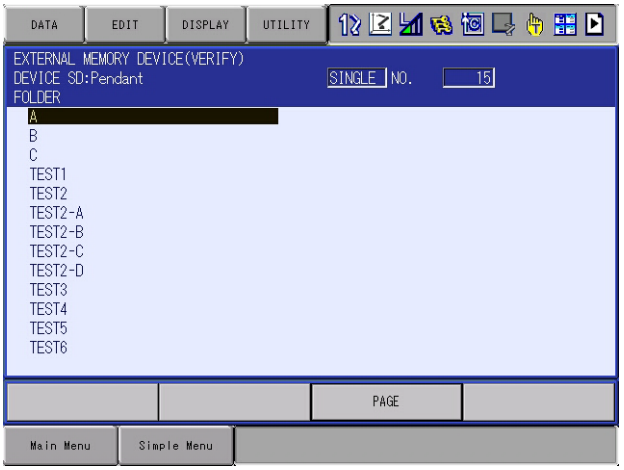
NOTE “SYSTEM BACKUP (CMOS.BIN)” cannot be verified.

■ **Verifying a Job**

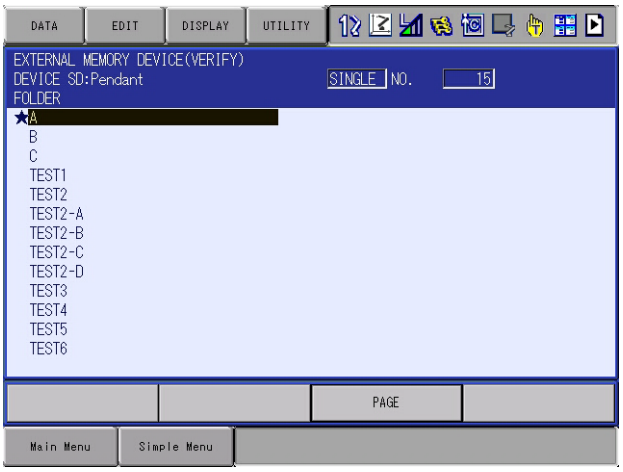
1. Select {EX. MEMORY} under the main menu.
2. Select {VERIFY}.
   – The following window appears.



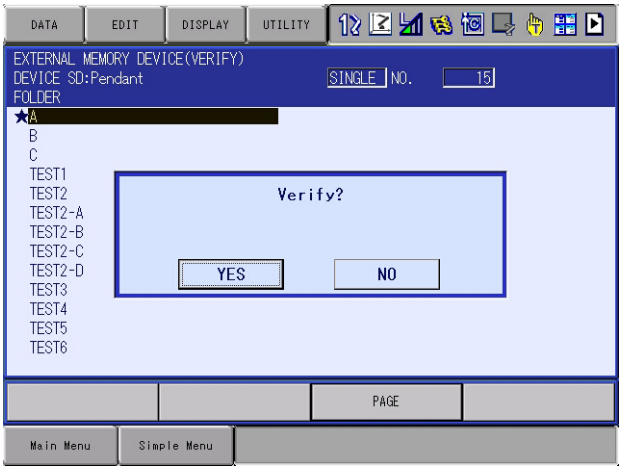
3. Select “JOB”.
   – The job selection window appears.



4. Select a job to be verified.
   – The selected jobs are marked with “★”.



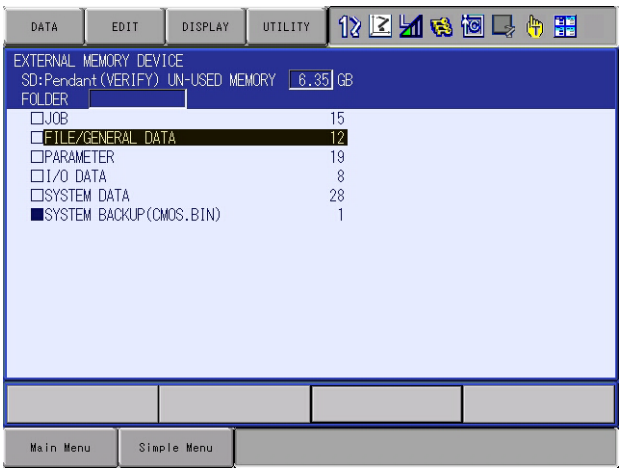
5. Press [ENTER].
   – The confirmation dialog box appears.



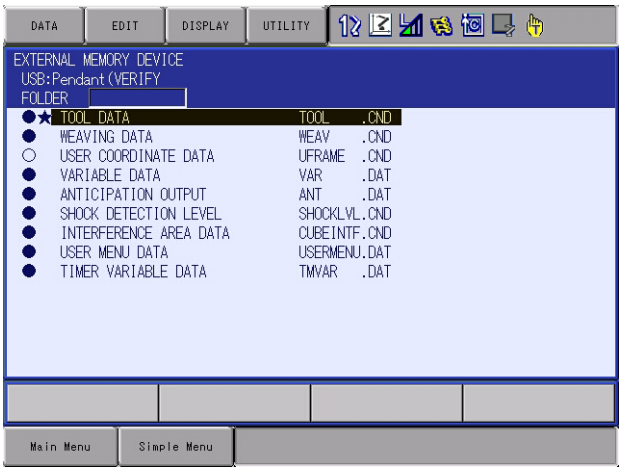
6. Select “YES”.
   – The selected jobs are verified.

■ Verifying a File (FILE/GENERAL DATA, PARAMETER, I/O DATA, SYSTEM DATA)

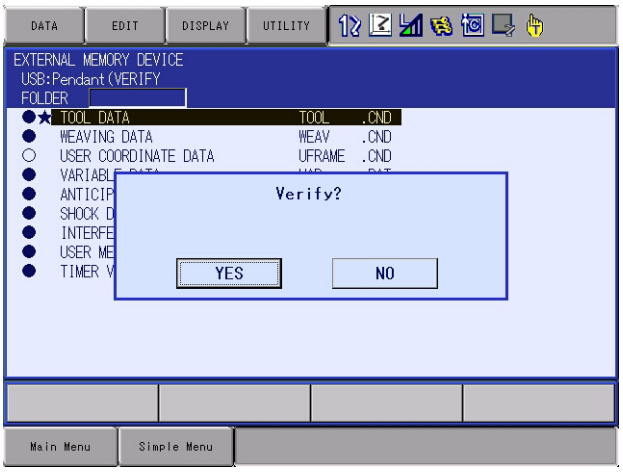
1. Select {EX. MEMORY} under the main menu.
2. Select {VERIFY}.
   – The following window appears.



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.



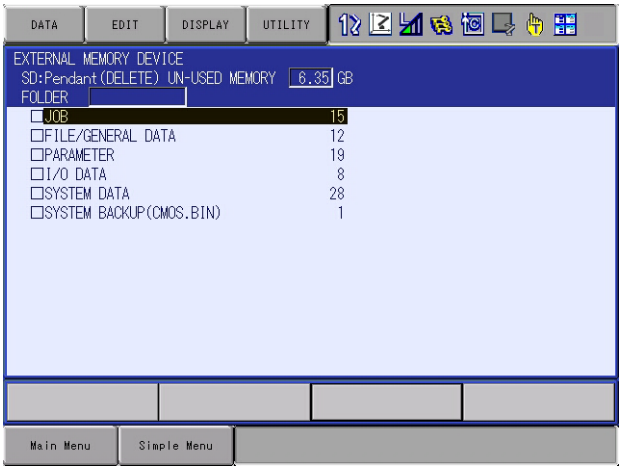
6. Select “YES”.
   – The selected files are verified.

7.3.0.8 Deleting Data

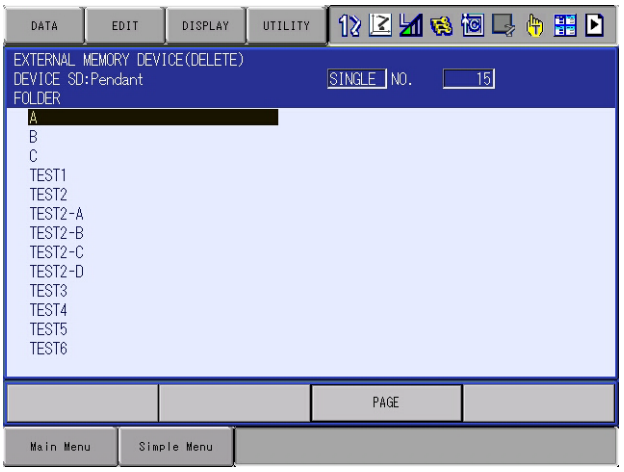
Follow the procedure below to delete a file or files on an external memory device.

■ Deleting a Job

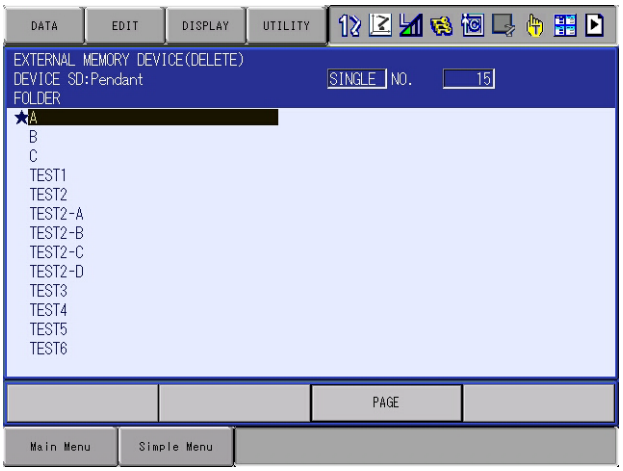
1. Select {EX. MEMORY} under the main menu.
2. Select {DELETE}.
   – The following window appears.



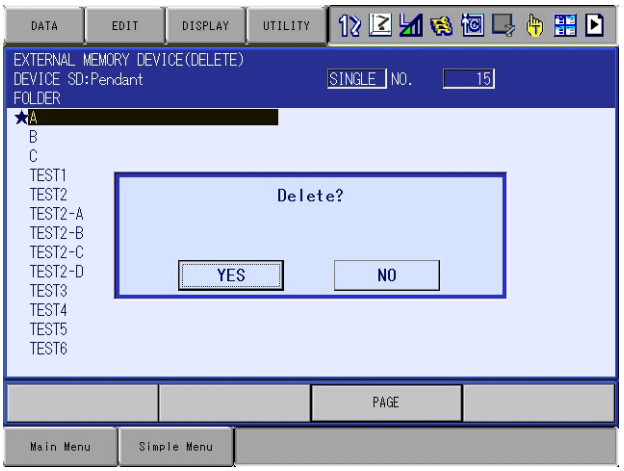
3. Select “JOB”.
   – The job selection window appears.



4. Select a job to be deleted.
   – The selected jobs are marked with “★”.



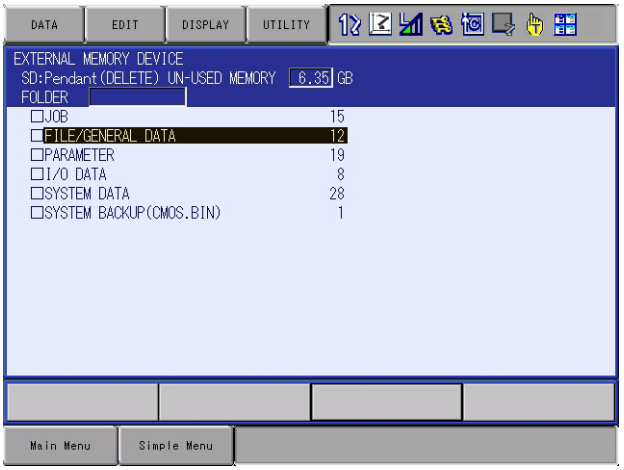
5. Press [ENTER].
   – The confirmation dialog box appears.



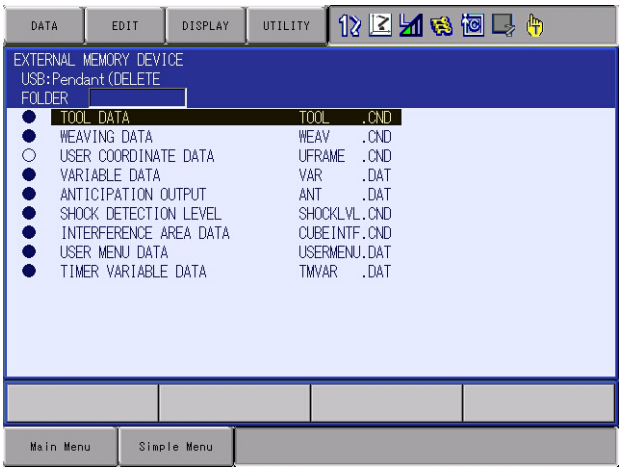
6. Select “YES”.
   – The selected jobs are deleted.

■ Deleting a File (FILE/GENERAL DATA, PARAMETER, I/O DATA, SYSTEM DATA)

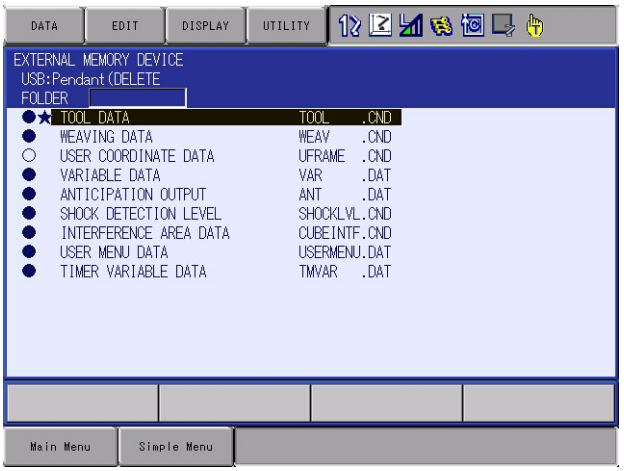
1. Select {EX. MEMORY} under the main menu.
2. Select {DELETE}.
   – The following window appears.



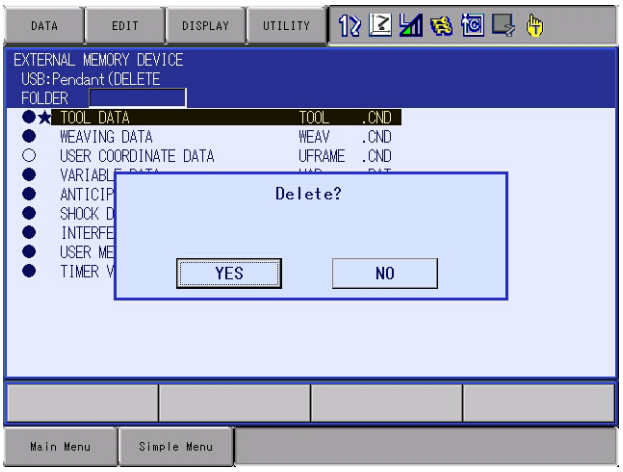
3. Select the group of the file to be deleted.



4. Select a file to be deleted.
   – The selected files are marked with “★”.



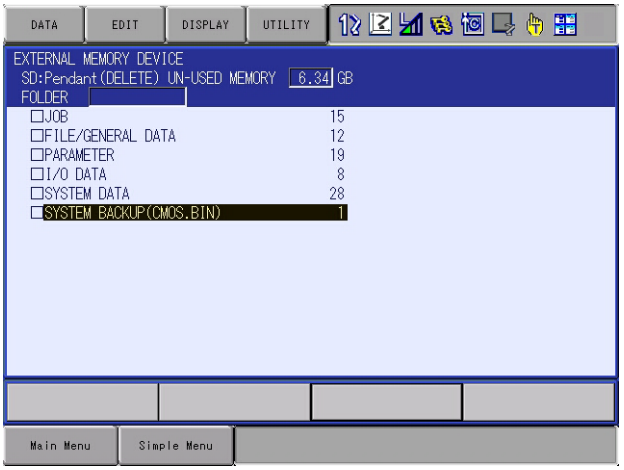
5. Press [ENTER].
   – The confirmation dialog box appears.



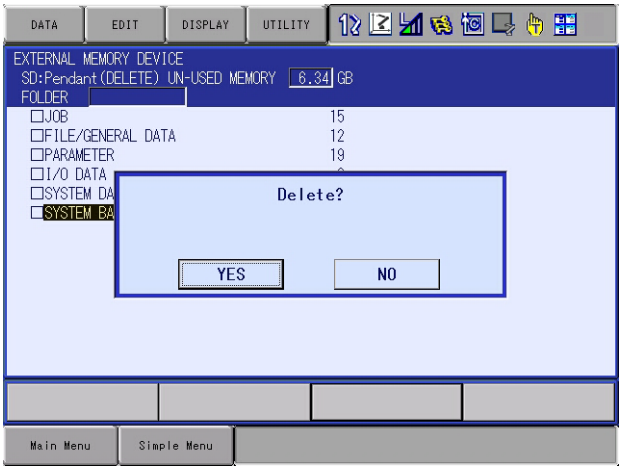
6. Select “YES”.
   – The selected files are deleted.

■ Deleting SYSTEM BACKUP (CMOS.BIN)

1. Select {EX. MEMORY} under the main menu.
2. Select {DELETE}.
   – The following window appears.



3. Select “SYSTEM BACKUP (CMOS.BIN)”.
   – A confirmation dialog box appears when CMOS.BIN exists in the saving device. And it will not appear when CMOS.BIN does not exist.



4. Select “YES”.
   – Deleting of SYSTEM BACKUP (CMOS.BIN) starts.

NOTE Deleting of SYSTEM BACKUP (CMOS.BIN is not executed while a data is transmitted together with data modification.

7.3.0.9 Job Selection Mode

The method of selecting a job and various data files when loading, saving, verifying, and deleting are described in the following:

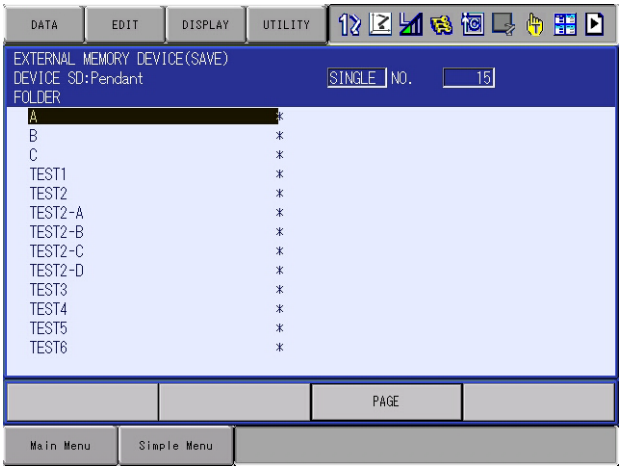
- Individual Selection
  Jobs and data files are selected individually one at a time.
- Batch Selection
  Jobs and data files are selected all at one time.
- Marker (*) Selection
  Loading: selects the files in the external memory device.
  Saving: selects the files in the memory of the YRC1000micro.
  Verifying: selects both the files in the external memory device and in the memory of the YRC1000micro.
- Batch Selection (individual file)
  Jobs and data files (FILE/GENERAL DATA, PARAMETER, I/O DATA, SYSTEM DATA) are selected all at one time.
  This operation can be performed on the window where the data type of the external memory device is selected. Only in the case of saving and verifying, operation of the external memory device can be performed.



Pendant logs, system backups, user definition files (when the optional function is enabled) are not included in batch selection.

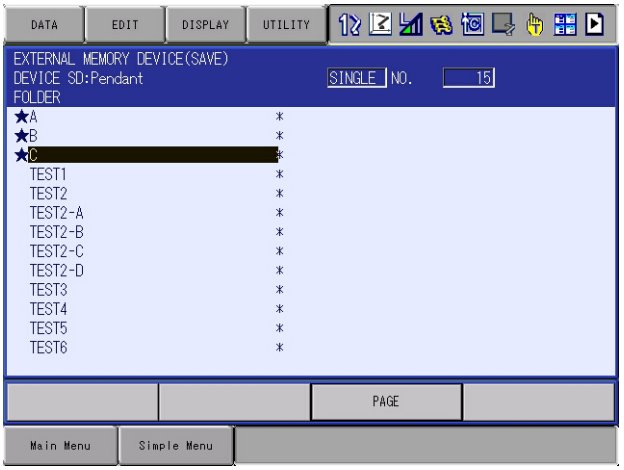
■ Using Individual Selection

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.



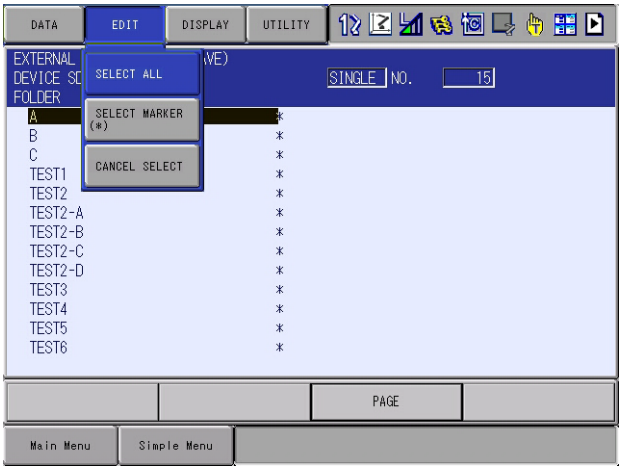
2. Press [SELECT].
   Move the cursor to a file needed and press [SELECT] again.
   *To cancel the selected items, select {EDIT} and then {CANCEL SELECT}.

   – The selected jobs are marked with "★".

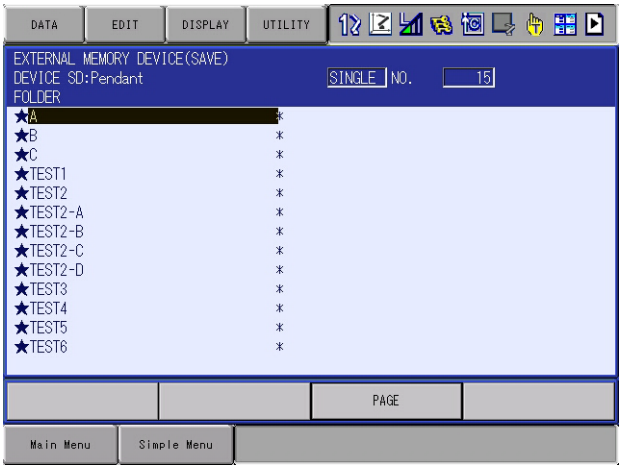


■ Using Batch Selection

1. In either the external memory JOB LIST window or the file selection window, select {EDIT} under the menu.
   – The pull-down menu appears.

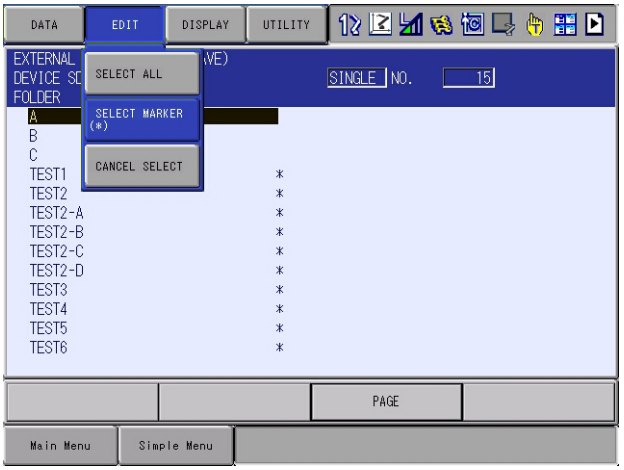


2. Select {SELECT ALL}.
   – All jobs are selected.
   *To cancel the selected items, select {EDIT} and then {CANCEL SELECT}.

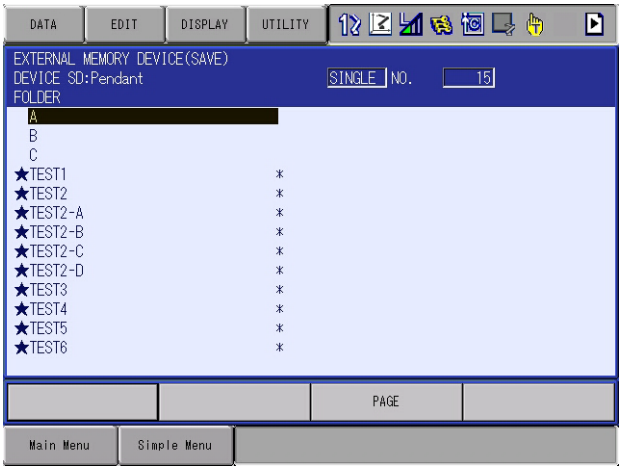


■ Using Marker (*) Selection

1. In either the external memory JOB LIST window or the file selection window, select {EDIT} under the menu.
   – The pull-down menu appears.



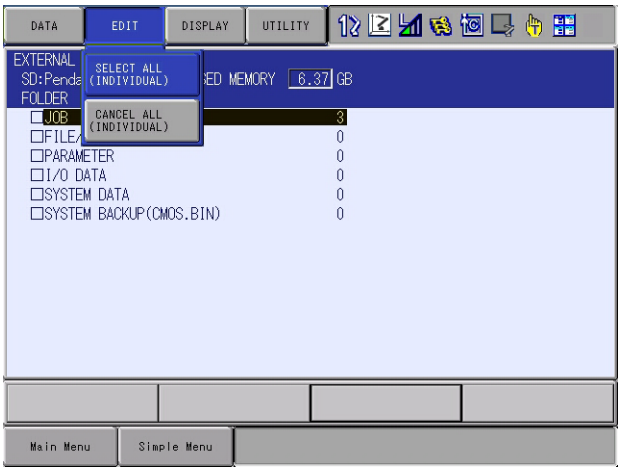
2. Select {SELECT MARKER (*)}.
   *To cancel the selected items, select {EDIT} and then {CANCEL SELECT}.



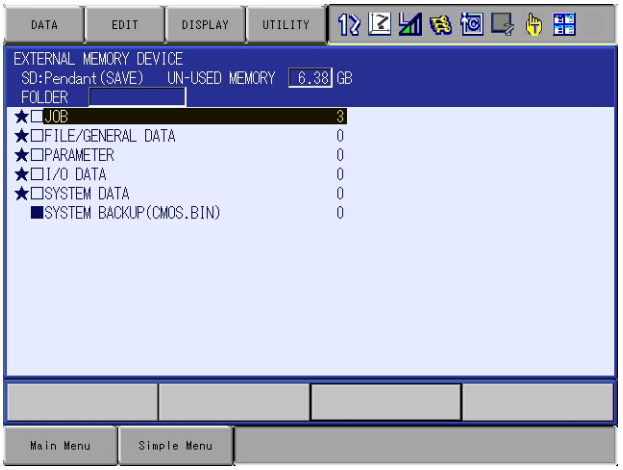
■ **Using Batch Selection (individual file)**

For two or more types of data (JOB, FILE/GENERAL DATA, PARAMETER, I/O DATA, SYSTEM DATA), the data can be selected all at one time. This operation can be performed when saving or verifying the data in the external memory device.

1. On the window where the types of data in the external memory device are selected, select {SELECT ALL (INDIVIDUAL)} from the pull-down menu {EDIT}.

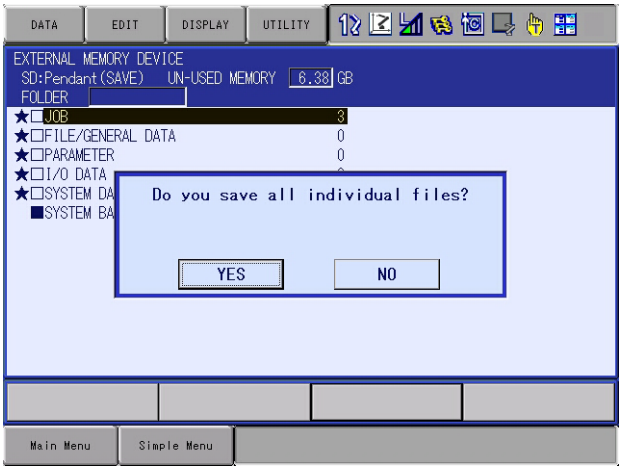


2. On the left of JOB, FILE/GENERAL DATA, PARAMETER, I/O DATA, and SYSTEM DATA, the signs "★" appear and indicate the items are selected.



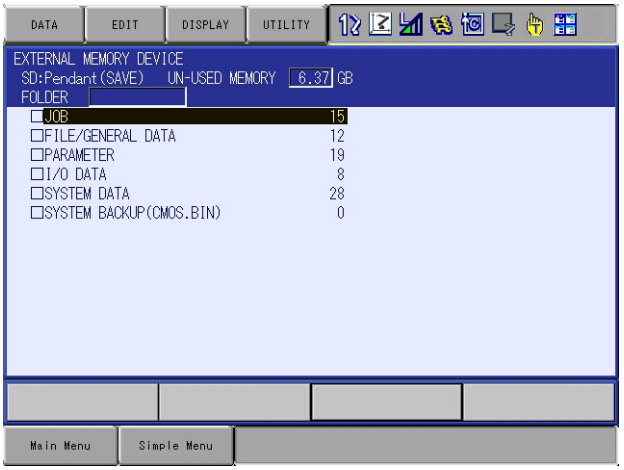
3. Press [ENTER].

4. The confirmation dialog box appears.
   When saving the data, “Do you save all individual files?” appears.
   When verifying the data, “Do you verify all individual files?” appears.



5. Select “YES”.

   – The data of the data type selected all at one time is saved or verified in the external memory device.



NOTE

- Move the cursor to the data type (JOB, FILE/GENERAL DATA, PARAMETER, I/O DATA, SYSTEM DATA) and press [SHIFT] + [SELECT] to individually select/cancel the data type.
- To perform operation (save/verify) of the external memory device all at one time for one specific data type, press [SHIFT] + [SELECT], and while the specific data type is selected, perform the steps 3 to 5 above.

SUPPLE-MENT

To cancel all the selection on the window where the data type is selected, select {CANCEL ALL (INDIVIDUAL)} from the pull-down menu {EDIT}. The selection of the data types is canceled all at one time, and the signs “★” on the left of JOB, FILE/GENERAL DATA, PARAMETER, I/O DATA, and SYSTEM DATA are hidden.

8 Parameter

8.1 Parameter Configuration

The parameters of YRC1000micro 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 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

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

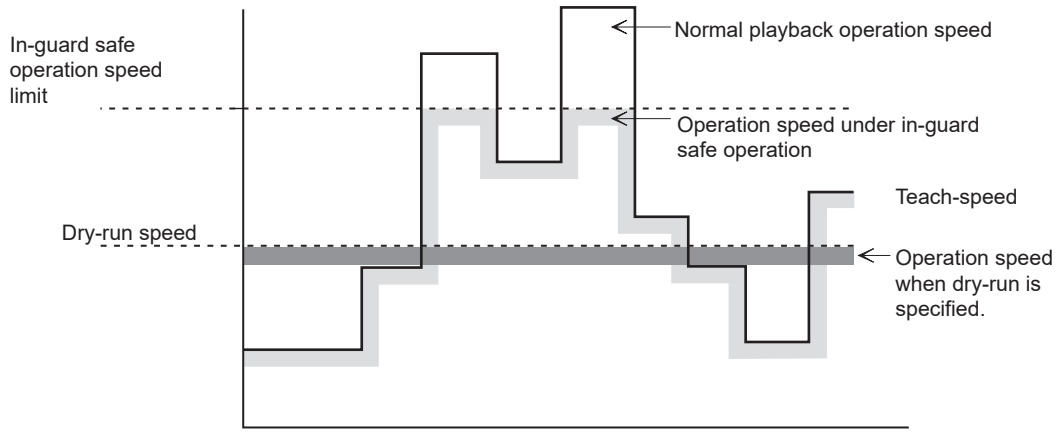
Units: 0.01%

The upper speed limit is set for in-guard safe operation. While the in-guard safe operation command signal is being input, the TCP speed is limited to the in-guard safe operation maximum 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

8.2.0.4 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.

8.2.0.7 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: 0.0001 degree)



If the value set for S1CxG031 or S1CxG032 is too small, the inching operation does not proceed.

8.2.0.8 S1CxG033 to S1CxG040: POSITIONING ZONE

Units: μm

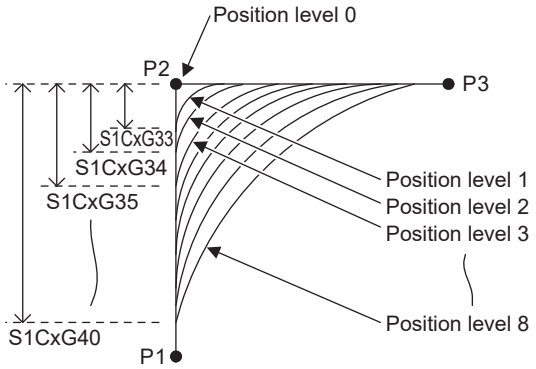
This parameter value will be referenced when positioning is specified with the “MOVE” instruction: MOVJ (joint movement) or MOVL (linear movement).

<Example> MOVL V=100.0 PL=1

Positioning level
Positioning specification

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.

Since operation will be turning inward during playback, as shown in the following diagram, use setting values taking safety aspects into consideration.



- Position level 1: S1CxG33 (µm)
- Position level 2: S1CxG34 (µm)
- Position level 3: S1CxG35 (µm)
- Position level 4: S1CxG36 (µm)
- Position level 5: S1CxG37 (µm)
- Position level 6: S1CxG38 (µm)
- Position level 7: S1CxG39 (µm)
- Position level 8: S1CxG40 (µm)

Position Level

Position level (PL: Position Level)
Position levels are divided into nine levels (0 to 8) and can be specified by using the “MOV” instruction.

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.

SUPPLE-MENT

- 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)

Example:
MOVL V=500 PL=1

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 control
1 : 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

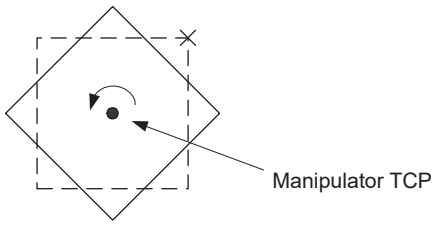
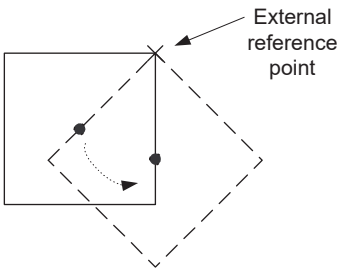


Fig. 8-2: 1: When external reference point is selected



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 changed
1 : 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 : Moves to the indicated step (initial setting).
1 : After moving back to the deviated position, moves to the indicated step.
2 : Moves back to the deviated position and stops.

Table 8-1: S2C422

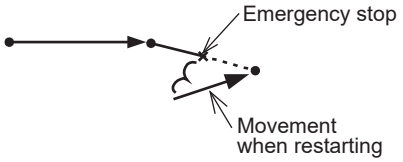
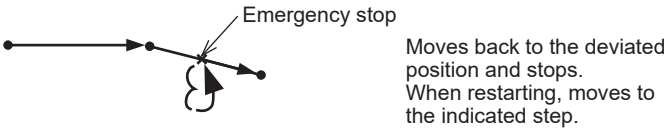
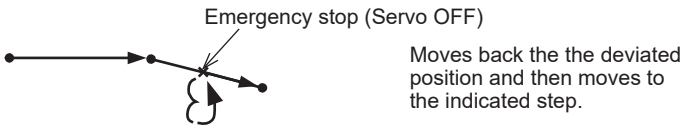
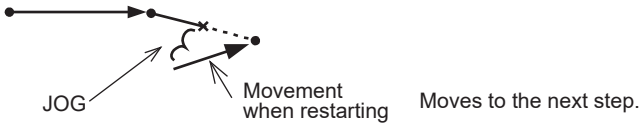
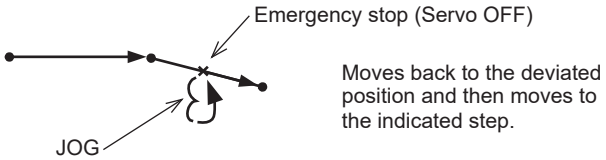
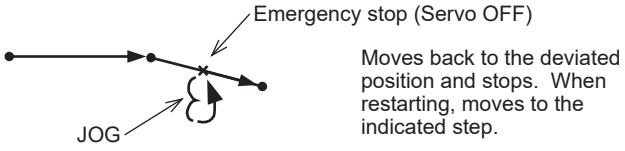
Parameter setting value	Movement when restarting
0	Moves to next step. 
1	After moving back to the deviated position, moves to the indicated step. 
2	

Table 8-2: S2C423

Parameter setting value	Movement when restarting
0	Moves to the next step. 
1	After moving back to the deviated position, moves to the indicated step. 
2	

NOTE

- The manipulator moves to the path deviated position in a linear movement at the low speed of the low-speed start (S1CxG044). After resetting from deviation, the manipulator operates at the taught speed.
- The factory-set value is 0: The manipulator moves in a straight line from the present position to the indicated step.

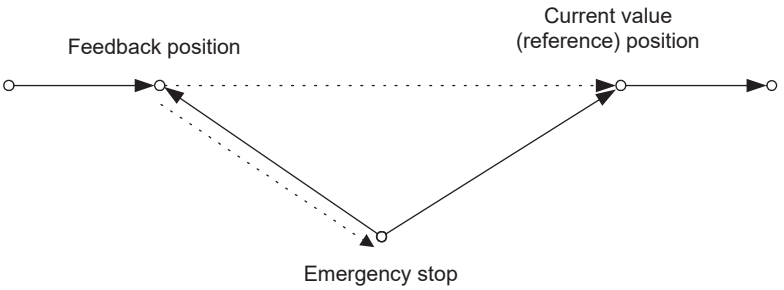
8.2.0.18 S2C424: DEVIATED POSITION

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.

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.



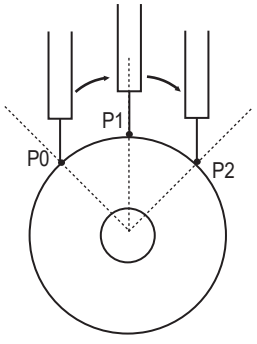
8.2.0.19 S2C425: CIRCULAR INTERPOLATION TOOL POSITION CONTROL

This parameter selects tool position control methods at circular interpolation operation.

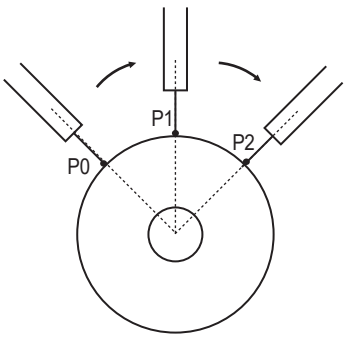
0 : Fixed angle position
Interpolation is performed depending on the position change viewed from the base coordinate.
As the figure below (left) shows, when tool position viewed from outside is not significantly changed and that position is mainly taught at teaching, this setting is required.

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.

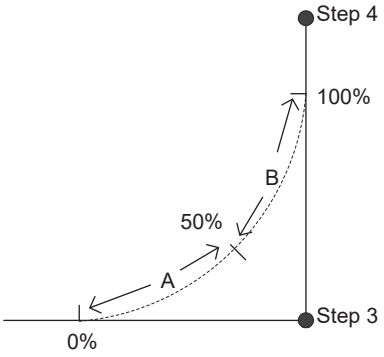
0: Not use

1: Use

8.2.0.21 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.



When 50% is set, moves to Step 3 if the manipulator stops in A section, and to Step 4 if the manipulator stops in B section.

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 TOOLON 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)

8.2.0.24 S3C1098 to S3C1102: POSITION CORRECTING FUNCTION DURING PLAYBACK

These parameters specify the necessary data for position correcting function (PAM) during playback operation.

S3C1098	Specifies the limit of position correcting range (Units: μm)
S3C1099	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 65:User 63
S3C1102	Specifies the limit of posture angle adjustment range (Units: 0.01°)

8.3 Mode Operation Setting Parameters

These parameters set various operations in teach mode or remote mode.
Some parameters can be set through {SETUP} → {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 Mode
1 : Editing Mode
2 : 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 mode
1 : 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 coordinates
2 : 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	Stops at move instruction

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 : Permitted
1 : 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 stored
1 : 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>

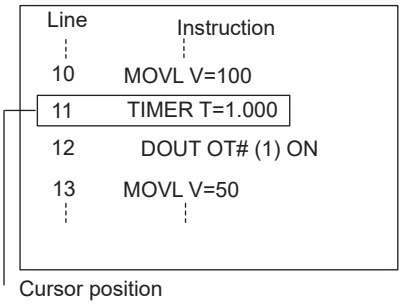


Fig. 8-4: S2C206-0 (Before the Next Step)

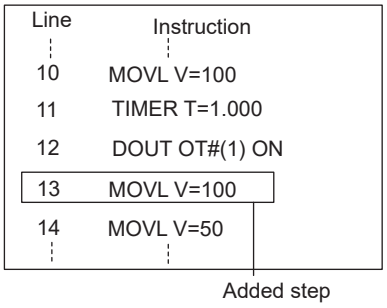
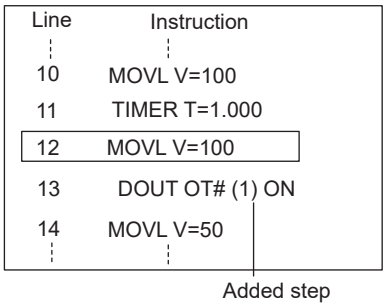


Fig. 8-5: S2C206-1 (Between Instructions)



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 : Permitted
1 : 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 : Permitted
1 : 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 : Permitted
1 : 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 : Permitted

1 : Prohibited

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 YRC1000micro, all robot instructions can be executed regardless of specification of instruction sets. The specification can be done on the TEACHING CONDITION window. For details, refer to “YRC1000micro INSTRUCTIONS (RE-CTO-A222) 8.12 Instruction Level Setting”.

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 function

1 : 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 Names

1 : Order of Date

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.

0 : 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	**Operation Units**	
0	MOVL DOUT TIMER DOUT MOVL	Stops at every instruction
1	MOVL DOUT TIMER DOUT MOVL	Stops at move instruction

NOTE 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.

0 : Permitted

1 : Prohibited

8.3.0.20 S2C220: PROGRAMMING PENDANT START

This parameter specifies whether a start instruction from the programming pendant is accepted or not.

The specification can be done on the OPERATE ENABLE SETTING window.

0 : Permitted
1 : Prohibited

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 OPERATE ENABLE SETTING window.

0 : mm/sec
1 : cm/min
2 : inch/min
3 : 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 FUNCTION ENABLE SETTING window.

0 : Permitted
1 : 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.
The specification can be done on the FUNCTION ENABLE SETTING window.

0 : Permitted
1 : 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 OPERATE ENABLE SETTING window.

0 : Permitted
1 : 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 OPERATE ENABLE SETTING window.

0 : Permitted
1 : Prohibited

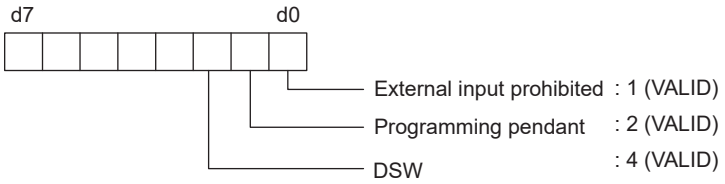
8.3.0.26 S2C228: PROGRAMMING PENDANT CYCLE SWITCHING

This parameter specifies whether cycle switching from the programming pendant is accepted or not.
The specification can be done on the OPERATE ENABLE SETTING window.

0 : Permitted
1 : Prohibited

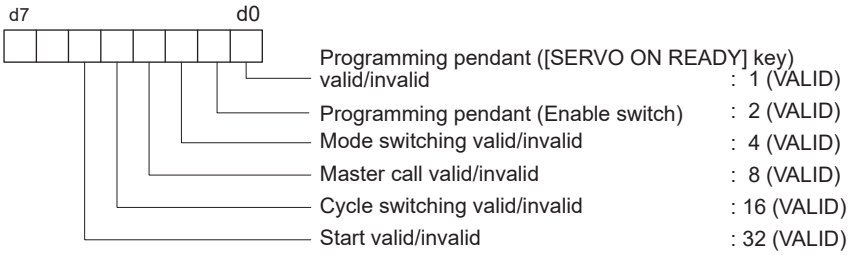
8.3.0.27 S2C229: SERVO ON FROM EXTERNAL PP PROHIBITION

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 OPERATE ENABLE SETTING 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.



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 : Permitted
1 : Prohibited

- Modification of a step
  When the tool number of the teaching step differs from the currently-selected 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 remote mode.

The specification can be done on the OPERATE CONDITION SETTING window.

0 : Step
1 : 1 cycle
2 : Continuous
3 : Not specified

8.3.0.31 S2C294: LOCAL FIRST CYCLE MODE

This parameter sets the cycle that changes from remote mode to the local mode.

The specification can be done on the OPERATE CONDITION SETTING window.

0 : Step
1 : 1 cycle
2 : Continuous
3 : Not specified

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 specification can be done on the OPERATE CONDITION SETTING window.

0 : Step
1 : 1 cycle
2 : Continuous
3 : Not specified

8.3.0.33 S2C313: TEACH MODE FIRST CYCLE MODE

This parameter sets the cycle that changes from play mode to teach mode.

The specification can be done on the OPERATE CONDITION SETTING window.

0 : Step
1 : 1 cycle
2 : Continuous
3 : Not specified

8.3.0.34 S2C314: PLAY MODE FIRST CYCLE MODE

This parameter sets the cycle that changes from teach mode to play mode.

The specification can be done on the OPERATE CONDITION SETTING window.

0 : Step
1 : 1 cycle
2 : Continuous
3 : Not specified

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.

The specification can be done on the PLAYBACK CONDITION SETTING window.

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.
2. 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



A job including 513 or more aliases cannot be saved in or loaded from the external memory device, but the job can be executed.

Examples of cases where saving and loading can be performed:

- Registering “OT#(1)” 513 times
- Registering “OT#(OUTPUT 1)” for 513 signal numbers
- Registering each from “OT#(OUTPUT 1)” to “OT#(OUTPUT 512)”, and registering one B000 without using an alias

Examples of cases where saving and loading cannot be performed:

- Registering each from “OT#(OUTPUT 1)” to “OT#(OUTPUT 513)”
- Registering each from “OT#(OUTPUT 1)” to “OT#(OUTPUT 512)”, and registering one B000 with using an alias

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

1. With this function valid, the confirmation dialog box “Register by name (alias) ?” is displayed when you select the variable on the DETAIL EDIT window.
2. 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

NOTE

A job including 513 or more aliases cannot be saved in or loaded from the external memory device, but the job can be executed.

Examples of cases where saving and loading can be performed:

- Registering “OT#(1)” 513 times
- Registering “OT#(OUTPUT 1)” for 513 signal numbers
- Registering each from “OT#(OUTPUT 1)” to “OT#(OUTPUT 512)”, and registering one B000 without using an alias

Examples of cases where saving and loading cannot be performed:

- Registering each from “OT#(OUTPUT 1)” to “OT#(OUTPUT 513)”
- Registering each from “OT#(OUTPUT 1)” to “OT#(OUTPUT 512)”, and registering one B000 with using an alias

8.3.0.38 S2C397: I/O VARIABLE CUSTOMIZE FUNCTION

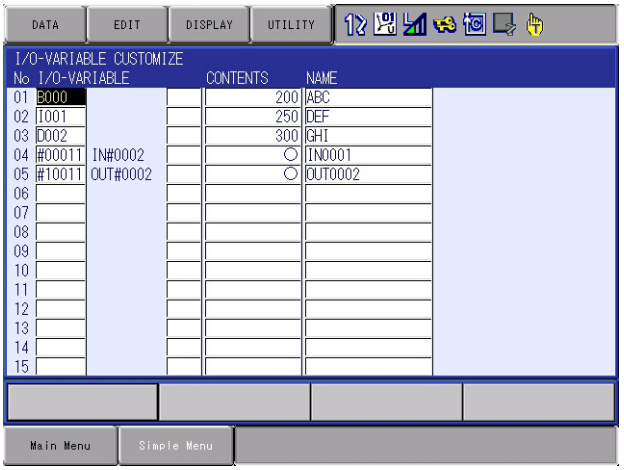
This function enables registration of any particular input/output signal/ variable. Reference and editing of signals/variables are possible on the same window.

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 {GENERAL}. 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 {EX.MEMORY} → {LOAD} {SAVE} {VERIFY} {DELETE} → {SYSTEM DATA}.

8.3.0.39 S2C410: WORD REGISTRATION FUNCTION / WORD EDITING FUNCTION SPECIFICATION

Specifies the valid or invalid to edit the words while inputting the characters.

0 : Invalid

1 : Valid

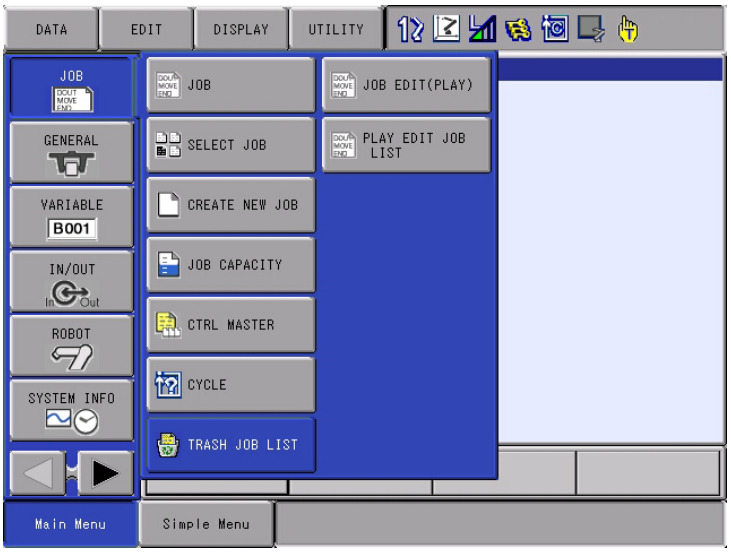
Note: It is able to edit the words when the security mode is set to the edit mode or the management mode.

8.3.0.40 S2C413: JOB UNDELETE FUNCTION

This function doesn't completely delete a job from its memory when deleting the job, but saves the data so that the job can be restored as needed.

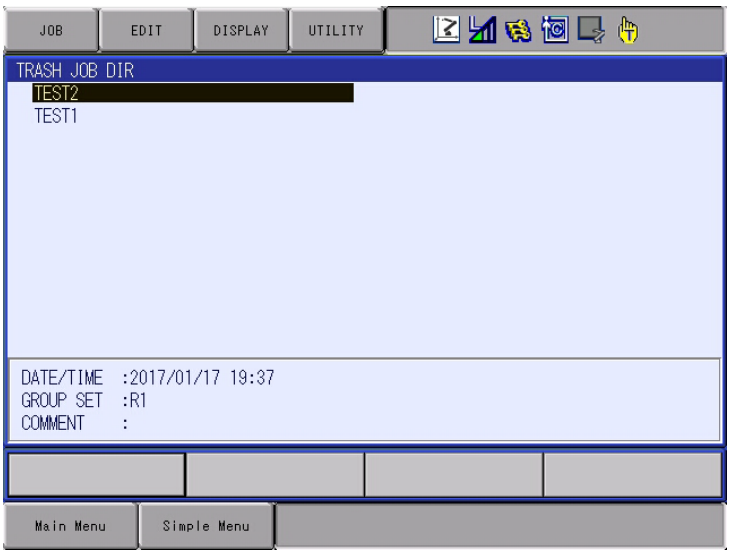
This parameter can be set on {TEACHING CONDITION} window.

If a job is deleted while this function is valid, the job disappears from the JOB LIST window. In this case, {TRASH JOB LIST} is newly displayed to {JOB} on the main menu and the deleted job is listed on it.



NOTE The job will not be listed on the trash job list and will not be restored if it is deleted when this function is invalid.

On the trash job list, the deleted jobs are displayed.

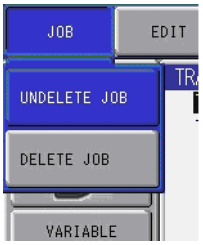


On this window, the following operations are available with the same operations as job list window.

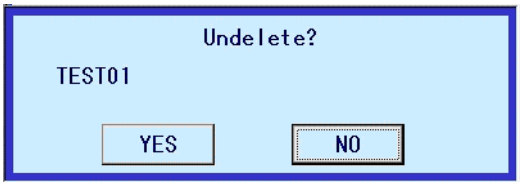
- Batch selection / canceling selection of the jobs ({EDIT} → {SELECT ALL} → {CANCEL SELECT})
- Job search ({EDIT} → {JOB SEARCH COND})
- Rearrange of the jobs in the order of date / order of name ({DISPLAY} → {DATE} {NAME})
- Job detailed information display ({DISPLAY} →{DETAIL})
- Displaying by job groups ({DISPLAY} → {FOLDER})

■ **Restoring the Job**

Choose a job to be restored and select {UNDELETE JOB} from {JOB} on the pull down menu.



A dialog box to confirm restoring the selected job.



Select “YES” to restore the job. The restored job is deleted from the trash job list and newly listed to the job list.

“NO” to cancel restoring the job.

■ **Deleting the Job Completely**

Delete a job from the memory. The job will not be restored after this operation.
Choose a job to be completely deleted, then select {DELETE JOB} from {JOB} on the pull down menu.



A dialog box to confirm deleting the selected job.



Select

“YES” to delete the job completely. The deleted job is deleted from the trash job list.

“NO” to cancel deleting the job.

NOTE The job data remains until it is completely deleted and the capacity of the memory becomes less as long as this function is valid. Delete unnecessary data to keep enough job capacity.

8.3.0.41 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 Resetting
1 : Permit Resetting

“PERMIT” is set as the initial value for the work time and motion time.

8.3.0.42 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.)

8.3.0.43 S2C433: POSITION TEACHING BUZZER

This parameter specifies whether the buzzer sound at position teaching is used or not.

0 : With buzzer

1 : Without buzzer

8.3.0.44 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 operating

1 : Linking

Fig. 8-7: 0: Does not operate the synchronizing side while teaching the synchronized side.

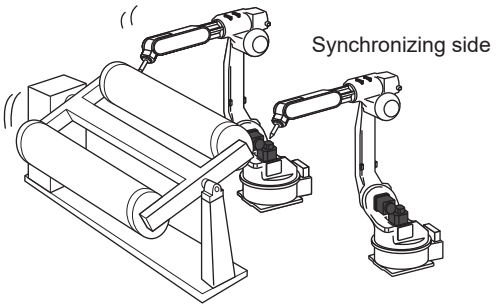
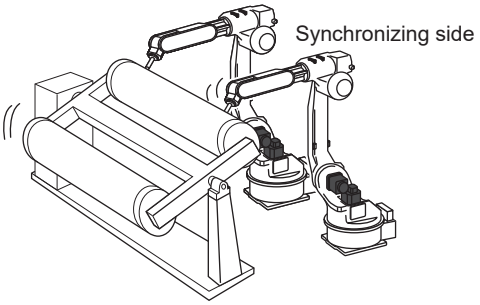


Fig. 8-8: 1: Links the synchronizing side while teaching the synchronized side.



8.3.0.45 S2C437: PLAYBACK OPERATION CONTINUATION FUNCTION

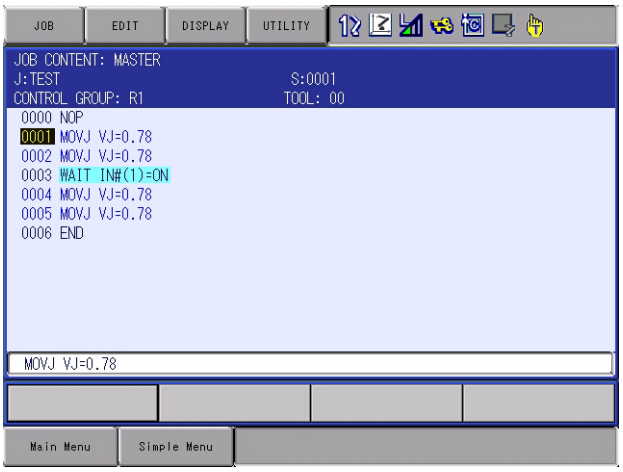
This function is used to decide where to resume the playback on the start operation after suspending the playback and moving the cursor or selecting other jobs.

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 • When “NO” selected, the playback resumes from the current position in job B

Note: 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.

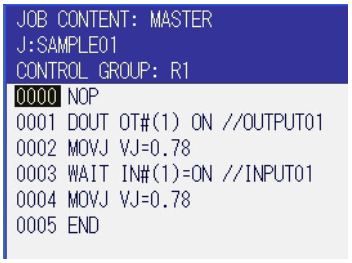


NOTE

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).

8.3.0.46 S2C544: I/O NAME DISPLAY FUNCTION FOR JOB

When a user input/output signal, whose name is already set, is used as a job, this function displays the signal name in the form of a comment.



NOTE When the specification of the signal is group specification (IG#, IGH#, OG#, OGH#), the name will not be displayed. Also, the name will not be displayed when the job is saved at external memory devices.

This parameter can be set on {FUNCTION ENABLE}.window.

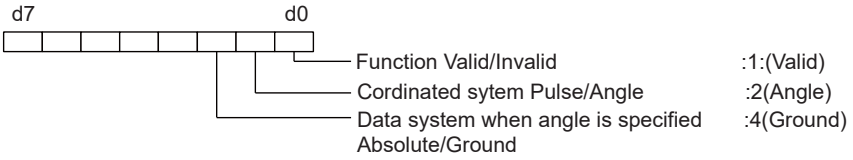
0 : Invalid
1 : Valid

8.3.0.47 S2C684:ALL AXES ANGLE DISPLAY FUNCTION

This function enables to change the display of manipulator position from pulse-formed to angle-formed on the specific window.

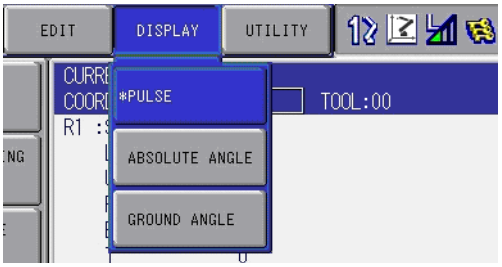
This function is valid in the following windows.

- Current value (however, it is invalid if the present displayed coordinate systems are “base”, “robot” or “user”.)
- Command position
- Work home position
- Second work home position



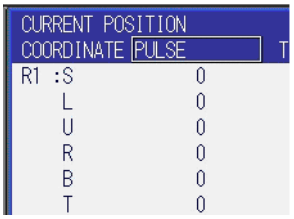
This function can be valid/invalid on {FUNCTION ENABLE} window.

Select {DISPLAY} on the pull down menu while this function is valid, then {PULSE}, {ABSOLUTE ANGLE} and {GROUND ANGLE} appear. Select one so that the presently displayed data can be changed to the selected data type.



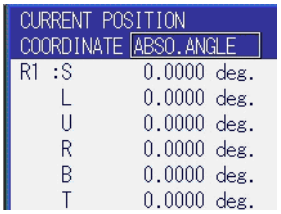
PULSE

Indicates the pulse data of each axis.



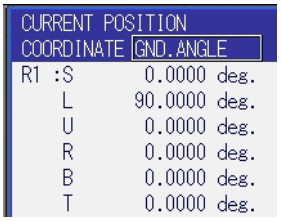
ABSOLUTE ANGLE

Indicates the independent angle at every axes on the basis that the absolute value is 0[deg] when the pulse is 0.



GROUND ANGLE

Indicates the L- and U-axes angle according to the manipulator installation direction. The value of unoperated axes may vary depending on the manipulator's posture.



NOTE As for the servo track, angle is not indicated but distance (unit [mm]).

8.3.0.48 S2C713: CONTROL POINT OPERATION SETTING ON THE SERVO TRACK

This parameter specifies a motion system by which the manipulator's control point is fixed while the servo track is in operation.

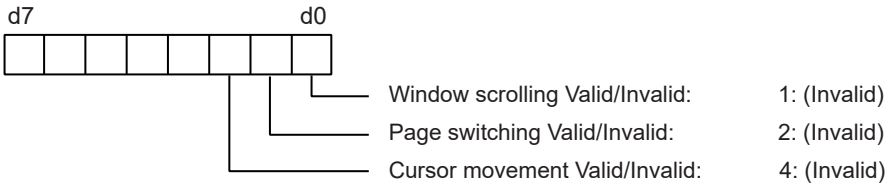
However, it is valid only when the selected control group is specified as a servo track and the servo track is operated by jog keys in the Cartesian coordinates.

0 : Normal operation

1 : Control point operation setting on the servo track

8.3.0.49 S2C1203: TOUCH OPERATION FUNCTION IN GENERAL-PURPOSE DISPLAY AREA

This parameter specifies whether window scrolling, page switching, and cursor movement by touch operation in the general-purpose display area are enabled or disabled.
The specification is done through the bit specification.



8.3.0.50 S2C1204: CURSOR MOVEMENT FUNCTION BY TOUCH OPERATION ON JOB WINDOW

This parameter specifies the cursor movement operation by touch operation on the job window.

The specification can be done on the {FUNCTION ENABLE SETTING} window.

0: Press [INTERLOCK] + touch operation

1: Touch operation + dialog confirmation

2: Cursor movement by touch operation is not available

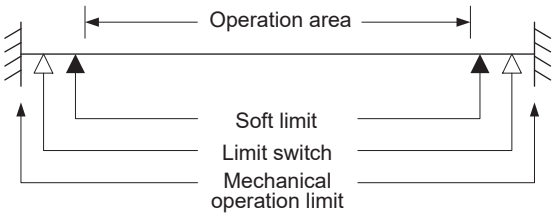
Note: S2C1203: When d2 (the cursor movement by the touch operation in the general-purpose display are) is disabled, the cursor cannot be moved.

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.

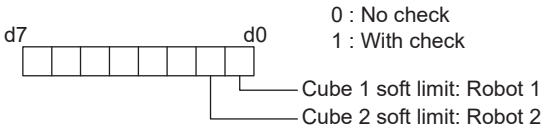
8.4.0.1 S1CxG800 to S1CxG819: PULSE SOFT LIMIT

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
S3C007: Robot 2: + side: Y
S3C008: Robot 2: + side: Z
S3C009: Robot 2: - side: X
S3C010: Robot 2: - side: Y
S3C011: Robot 2: - side: Z

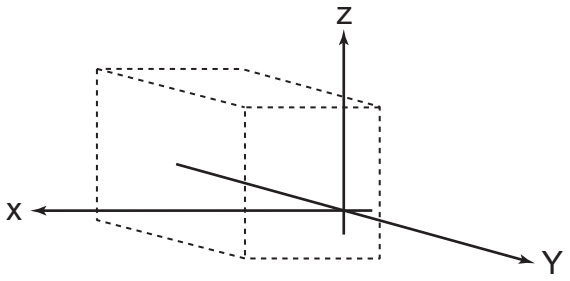
Soft Limit

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.

SUPPLE -MENT



- Pulse Soft Limit (Independent Axis Soft Limit)
  Refer to *chapter 8.4.0.1 “S1CxG800 to S1CxG819: PULSE SOFT LIMIT”* .

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 (-)

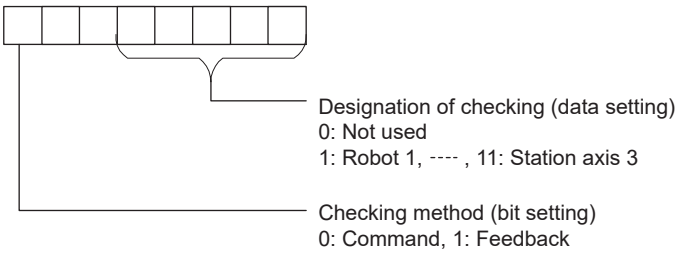
8.4.0.4 S2C003 to S2C066: CUBE/AXIS INTERFERENCE CHECK

1. Designation of checking
   These parameters specify the cube/axis interference to be used by bit.

0 : Cube Interference/Axis Interference Not Used
1 : Robot 1
2 : Robot 2
5 : Base Axis 1
6 : Base Axis 2
9 : Station Axis 1
10 : Station Axis 2
11 : Station Axis 3

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.

SUPPLE -MENT

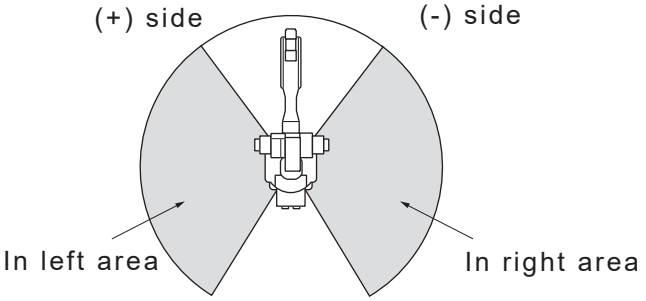
Checking Method Designation	Servo Power Supply ON	Servo Power Supply OFF
Command	Command	Feedback
Feedback	Feedback	Feedback

During the servo float function operation, checking is performed by feedback regardless of the checking method designation.

Interference Area

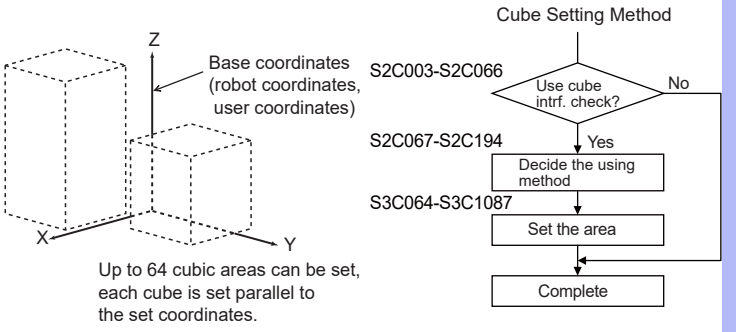
It is possible to output whether the TCP during operation is inside or outside as a status signal, and to set the area to control the position by parameters S2C003 to S2C194. When the manipulator attempts to enter this area, the corresponding input signal (e.g., an “entrance prohibit signal”) is detected. 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.

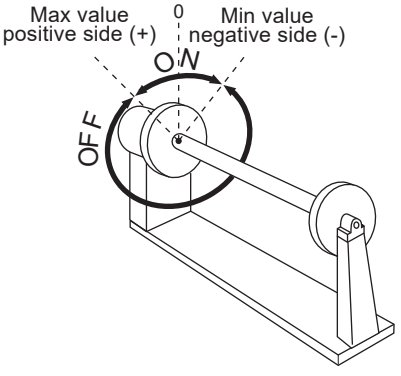


• Cubic Interference Area
Up to 64 cubic areas can be set. The edges of the cubes are set parallel to the robot coordinates or the user coordinates.

SUPPLE -MENT



• 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 INTERFERENCE/AXIS INTERFERENCE SIGNAL USING METHOD

For each interference signal, the reference coordinate system for the interference area can be specified by the type and number of the coordinate system.

S2C067: Cube/axis interference signal 1 Type of the coordinate system
S2C068: Cube/axis interference signal 1 Number of the coordinate system
S2C069: Cube/axis interference signal 2 Type of the coordinate system
S2C070: Cube/axis interference signal 2 Number of the coordinate system
.
.
.
S2C194: Cube/axis interference signal 64 Number of the coordinate system

1. Type of the coordinate system
   Specify the reference coordinate system for the interference area.
   - 0 : Pulse (axis interference)
   - 1 : Base coordinates (cube interference)
   - 2 : Robot coordinates (cube interference)
   - 3 : User coordinates (cube interference)

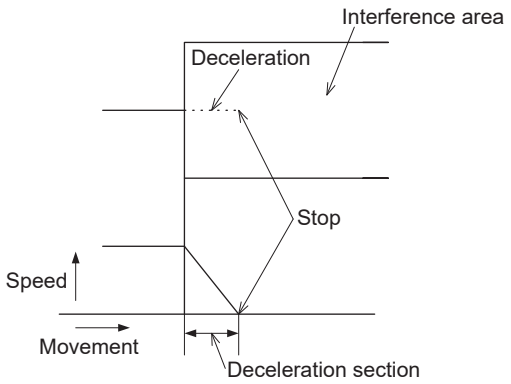
2. Number of the coordinate system
   When “3: User coordinates” is specified for the type of the coordinate system, specify the number of the user coordinates here.

Precaution When Setting the Interference Area

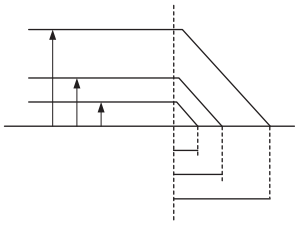
The following must be considered in advance when setting the area for the cube/axis interference or the S-axis interference.

The manipulator is decelerated to stop from the point where it enters in the area, and the actual point where the manipulator stops is inside the area. Thus, set the area in consideration of the amount of the manipulator movement in the deceleration section shown in the figure below.

SUPPLE -MENT



The above-mentioned amount depends on the moving speed of the manipulator at that time as shown below.

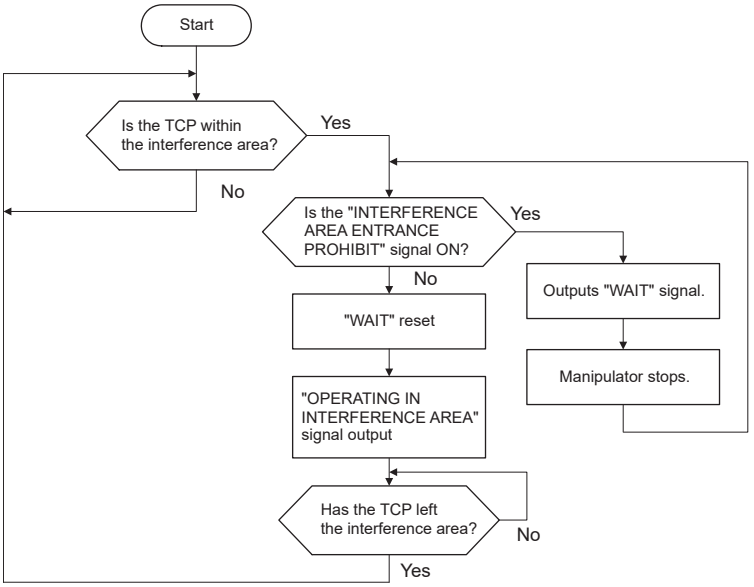


V = 1500 mm/s: approx. 300 mm (max.)
V = 1000 mm/s: approx. 160 mm
V = 30 mm/s: approx. 3 to 4 mm
V = 20 mm/s: approx. 2 mm

SUPPLE -MENT

Interference Prevention in Interference Area

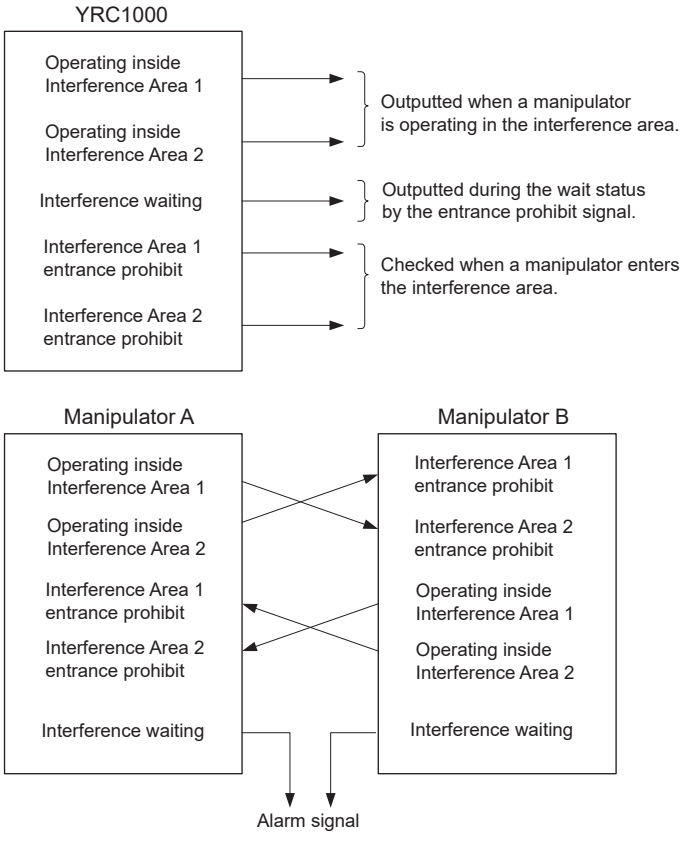
Processing to prevent interference is executed in the I/O processing section. The relation between the YRC1000micro I/O signal and manipulator operation is shown below.



If the status becomes the wait status by the entrance prohibit signal, the manipulator enters the area just a little bit because of the deceleration process, and then stops.

The manipulator does not enter the interference area where the entrance prohibit signal is already valid.

Fig. 8-9: Connection Example Where Two Manipulators Are Operated in the Same Area

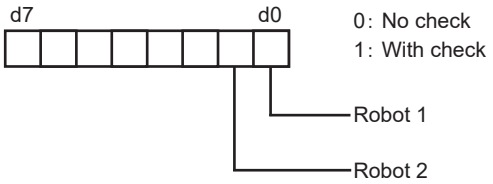


8.4.0.6 S2C236 to S2C237: ROBOT INTERFERENCE AREA CHECK

This parameter specifies whether to check the interference area between Robot (manipulator) 1 and Robot (manipulator) 2.

S2C236: Interference area check between Robot 1 and another robot

S2C237: Interference area check between Robot 2 and another robot



Examples are shown below.

<Example 1> When S2C236 = 2 (0000_0010), Robot 1 performs the interference area check with Robot 2.

<Example 2> When S2C236 = 1 (0000_0001), Robot 2 performs the interference area check with Robot 1.

Interference area checks are performed by using the sphere with the TCP as its center. When “With check” is selected by using the parameter, specify the following parameters.

Parameter	Description	Unit
S3C1089	For robot interference area check: Radius of Robot 1 TCP sphere	μm
S3C1090	For robot interference area check: Radius of Robot 2 TCP sphere	μm

By the robot interference area check, if an interference between the above-mentioned spheres specified for the robots is detected, the following system output signal is turned ON:

System output signal SOUT#145 (#50190): SPHERE INTRF R1-R2

8.4.0.7 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”* .

8.4.0.8 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”* .

8.4.0.9 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”* .

8.4.0.10 S3C1089 to S3C1090: ROBOT INTERFERENCE AREA

For details, see *chapter 8.4.0.6 “S2C236 to S2C237: ROBOT INTERFERENCE AREA CHECK”* .

8.4.0.11 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.

8.5 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 state

1 : Initialized (all user relays OFF)

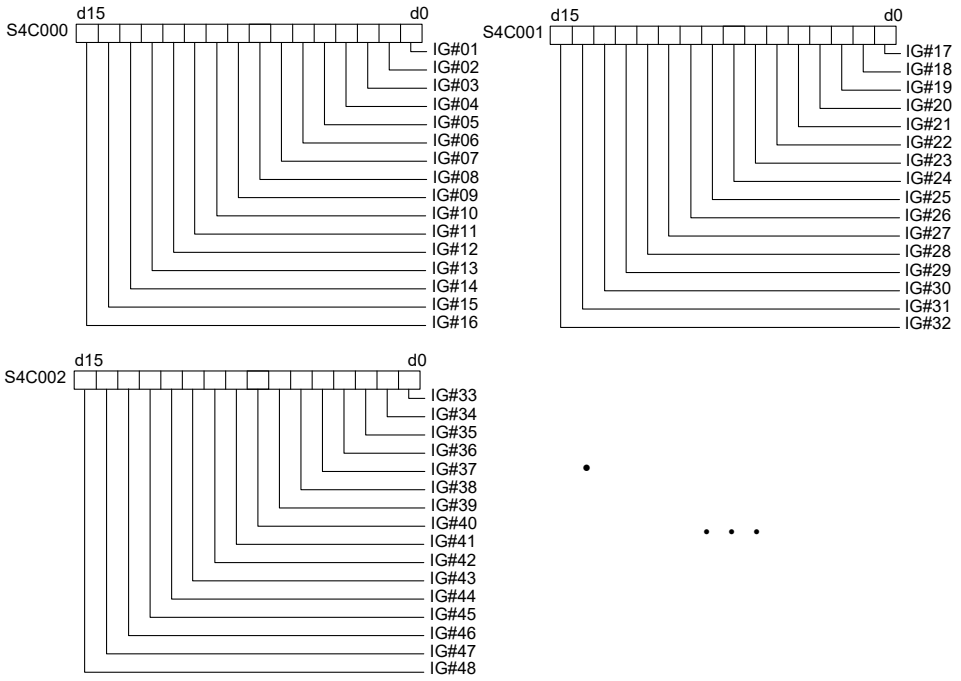
8.5.0.2 S4C000 to S4C015, S4C1100 to S4C1115: PARITY OF USER INPUT GROUPS

These parameters specify whether to execute parity 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

A parity check is performed against the input group where a bit-ON (1) was done by this parameter.

S4C000 to S4C015	: IG#(1) to IG#(256)
S4C1100 to S4C1115	: IG#(257) to IG#(512)



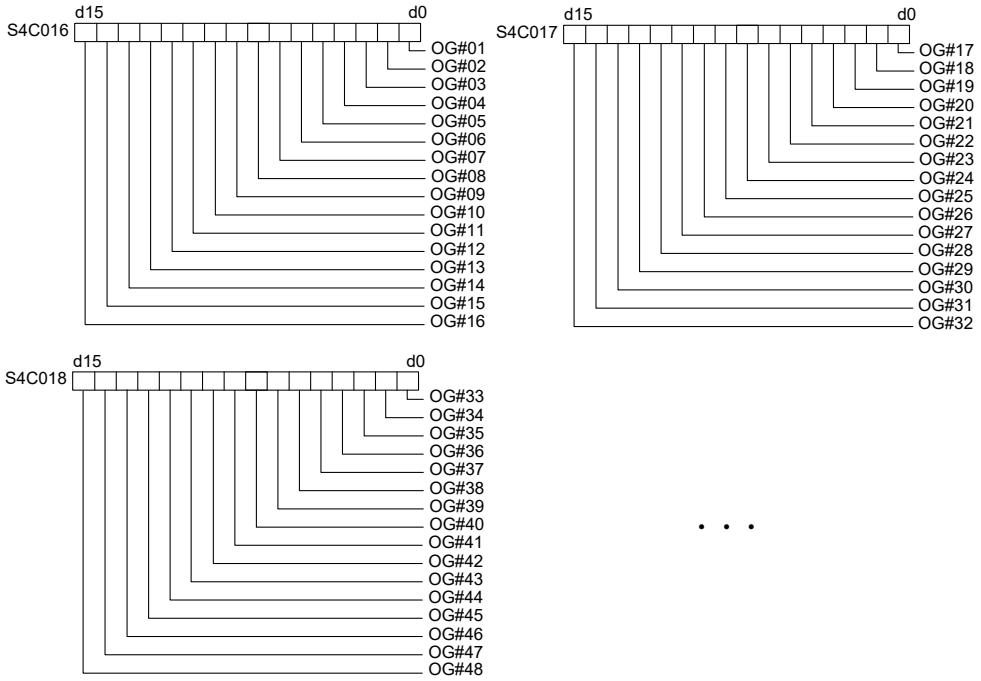
Parity bits are set as the highest level bits of each input group and are written in even parity. If an error is detected during parity check, an alarm occurs and the manipulator stops. Remains unchanged if no parity check is specified.

8.5.0.3 S4C016 to S4C031, S4C1116 to S4C1131: PARITY OF USER OUTPUT GROUPS

These parameters specify whether the output group instruction is executed with parity check (even parity).

A parity check is performed against the output group where a bit-ON (1) was done by this parameter.

S4C016 to S4C031	:	OG#(1) to OG#(256)
S4C1116 to S4C1131	:	OG#(257) to OG#(512)



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.

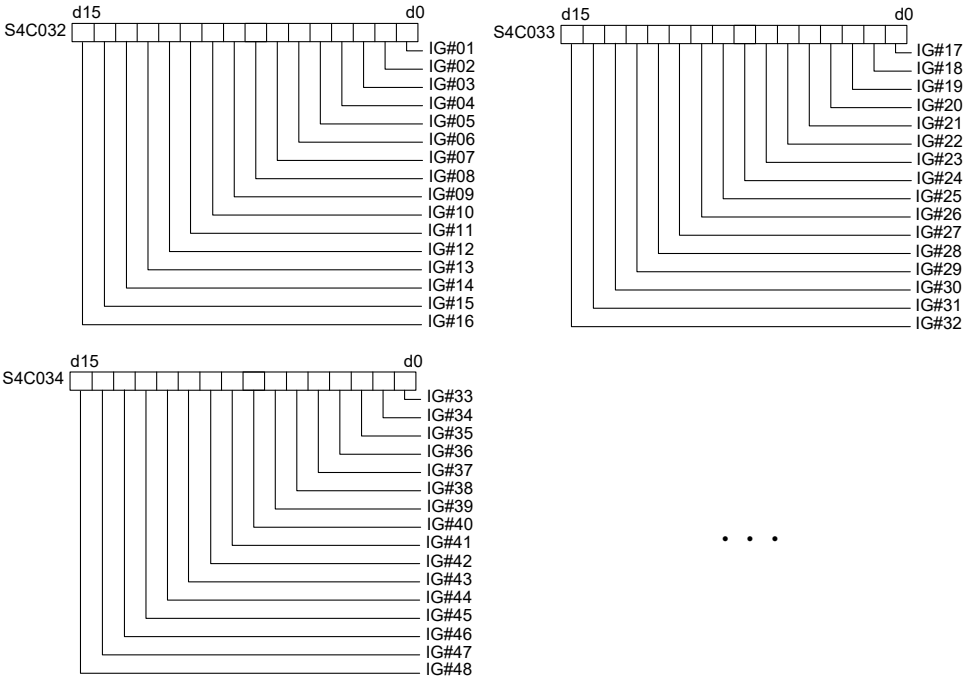
8.5.0.4 S4C032 to S4C047, S4C1132 to S4C1147: DATA OF USER INPUT GROUPS

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

The input group where a bit-ON (1) was done by this parameter is treated as BCD data.

S4C032 to S4C047	:	IG#(1) to IG#(256)
S4C1100 to S4C1115	:	IG#(257) to IG#(512)

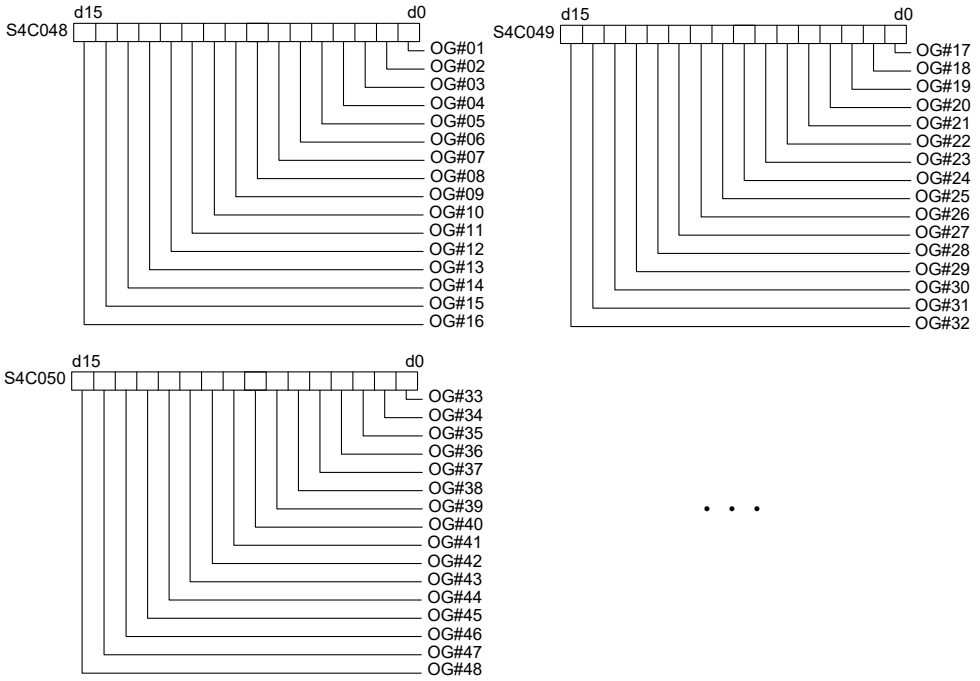


8.5.0.5 S4C048 to S4C063, S4C1148 to S4C1163: DATA OF USER OUTPUT GROUPS

These parameters specify whether the output group instruction is executed with binary data or BCD data.

The output group where a bit-ON (1) was done by this parameter is treated as BCD data.

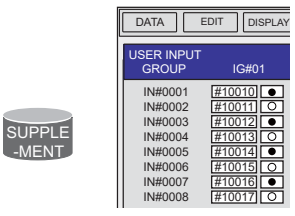
S4C048 to S4C063	:	OG#(1) to OG#(256)
S4C1148 to S4C1163	:	OG#(257) to OG#(512)



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]



State	Binary	Case	BCD		Case
1	$2^0 = 1$	1	$2^0 = 1$	Total is in ones.	1
0	$2^1 = 2$	0	$2^1 = 2$		0
1	$2^2 = 4$	4	$2^2 = 4$		4
0	$2^3 = 8$	0	$2^3 = 8$		0
1	$2^4 = 16$	16	$2^0 = 1$	Total is in tens.	1
0	$2^5 = 32$	0	$2^1 = 2$		0
1	$2^6 = 64$	64	$2^2 = 4$		4
0	$2^7 = 128$	0	$2^3 = 8$		0
		85			55
		Binary data value			BCD data value

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.

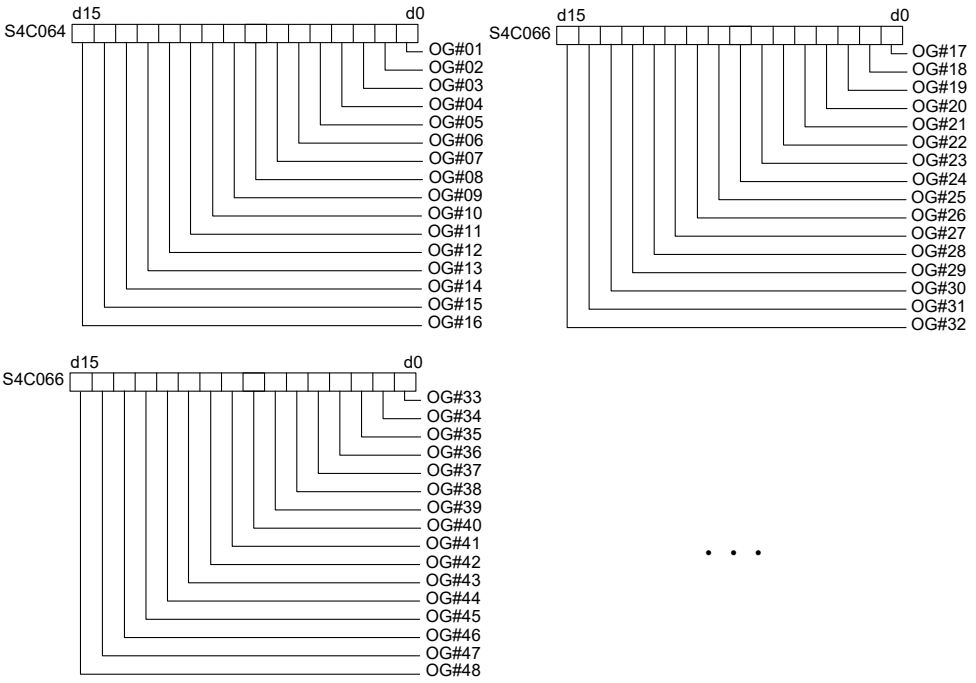
8.5.0.6 S4C064 to S4C079, S4C1164 to S4C1179: USER OUTPUT GROUP TO BE INITIALIZED AT SWITCHING MODE

Set the user output group with bit to be initialized at switching mode.

Use these parameters when using universal output signals as work instructions for peripheral devices.

The signal of the output group where the bit-on (1) is done by this parameter will be turned OFF at mode switching.

S4C064 to S4C079	:	OG#(1) to OG#(256)
S4C1164 to S4C1179	:	OG#(257) to OG#(512)



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”.

8.6 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.

<Example> 0: Not Provided

SMOVL V=100

+MOVL ← Master side

Speed specification not provided

<Example> 1: Provided

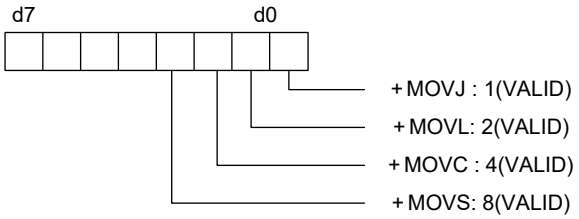
SMOV L V=100

+MOV L V=100 ← Master side

Speed specification provided

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.

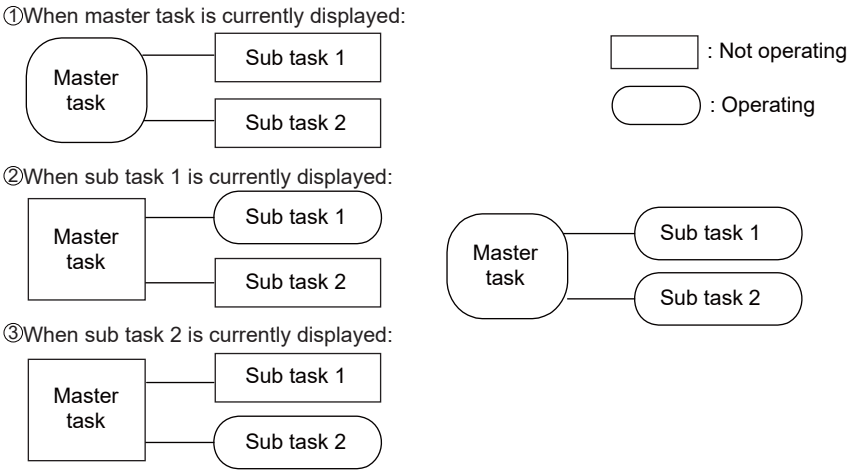


8.6.0.3 S2C231: OPERATION METHOD AT FWD/BWD OPERATION OR TEST RUN BY INDEPENDENT CONTROL

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.



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 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.

0 : 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

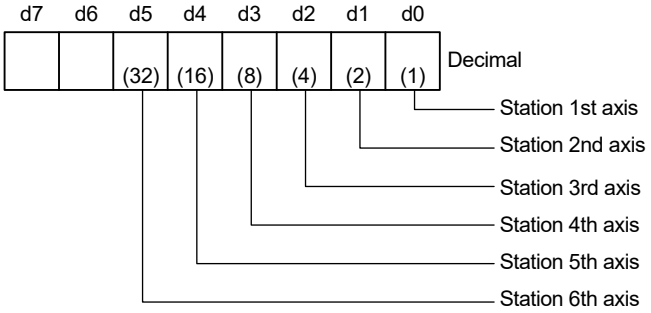
This parameter specifies the station axis displayed unit (bit specification).

0 : Display angle (deg)

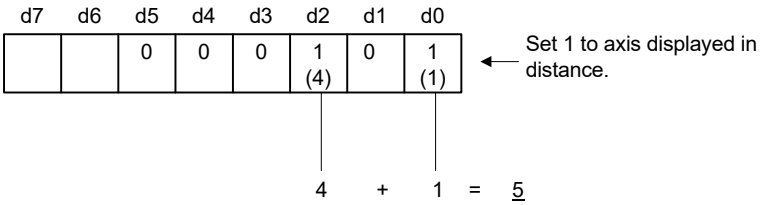
1 : Display in distance (mm)

■ **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:



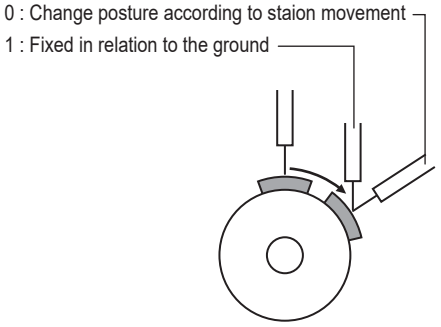
Therefore, set parameter S2C265 of station 1 to 5.

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

8.6.0.9 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.

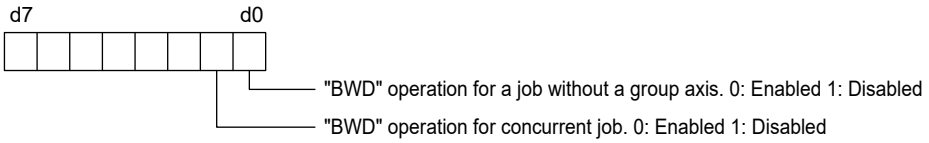
For the jobs without control group specification such as master job, the conditions for execution can be set by the parameter.

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

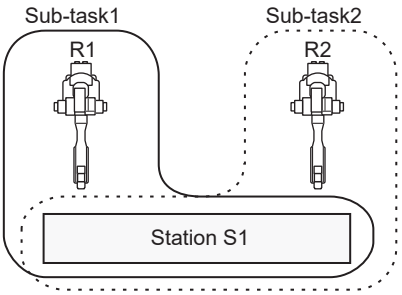
This parameter prohibits step-back operation of a job without a step.

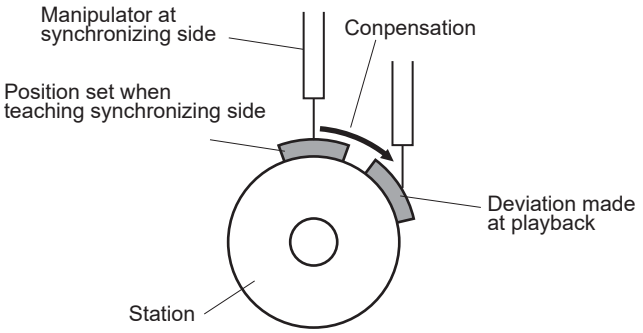


8.6.0.11 S3C1101: MAXIMUM DEVIATION ANGLE OF CURRENT STATION POSITION (When Twin Synchronous Function Used)

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.

8.7 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 μm that can be processed by small-circle cutting machine.
S1CxG051 (Maximum speed)	:	Set the maximum cutting speed at operation by CUT 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.

S1CxG052 (+ direction)	:	Set the limit value in the positive direction of cutting angle DIR set by CUT instruction, in the units of 0.01°.
S1CxG053 (- direction)	:	Set the limit value in the negative direction of cutting angle DIR set by CUT instruction, in the units of 0.01°.

8.7.0.3 S1CxG054 to S1CxG055: SMALL CIRCLE CUTTING OVERLAP VALUE

These parameters set the overlapped value at small circle cutting.

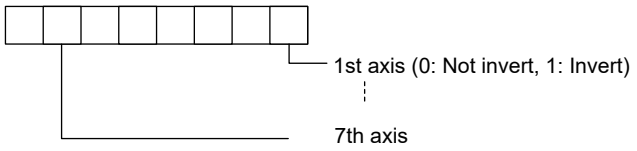
S1CxG054 (Operation radius)	:	Set the operation radius at inner rotation in the units of 1 μm after overlapping by CUT instruction.
S1CxG055 (Rotation angle)	:	Set the rotation angle at inner rotation in the units of 0.1° after overlapping by CUT instruction.

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.

0 : Previous step with priority (B-axis moving distance minimized)
1 : Form with priority
2 : Previous step with priority (R-axis moving distance minimized)
4 : Previous step with priority (R-axis moving distance minimized, and pulse limit avoided)

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.

8.8 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 : Invalid

1 : Valid

The anticipator function is a function to quicken or slow the ON/OFF timing of four universal 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.

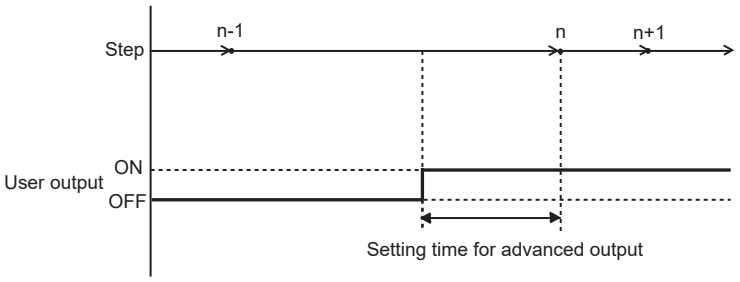
Setting the time to a positive value (+) delays the signal output.

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.

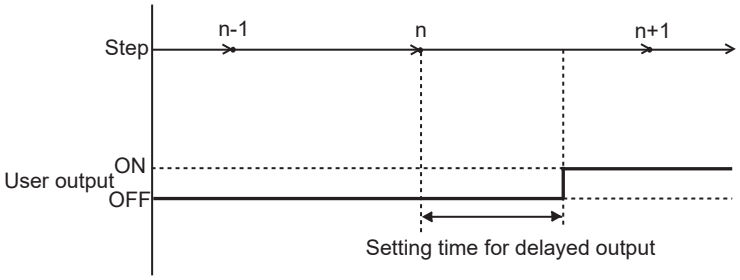
Step	Instructions
:	:
n-1	MOVL
n	MOVL NWAIT
	ANTOUT AT#(1) ON
n+1	MOVL



<Delayed Signal Output>

Signal output is carried out after the step is reached.

Step	Instructions
:	:
n-1	MOVL
n	MOVL NWAIT
	ANTOUT AT#(2) ON
n+1	MOVL



8.8.0.2 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 4096 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.

8.8.0.3 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 — ON -OFF — OFF
1	+ON — ON/OFF with the key ON while the key is pressed OFF if the key is not pressed ON OFF

8.8.0.4 S2C786: COOLING FAN ALARM DETECTION

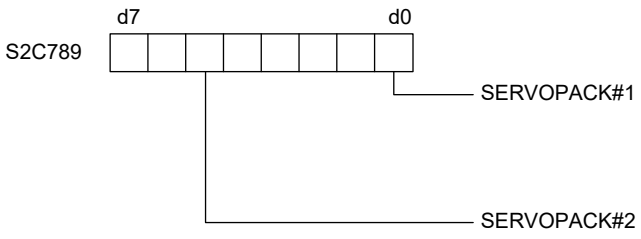
This parameter specifies a detection display for cooling fan 1 with alarm sensor, connected to power ON unit.

0 : No detection
1 : Detected with message display
2 : Detected with message and alarm display

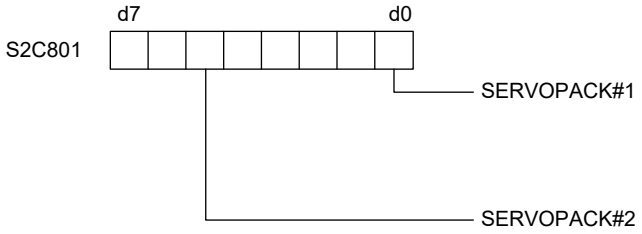
8.8.0.5 S2C789: COOLING FAN ALARM 1 OPERATION

This parameter specifies the operation of cooling fan 1 with alarm sensor, connected to power ON unit.

Each bit specifies the power ON unit to which the detecting sensor is connected.



8.8.0.6 S2C801: FAN ALARM 1 WELDER STATUS



8.8.0.7 S2C1962: MODEL INFORMATION MAINTENANCE FUNCTION

This parameter specifies whether to start the controller in the mode to perform robot model information maintenance.

0 : Standard mode

1 : Maintenance mode

The encoders built into the robot's axes contain model information. This model information can be set in maintenance mode. After the parameter is set, the controller must be turned OFF and ON again.

Starting the controller in maintenance mode prevents alarm 1915 “CONTROLLER TYPE MISMATCH (SERVO)” and allows home position calibration to be performed. The alarm can be prevented only when alarms are occurring on half or less of the number of axes in the robot configuration.

Restore this parameter to standard mode after home position calibration.

For the method to use, please refer to “8.1 Home Position Calibration” in “YRC1000micro INSTRUCTIONS (RE-CTO-A222)”.

8.9 Transmission Parameters

These parameters are used when the optional FC1, FC2, or data transmission function is used.

8.10 Application Parameters

8.10.1 Material Handling, Press Tending, Cutting, and Other Applications

8.10.1.1 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 Material Handling, Press Tending, Cutting, and Other Applications

9.1 Simplified Teaching and Playback

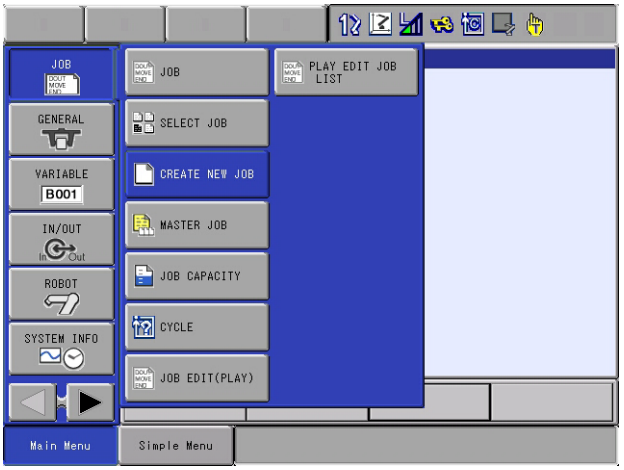
9.1.1 Teaching

9.1.1.1 Preparation for Teaching

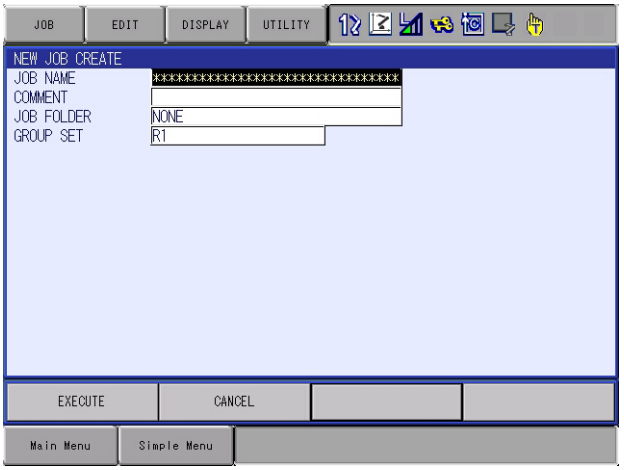
Perform the following tasks before starting to teach.

- Set the operation mode to teach mode.
- Enter the job name.

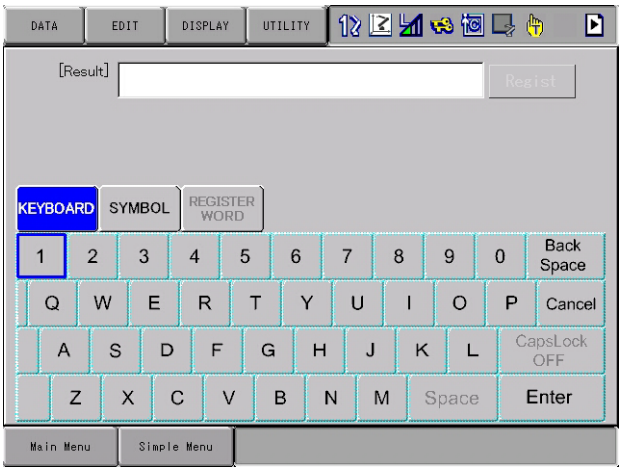
1. Confirm that the mode switch on the programming pendant is set to “TEACH”. If not, set the switch to “TEACH”.
2. Press [SERVO ON READY].
   The SERVO ON LED will blink. If [SERVO ON READY] is not pressed, the servo power supply cannot be turned ON using the Enable switch.
3. Select {JOB} under the main menu, and select {CREATE NEW JOB} in the sub menu.



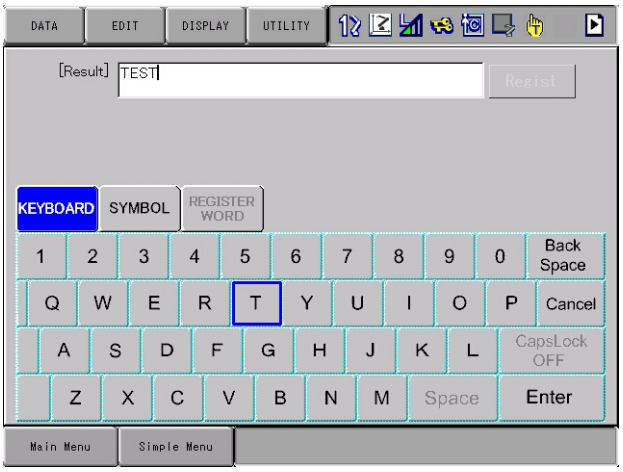
4. After the NEW JOB CREATE window appears, press [SELECT].



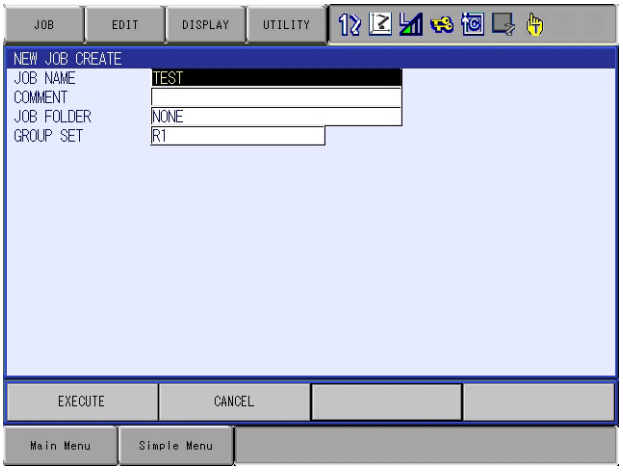
5. After the following window appears, input the job name. The word “TEST” is used in this example job name.



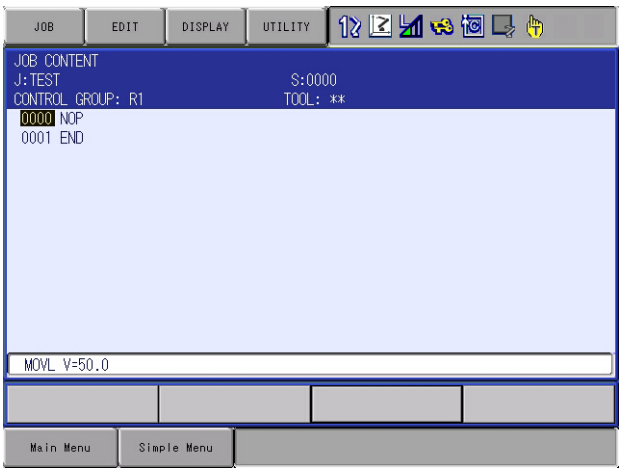
6. Move the active window to software keypad by pressing the [AREA]. Move the cursor to “T” and press [SELECT]. Enter “E,” “S,” and “T” in the same manner. The characters can also be entered by directly touching each character on the screen.



7. Press [ENTER] to register.



8. Move the cursor to “EXECUTE” and press [SELECT]. The job “TEST” is registered and the job is displayed. The NOP and END instructions are automatically registered.



SUPPLE-MENT

Characters which can be Used for Job Names

Job names can be created from numbers and the alphabetical letters. The input display can be switched between upper-case characters, lower-case characters, and symbols by pressing [PAGE] during Step 5. Up to 32 characters can be used.

9.1.1.2 Teaching Procedure

To playback the manipulator, the instruction to move the manipulator must be written in a job. This instruction is called a move instruction. The destination position, the interpolation method, the play speed, etc. are registered in the move instruction.

Main move instructions begin with “MOV” in the INFORM III language used by the YRC1000micro.

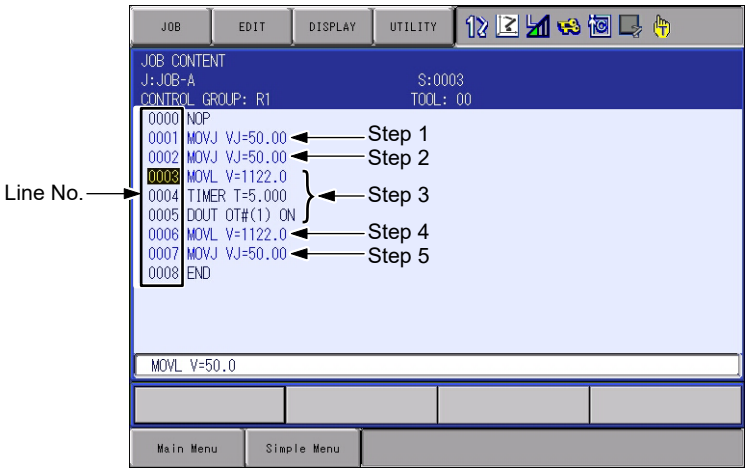
<Example>

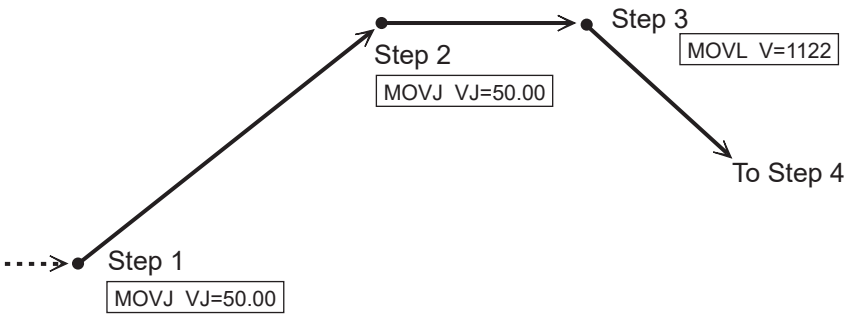
MOVJ VJ=50.00

MOVL V=1122 PL=1

<Example>

Refer to the following JOB CONTENT window. When executing playback, the manipulator moves to the position of Step 1 with the interpolation type and play speed registered in Step 1’s move instruction. Then, the manipulator moves between Steps 1 and 2 with the interpolation type and play speed registered in Step 2’s move instruction. Then, the manipulator moves between Steps 2 and 3 with the interpolation type and play speed registered in Step 3’s move instruction. After the manipulator reaches the position of Step 3, the manipulator then executes the TIMER instruction followed by the DOUT instruction, and then continues on to Step 4.



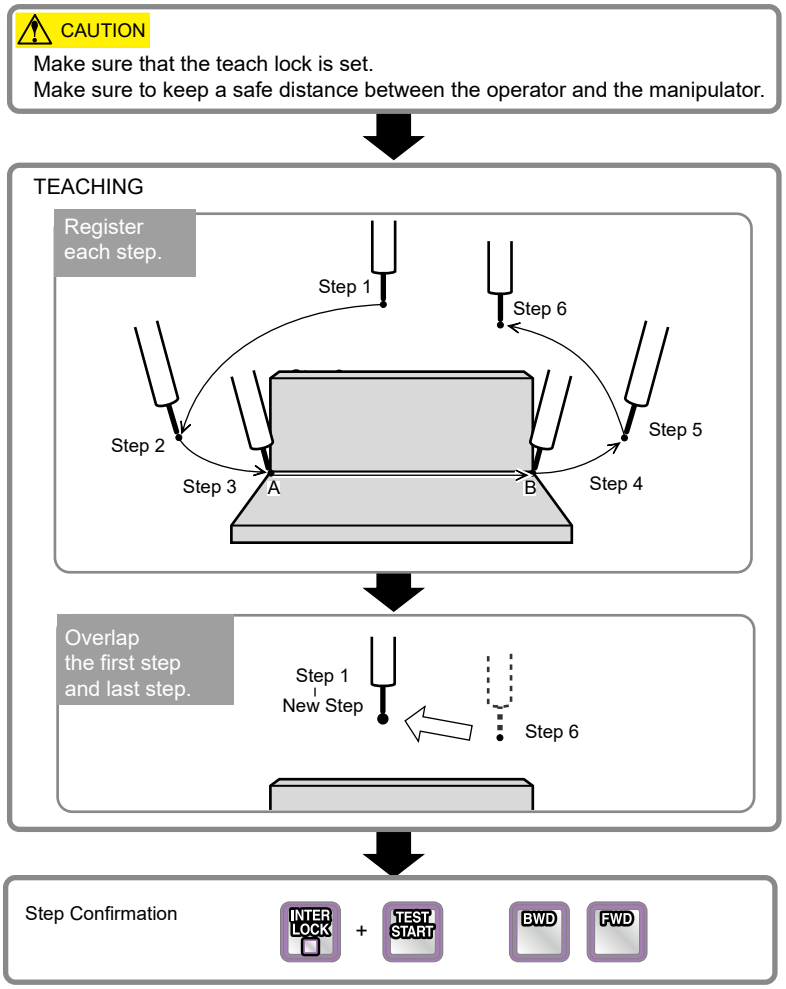


■ Teaching a Job

A job is a work program that describes the tasks that the manipulator will execute. Jobs are created using a robot programming language called INFORM III.

The following example will instruct you how to teach the manipulator all of the steps from Point A to Point B of the following workpiece. This job can be completed in 6 steps.

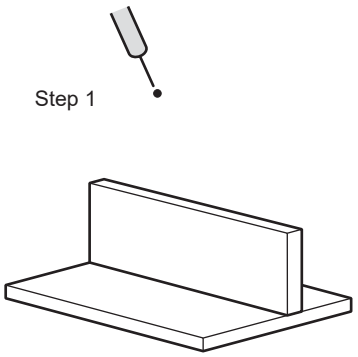
Fig. 9-1: Teaching a Job



Actual work is not performed here.

■ Step 1 -- Standby Position

Always be sure the manipulator is in a safe work area before operation.



1. Grip the Enable switch and the servo power will turn ON. The manipulator can then be operated.
2. Move the manipulator to the standby position using [Axis Keys]. Be sure the position is safe and that the work area is appropriate for the job to be programmed.
3. Select joint interpolation by pressing [MOTION TYPE]. Joint instruction “MOVJ...” will be displayed in the input buffer line.



4. Move the cursor to the line number 0000 and press [SELECT].



5. The input buffer line appears. Move the cursor to the right to VJ=*.**, which shows the speed. While pressing [SHIFT] simultaneously, move the cursor up and down (to higher and lower play speeds) until the desired speed is specified.
   Set the speed to 50%.

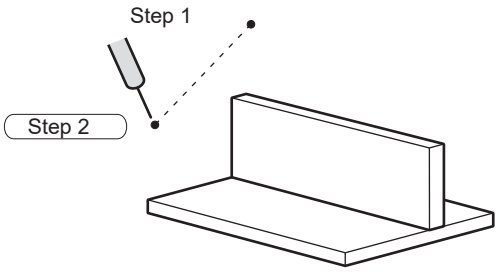


6. Press [ENTER]. Step1 (Line 0001) is registered.



■ **Step 2 -- Near the Work Start Position**

Define the manipulator's working posture.

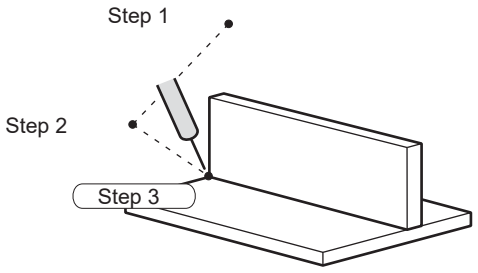


1. Move the manipulator to the working position using [Axis Keys].
2. Press [ENTER]. Step 2 (Line 0002) is registered.

```
0000 NOP
0001 MOVJ VJ=50.00
0002 MOVJ VJ=50.00
0003 END
```

■ **Step 3 -- Work Start Position**

Move the manipulator to the work start position with the pose as shown in Step 2.



1. Change to medium speed by pressing [FAST] or [SLOW] until  is displayed in the status area.



2. Do not release the pose in Step 2. Press [COORD] to select the Cartesian coordinates. Move the manipulator to the welding start position using [Axis Keys].



3. With the cursor located on the line number 0002, press [SELECT].
4. The input buffer line appears. Move the cursor to the right to VJ=*.**, which shows the speed. While pressing [SHIFT] simultaneously, move the cursor up and down (to higher and lower play speeds) until the desired speed is specified.
   Set the speed to 12.50%.

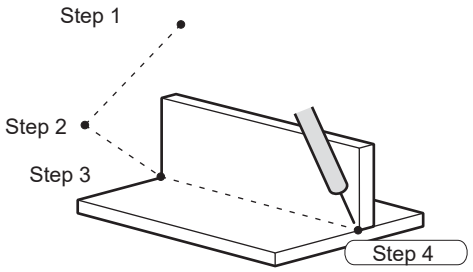


5. Press [ENTER]. Step 3 (Line 0003) is registered.



■ Step 4 -- Work End Position

Specify the work end position.



1. Move the manipulator to the work end position with [Axis Keys]. While the manipulator is moving, keep a wide enough distance to ensure it will not strike the workpiece. There is no need to follow the work line too closely.
2. Press [MOTION TYPE] to select linear interpolation (MOVL).



3. With the cursor located on the line number 0003, press [SELECT].



4. The input buffer line appears. Move the cursor to the right to V= 100.0, which shows the speed. While pressing [SHIFT] simultaneously, move the cursor up and down (to higher and lower play speeds) until the desired speed is specified.
   Set the speed to 200.0 cm/min.

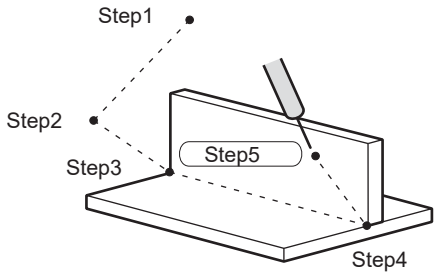


5. Press [ENTER]. Step 4 (Line 0004) is registered.



■ Step 5 -- Clear Position

Move the manipulator to a position where it will not strike the workpiece or fixture.



1. Change the speed to high speed by pressing [FAST].



NOTE This button only affects teaching speed. When the job is played, the job will execute at the speed defined in Step 4.

2. Move the manipulator with [Axis Keys] to a position where it will not strike the fixture.
3. Press [MOTION TYPE] to set to the joint interpolation type (MOVJ).



4. With the cursor located on line number 0004, press [SELECT].



5. The input buffer line appears. Move the cursor to the right to VJ=12.50, which shows the speed. While pressing [SHIFT] simultaneously, move the cursor up and down (to higher and lower play speeds) until the desired speed is specified.
   Set the speed to 50%.

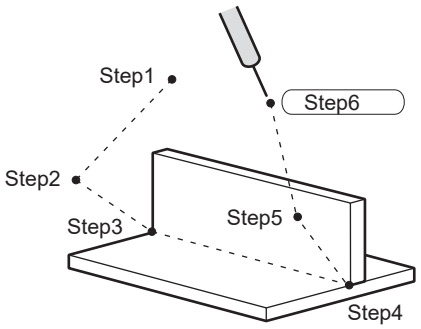


6. Press [ENTER]. Step 5 (Line 0005) is registered.



■ Step 6 -- Near the Standby Position

Move the manipulator near the standby position.



1. Move the manipulator near the standby position with [Axis Keys].
2. Press [ENTER]. Step 6 (Line 0006) is registered.

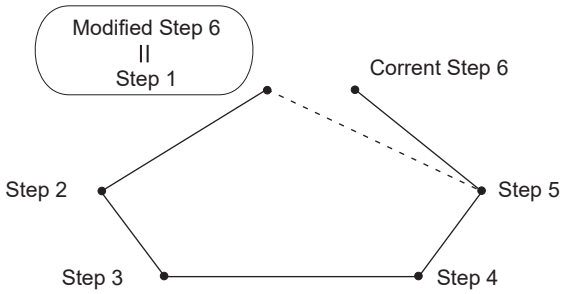


■ **Ensuring the First and Last Step are Identical**

The manipulator has stopped at Step 6, which should be very close to Step1.

It is possible to move directly from the job end position of Step 5 to Step1, so the manipulator can begin the next job quickly and efficiently.

The following operation will make Step 6 (end position) and Step1 (standby position) identical.



1. Move the cursor to Step1 (Line 0001).



2. Press [FWD]. The manipulator will move to Step1.
3. Move the cursor to Step 6 (Line 0006).



4. Press [MODIFY].
5. Press [ENTER]. This will change the position of Step 6 to be the same as Step1.

9.1.1.3 Path Confirmation

The job is now complete. Try to check each step separately to ensure there are no problems.

1. Move the cursor to Step 1 (Line 0001).



2. Change to medium speed by pressing [FAST] or [SLOW].



3. Press [FWD] to confirm each step executed by the manipulator. Each time [FWD] is pressed, the manipulator moves one step.
4. When you finish step confirmation, move the cursor to the beginning of the job.
5. Run all the steps continuously. Hold down [INTERLOCK] and press [TEST START]. The manipulator plays back all the steps continuously and stops when one cycle is finished.

Proceed to the next section to change the position and speed of the job steps.

9.1.1.4 Correcting a Job

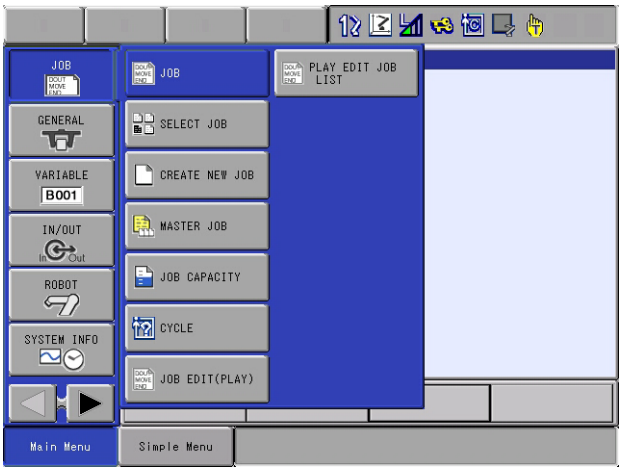
Confirm the manipulator's motion in each step. If any position modification or adding or deleting of steps is necessary, display the job content first with the following procedure.

NOTICE

- After the job is corrected, be sure to confirm the path.

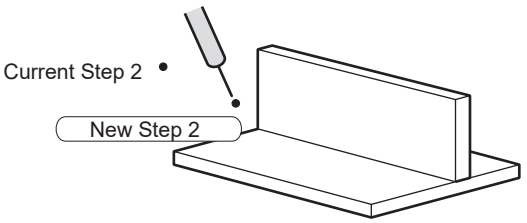
■ **Before Correcting a Job**

1. Select {JOB} under the main menu and {JOB} under the sub menu to display the JOB CONTENT window.



9.1.1.5 Changing the Position Data

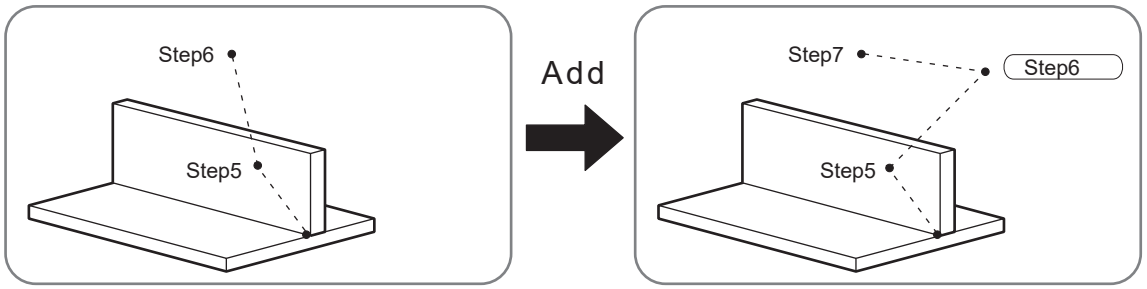
Change the position registered in Step 2.



1. Move the manipulator to Step 2 (Line 0002) by pressing [FWD].
2. Move the manipulator to the modified position with [Axis Keys].
3. Press [MODIFY].
4. Press [ENTER]. The step’s position data is changed.

■ **Adding a Step**

Add a new step between Step 5 and Step 6.



1. Move the manipulator to Step 5 (Line 0005) by pressing [FWD].

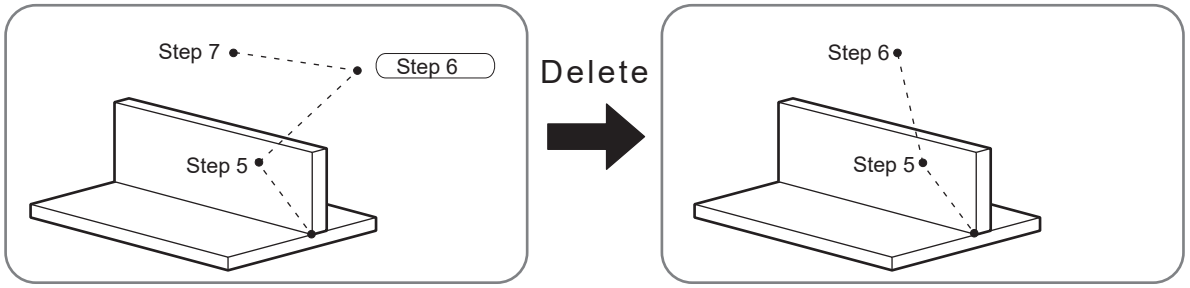
```
0000 NOP
0001 MOVJ VJ=50.00
0002 MOVJ VJ=50.00
0003 MOVJ VJ=12.50
0004 MOVL V=200.0
0005 MOVJ VJ=50.00
0006 MOVJ VJ=50.00
0007 END
```

2. Move the manipulator to the position at which you wish to add a step using [Axis Keys].
3. Press [INSERT].
4. Press [ENTER]. The step is added. When a step is added, the numbering is automatically adjusted to count the new step.

```
0001 MOVJ VJ=50.00
0002 MOVJ VJ=50.00
0003 MOVJ VJ=12.50
0004 MOVL V=200.0
0005 MOVJ VJ=50.00
0006 MOVJ VJ=50.00
0007 MOVJ VJ=50.00
0008 END
```

■ **Deleting a Step**

Delete the step you just added.



1. Move the manipulator to Step 6 (Line 0006) by pressing [FWD].



2. Make sure the cursor is on the step you wish to delete, and press [DELETE].
3. Press [ENTER]. The step is deleted. When a step is deleted, the numbering of step is automatically adjusted corresponding to the deletion.

SUPPLE -MENT

When “Error 2070: Set Robot Exactly to Taught Position” Occurs

When the operator presses [ENTER] during the previous operation, an error can occur in some cases. The error occurs because the manipulator has not been moved exactly to the taught position. Cancel the error with either of the following two procedures:

- Press [CANCEL] and press [FWD] to move the manipulator to the position of the step.
- Press [MODIFY] and press [ENTER] to change the position data of the step, then press [DELETE] and press [ENTER].

If the cursor in the window is blinking, the manipulator is not in the taught position.

■ **Changing the Speed between Steps**

Change the manipulator speed. Slow the speed between Step 3 and Step 4.

1. Move the cursor to Step 4.



2. Move the cursor to the instruction and press [SELECT].



3. The input buffer line appears. Move the cursor to the right to "V= 200.0," which shows the speed. While pressing [SHIFT] simultaneously, move the cursor up and down (to higher and lower play speeds) until the desired speed is specified.
   Set the speed to 93.0 cm/min.



4. Press [ENTER]. The speed is changed.





The unit for speed can be verified and modified by "SPEED DATA INPUT FORM" from {SETUP} → {OPERATE COND}.

9.1.2 Playback

9.1.2.1 Preparation before Playback

NOTE

To run the program from the beginning of the job, perform the following operation.

- Move the cursor to the beginning of the job.
- Move the manipulator close to Step 1 with [Axis Keys].

When playback is started, the manipulator begins to move from the Step 1.

9.1.2.2 Playback Procedure

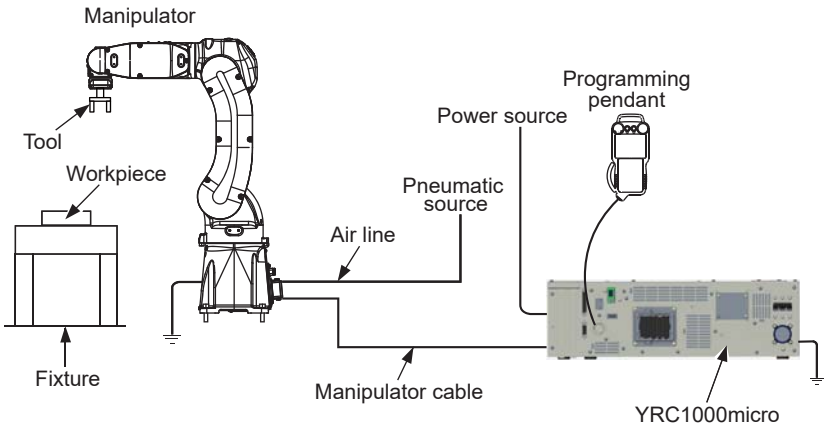
Begin operation only after ensuring there is no one in the working envelope of the manipulator.

1. Switch the mode switch on the programming pendant to “PLAY.”
2. Press [SERVO ON READY] to turn ON the servo power.
3. Press [START]. The manipulator will perform one complete taught cycle and then stop.

9.1.3 Example of Actual Application

9.1.3.1 Example Job

The figure below shows an example of cutting. The job creation procedure is then explained.



Line	Instruction	Explanation	
0000	NOP		
0001	MOVJ VJ=25.00	Moves manipulator to the standby position.	(Step 1)
0002	MOVJ VJ=25.00	Moves manipulator near the cutting start position.	(Step 2)
0003	MOVJ VJ=12.50	Moves manipulator to the cutting start position.	(Step 3)
0004	TOOLON	Starts cutting.	
0005	MOVL V=50.0	Moves manipulator to the cutting end position.	(Step 4)
0006	TOOLOF	Ends cutting.	
0007	MOVJ VJ=25.00	Moves manipulator to the position where the tools and workpieces do not interfere.	(Step 5)
0008	MOVJ VJ=25.00	Moves manipulator to the standby position.	(Step 6)
0009	END		

9.1.3.2 Teaching Procedure

The teaching procedure of Step 2 which specifies the cutting pose and Step 3 and 4 (cutting section) are explained.

NOTE

- Teach Step 1, which is the standby position, to a safe position where the manipulator will not collide with the workpiece and the tool.
- Confirm the cutting path with [FWD] and [BWD] after teaching.

■ **Step 2 -- Near cutting position**
Define the cutting pose.

1. Specify the correct posture with [Axis Keys] for the manipulator to start cutting.
2. Press [ENTER]. Step 2 is registered.



■ **Step 3 -- Cutting Start Position**

Move to the cutting start position with the pose as shown in Step 2, and register the TOOLON instruction.

1. Change to medium speed by pressing [FAST] or [SLOW]. Medium speed:  is displayed in the status area.



2. Move the manipulator to the cutting start position with [Axis Keys]. At this time, do not release the pose input in Step 2.
3. With the cursor located on the line number, press [SELECT].



4. The input buffer line appears. Move the cursor to the right to "VJ=25.00," which shows the speed. While pressing [SHIFT] simultaneously, move the cursor  up and down (to higher and lower play speeds) until the desired speed is specified.
   Set the speed to 12.50%.



5. Press [ENTER]. Step 3 is registered.



6. Press [2/TOOL ON]. "TOOLON" is displayed in the input buffer line.



7. Press [ENTER]. The TOOLON instruction is registered.

■ Step 4 -- Cutting End Position

Define the cutting end position.

1. Move the manipulator to the cutting end position with [Axis Keys]. It is necessary to choose a direction in which the treatment device and the tools do not interfere when the manipulator moves, and teach that position.
2. Set linear interpolation (MOVL) by pressing [MOTION TYPE].



3. With the cursor located on the line number, press [SELECT].



4. The input buffer line appears. Move the cursor to the right to “V=11.0,” which shows the speed.
   Press [SELECT] to enable the input of numbers. Then, input the desired value of 50.0mm/s with [Numeric Keys] and press [ENTER].
5. Press [ENTER]. Step 4 is registered.



6. Press [./TOOL OF]. “TOOLOF” is displayed in the input buffer line.

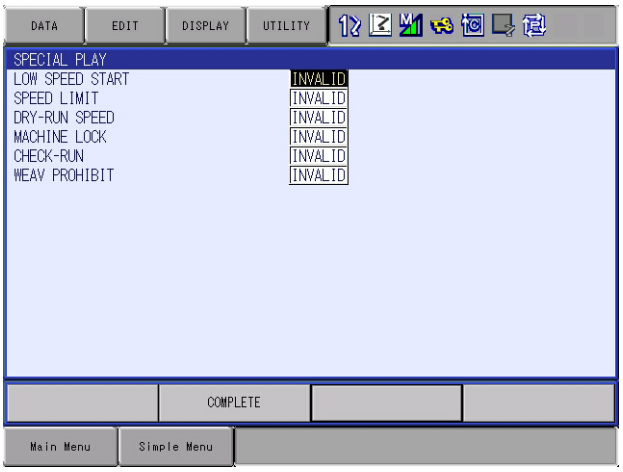


7. Press [ENTER]. The TOOLOF instruction is registered.

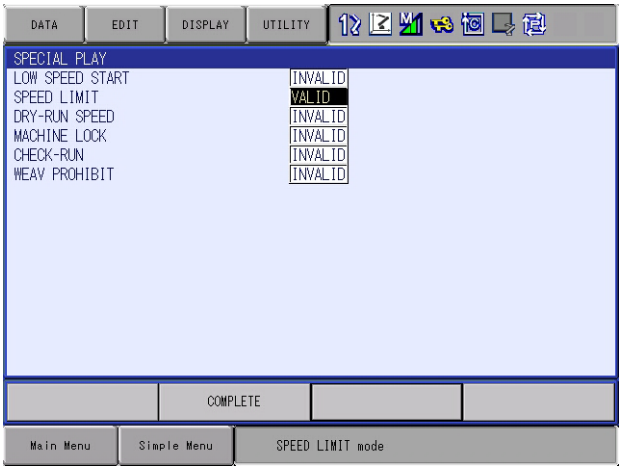
9.1.3.3 Confirmation of Cutting Operation (Speed Limitation Drive)

The speed limitation drive is executed to confirm the taught path.
All the operations operate below the limitation speed during teach mode (250 mm/s usually) in the speed limitation drive. If the taught speed is below the limitation speed, the operation is executed at the same speed as the teaching procedure.

1. Switch the mode switch on the programming pendant to “PLAY.”
2. Select {UTILITY} and {SETUP SPECIAL RUN}. The SPECIAL PLAY window appears.



3. Move the cursor to the “SPEED LIMIT” setting and press [SELECT]. The condition becomes “VALID” and the speed limit is turned ON.



■ **Cutting Execution**

Once the path has been determined, cutting is finally executed at actual speed. If the job is played back with the speed limitation drive disabled, cutting is executed at taught speed.

9.2 Operation for Tool Control

9.2.1 Function Keys

Each function used for tool control is allocated on the [Numeric Keys] of the programming pendant.



	Registers the TOOLON instruction. If [INTERLOCK] is pressed simultaneously, the TOOLON operation is executed.
	Registers the TOOLOF instruction. If [INTERLOCK] is pressed simultaneously, the TOOLOFF operation is executed.
	Registers the CALL instruction for the reserved job TOOLONxx.
	Registers the CALL instruction for the reserved job TOOLOFxx.

9.2.2 Tool Control Settings

The following setting can be performed on the GENERAL DIAGNOSIS window.

1. Select {GENERAL} under the main menu.
2. Select {GENERAL DIAGNOSIS}.
   – The GENERAL DIAGNOSIS window appears.



   – Select “CONTINUE” to continue the work operation when the manipulator is restarted after it abort for any reason during the work operation.
   Select “STOP” to abort the work operation if the manipulator stops. When the manipulator is restarted, it moves without doing any work. Use the work start command to restart the work instruction.
3. Select the setting data of “WORKING ABORT PROCESS”.
   – Each time [SELECT] is pressed, “CONTINUE” and “STOP” is alternately displayed. The displayed state is the current setting.



9.2.3 Work Instructions

9.2.3.1 TOOLON/TOOLOF Instructions

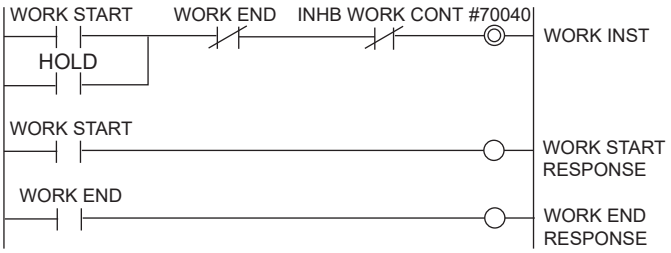
These instructions are to perform TOOLON/TOOLOFF. The function keys are [TOOLON] and [TOOLOF].

1. Select {JOB} under the main menu.
2. Select {JOB}.
3. Press [TOOLON] or [TOOLOF].
   – The TOOLON or TOOLOF instruction is displayed in the input buffer line. Or press [INFORM LIST] to display the instruction box and select the TOOLON/TOOLOF instruction.



   – **TOOLON**
   Turns ON the work instruction.
   Turns ON the work start command (system output relay #51530) and waits for the work start response (system input relay #41130).
   The next instruction is executed when the work response turns ON.
   The work start response relay turns ON immediately after the work start command is output.

   – **TOOLOF**
   Turns OFF the work instruction.
   Turns ON the work end command (system output relay #51531) and waits for the work end response (system input relay #41131).
   The next instruction is executed when the work end response turns ON.
   The work end response relay turns ON immediately after the work end command is output. The work instruction is programmed to hold after the work start command turns ON and to turn OFF when the work end command turns ON.
   When the manipulator stops during the work operation, the work instruction turns OFF.
   When restarting, turn ON the work instruction when “WORKING ABORT PROCESS” is set to “CONTINUE”. Do not turn OFF the work instruction when “STOP” is set.



4. Press [INSERT].
5. Press [ENTER].

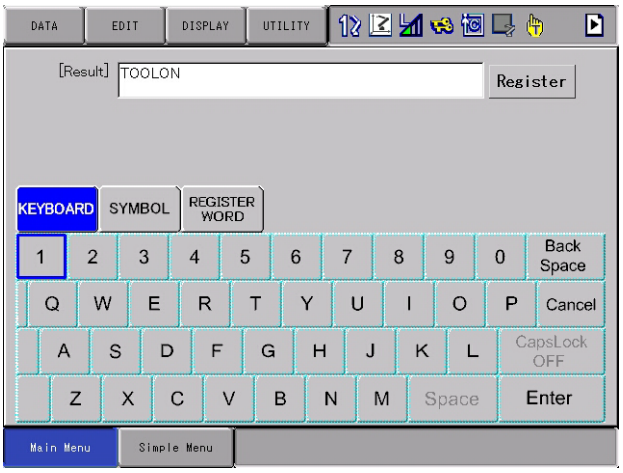
9.2.3.2 CALL Instruction

This instruction calls a reserved job TOOLONxx or TOOLOFxx. The function keys for registration are [TOOLON JOB] and [TOOLOF JOB].

1. Select {JOB} under the main menu.
2. Select {JOB}.
3. Press [TOOLON JOB] or [TOOLOF JOB].
   – The CALL instruction is displayed in the input buffer line.



4. Select the job name.
   – The JOB LIST window appears.
5. Press [PAGE].
   – The window for character input appears.
   The job name can now be changed.



   – Modify the job name and press [ENTER].



6. Press [INSERT].
7. Press [ENTER].

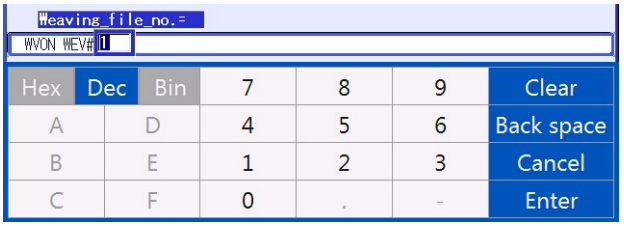
9.2.3.3 WVON Instruction

This instruction starts the weaving motion. Specify conditions in the weaving condition file when registering the WVON instruction.

1. Select {JOB} under the main menu.
2. Select {JOB}.
3. Press [INFORM LIST].
4. Select the WVON instruction.
   – The WVON instruction is displayed in the input buffer line.



   – To register the instruction displayed in the input buffer line without editing, press [INSERT] and then press [ENTER].
5. Select the file number and edit.
   – The input line is displayed.



   – Input weaving file number using [Numeric Keys] and press [ENTER]. (In the following example, 2 is entered.)



6. Press [INSERT].
7. Press [ENTER].

9.2.3.4 WVOF Instruction

This instruction ends the weaving motion.

1. Select {JOB} under the main menu.
2. Select {JOB}.
3. Press [INFORM LIST].
4. Select the WVOF instruction.
   – The WVOF instruction is displayed in the input buffer line.

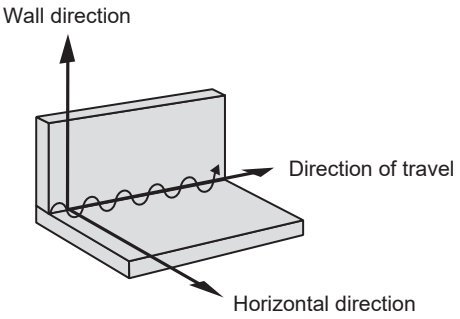


5. Press [INSERT].
6. Press [ENTER].

9.3 Weaving Operation

9.3.1 Weaving Basic Coordinate System

Weaving is performed based on the following coordinate system. This coordinate system is automatically generated when weaving is executed.

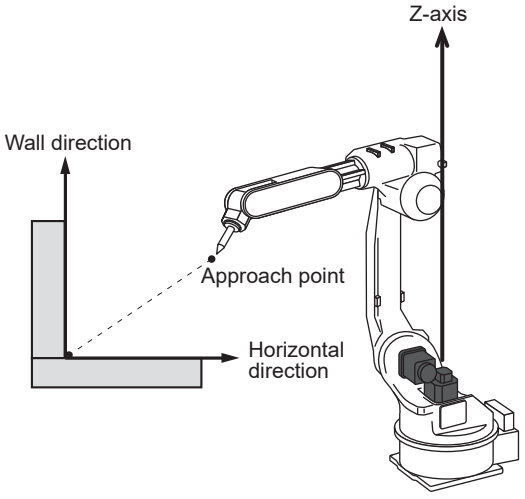


Weaving Basic Coordinate System

Wall Direction:	Z-direction of the robot axis
Horizontal Direction:	The direction to the approach point from the wall
Direction of Travel:	The direction in which the manipulator moves from the weaving start point to the end point

SUPPLE -MENT

The approach point is a point indicated by a step immediately before the step where weaving starts.



NOTE

Depending on the mounting status and shape of the workpiece, a definition of the above coordinate system may not be sufficient to generate a weaving pattern. In this case, register the reference point REFP 1, REFP 2, or REFP 3 (MODE: ELLIPSE).

If the “MODE” is set to “ELLIPSE”, the reference point REFP 1 will not be referred to.

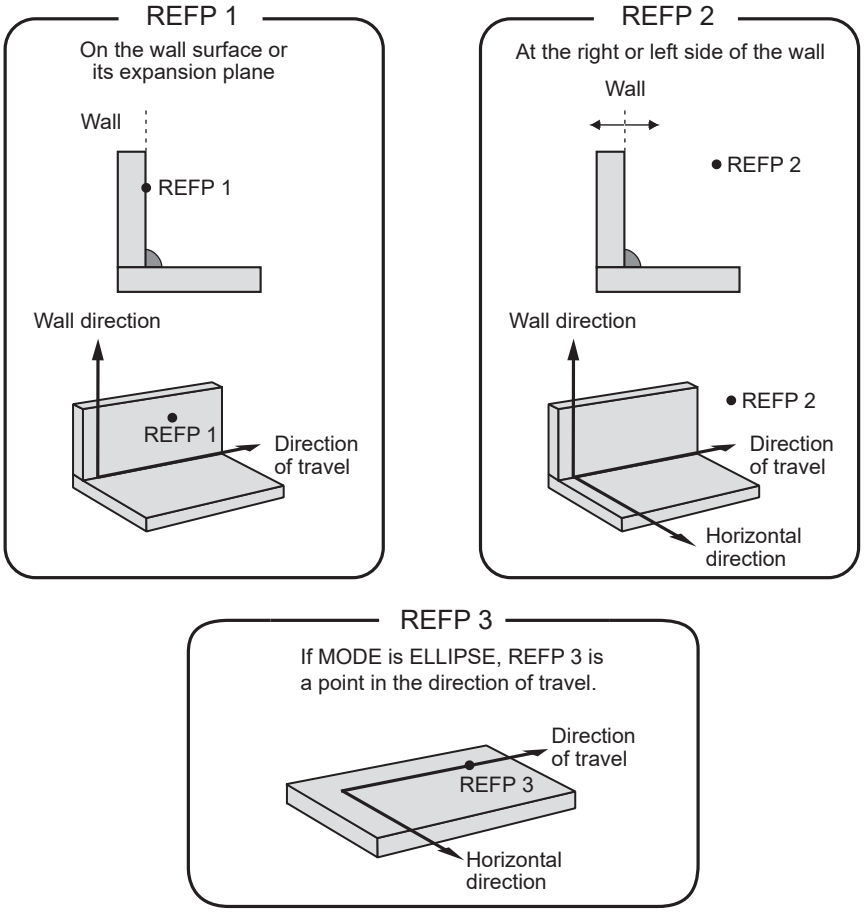
For details, see *chapter 9.3.4.2 “Editing the Condition Data”* .

9.3.1.1 Cases that Require the Registration of Reference Points

The registration of the reference point REFP 1, REFP 2, or REFP 3 is not usually required. They are required only with a special workpiece condition, etc.

The REFP 1, that defines the wall direction, is a point on the wall surface or its expansion plane. The REFP 2, which defines the horizontal direction, is a point at the right or left side of the wall.

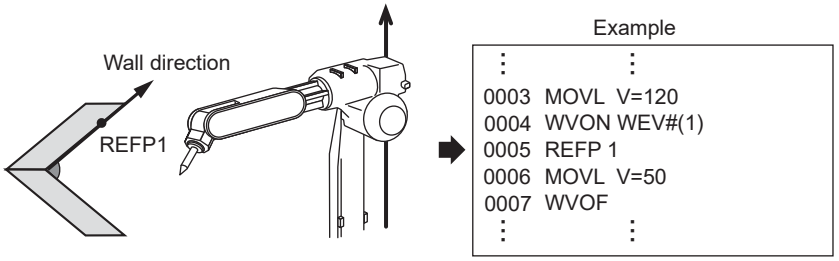
If the “MODE” is set to “ELLIPSE”, REFP 3 is the reference point which defines the direction of travel.



SUPPLE -MENT For information on registering REFP, refer to *chapter 3.2.3.2 “Registering Reference Point Instructions”* .

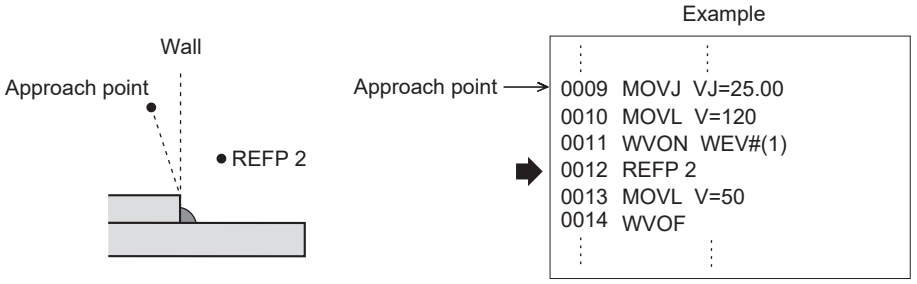
< Example 1 >

REFP 1 is registered because the wall direction is not parallel to the Z-axis of the robot coordinates.



< Example 2 >

REFP 2 is registered because the approach point is at another side of the wall.



NOTE

If the weaving start step (immediately before WVON) and the previous step (approach point) are same, the weaving start point and the approach point become same, and the horizontal direction become undefined.
In this case, register the reference point REFP 2.

9.3.2 WVON

9.3.2.1 Function

This is the weaving start operation.

9.3.2.2 Syntax

The tag to be used varies according to the control group of job.

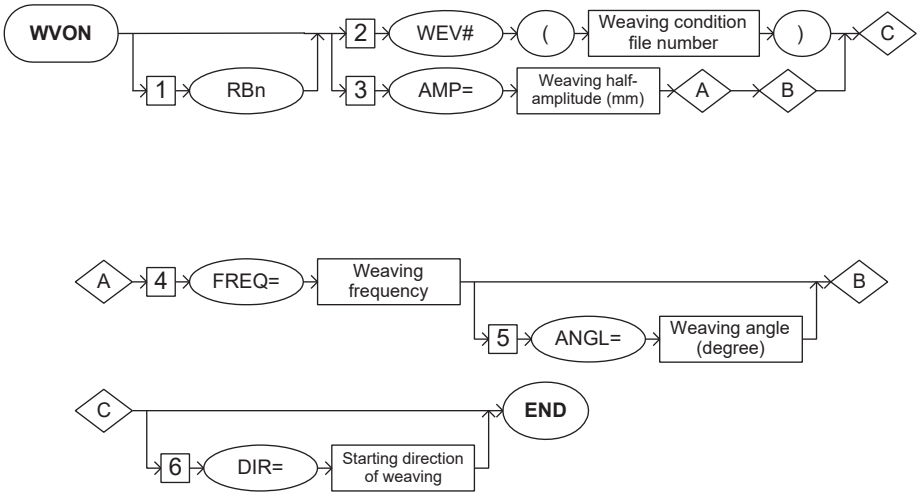


Table 9-1: Job Type and Control Group

Type	Control Group of Job	Note
Independent	Job with one manipulator (Standard)	
Coordinated	Job with two manipulators	Optional

Table 9-2: Tag Usage Limitation

Tag	Control Group of Job		Note
	1	2	
RB1	X	O	
RB2	X	O	
WEV#( )	O	O	
AMP=	O	O	
FREQ=	O	O	
ANGL=	O	O	
DIR=	O	O	

O: Available
X: Not available

9.3.2.3 Explanation

■ **RB1/RB2 [1]**
Be sure to choose one of the following tags.

Tag	Explanation	Note
RB1	Specifies the weaving motion of robot 1.	
RB2	Specifies the weaving motion of robot 2.	

■ **WEV# (Weaving condition file number)/AMP [2] = Weaving half-amplitude [3]**
Be sure to choose one of the following tags.

Tag	Explanation	Note
WEV# (Weaving condition file number)	Specifies the weaving condition file number. Conditions for the weaving motion are registered in the weaving condition file.	No. 1 to 16 The number can be specified by B/I/D/LB/LI/LD variable.
AMP = Weaving half-amplitude	Specifies the half-amplitude of weaving.	Half-amplitude: 0.1 to 99.9 mm The half-amplitude can be specified by B/B[ ]/LB/LB[ ]/I/I[ ]/LI/LI[ ]/D/D[ ]/LD/LD[ ] variable. (Unit: 0.1 mm)

■ **FREQ = Weaving frequency [4]**
Only when “AMP = Weaving half-amplitude” is selected in the above *“WEV# (Weaving condition file number)/AMP [2] = Weaving half-amplitude [3]”* , be sure to add the following tag.

Tag	Explanation	Note
FREQ = Weaving frequency	Specifies the weaving frequency.	Frequency: 0.1 to 5.0 Hz The frequency can be specified by B/I/D/B[ ]/I[ ]/D[ ]/LB/LI/LD/LB[ ]/LI[ ]/LD[ ] variable. (Unit: 0.1 Hz)

■ **ANGL = Weaving angle [5]**
Only when “AMP = Weaving half-amplitude” is selected in the above *“WEV# (Weaving condition file number)/AMP [2] = Weaving half-amplitude [3]”* , this tag is added or omitted after *“FREQ = Weaving frequency [4]”*

Tag	Explanation	Note
ANGL = Weaving angle	Specifies the weaving angle.	Angle: 0.0 to 180.0 degree The degree can be specified by B/I/D/B[ ]/I[ ]/D[ ]/LB/LI/LD/LB[ ]/LI[ ]/LD[ ] variable. (Unit: 0.1)

■ **DIR = Starting direction of weaving [6]**

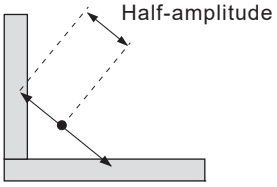
This tag can be added or omitted.

Tag	Explanation	Note
DIR = Starting direction of weaving	Specifies the starting direction of weaving.	Direction: 0 to 1 0: Forward 1: Backward The direction can be specified by B/I/D/B[]/I[]/D[]/ LB/LI/LD/LB[]/LI[]/LD[] variable.

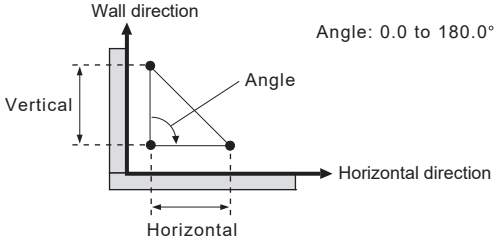
SUPPLE -MENT

Setting conditions for weaving

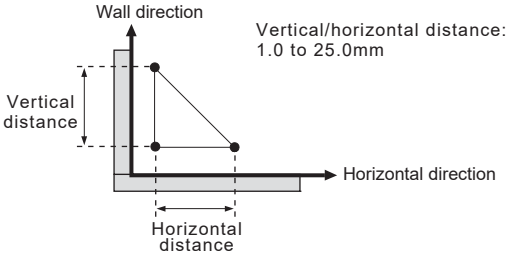
• Weaving half-amplitude
Specify the amplitude size of weaving motion.



• Weaving angle
Specify the angle of weaving motion.

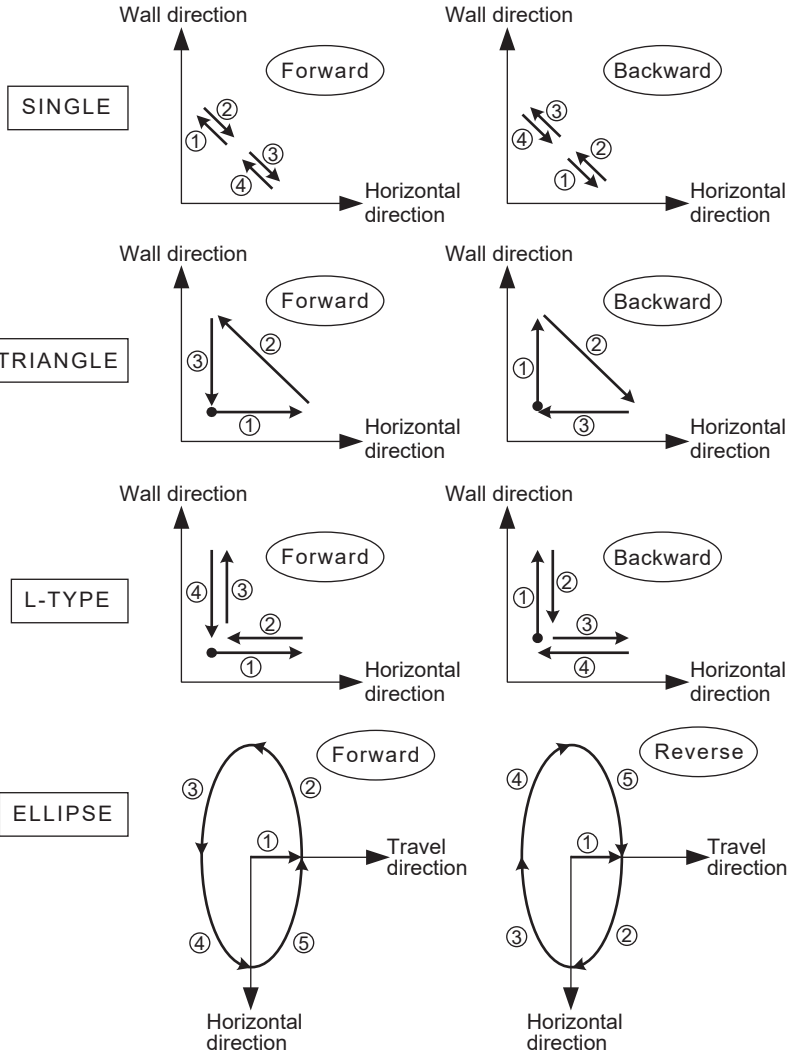


MODE: TRIANGLE, L-TYPE



MODE: TRIANGLE, L-TYPE

• Starting direction of weaving
Specify the starting direction of weaving motion.



9.3.2.4 Registering the WVON Instruction

This is the instruction to start the weaving operation.

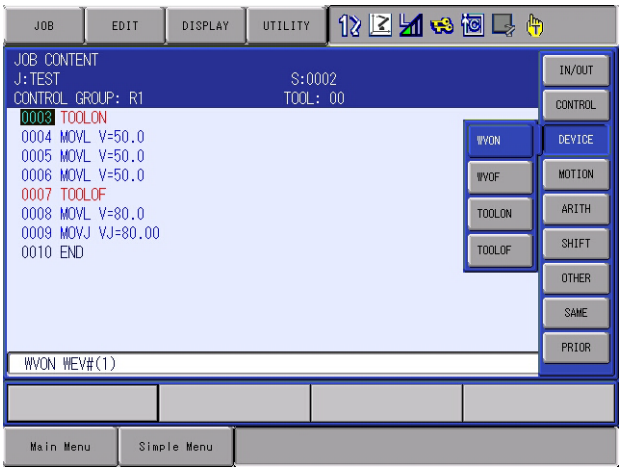
1. Move the cursor to the address area.
2. Press [INFORM LIST].
   – The instruction list dialog box appears.



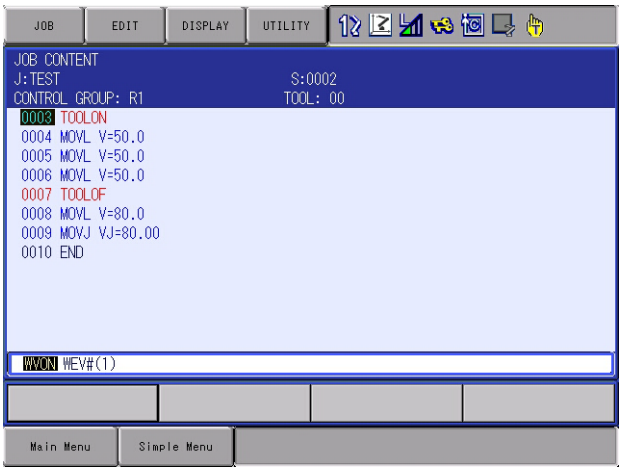
3. Select “DEVICE”.

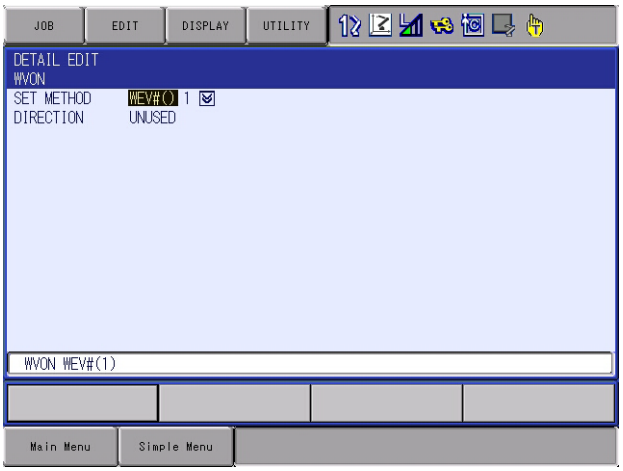


4. Select the WVON instruction.
   – The “WVON” instruction appears in the input buffer line.



5. Press [SELECT], and set the file number in the DETAIL EDIT window.
   – Select the file number (1 to 255).
   (1) Move the cursor to the file number and press [SELECT].
   (2) Input the file number using [Numeric Key] and press [ENTER].





6. Press [INSERT], and then [ENTER].
   – The set contents are displayed in the input buffer line.
7. Press [ENTER] again.
   – The set contents are registered in the job.



   – When the set contents are not to be registered, press [CANCEL] to return to the JOB CONTENT window.

9.3.3 WVOF Instruction

9.3.3.1 Function

This is the weaving end instruction.

9.3.3.2 Syntax

The control group of job limits the tag usage.

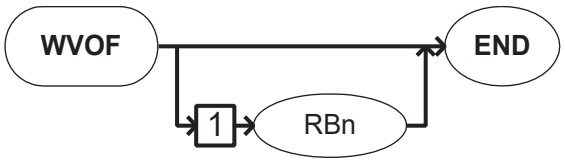


Table 9-3: Job Type and Control Group

Type	Control Group of Job	Note
Independent	Job with one manipulator (Standard)	
Coordinated	Job with two manipulators	Optional

Table 9-4: Tag Usage Limitation

Tag	Control Group of Job		Note
	1	2	
RB1	X	O	
RB2	X	O	

O: Available
X: Not available

9.3.3.3 Explanation

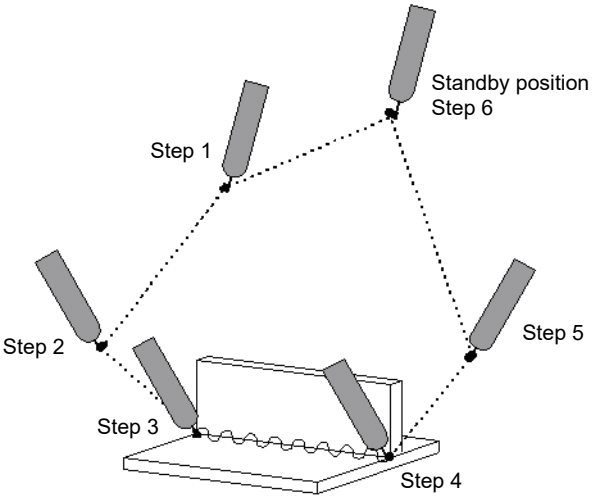
■ **RB1/RB2 [1]**

Be sure to choose one of the following tags.

Tag	Explanation	Note
RB1	Specifies the weaving motion of robot 1.	
RB2	Specifies the weaving motion of robot 2.	

<Example>

```
NOP
MOVJ VJ=50.00      · · ·  Step 1
MOVL V=220         · · ·  Step 2
MOVL V=200         · · ·  Step 3
WVON WEV#(2)       · · ·  Weaving start
TOOLON             · · ·  Cutting start
MOVL V=138         · · ·  Step 4
TOOLOF             · · ·  Cutting end
WVOF               · · ·  Weaving end
MOVL V=200         · · ·  Step 5
MOVJ VJ=50.00      · · ·  Step 6
END                · · ·
```



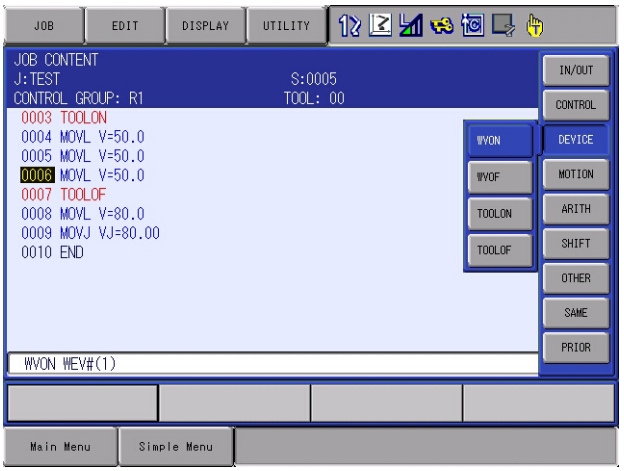
9.3.3.4 Registering the WVOF Instruction

This is the instruction to end the weaving operation.

1. Move the cursor to the address area.
2. Press [INFORM LIST].
   – The instruction list dialog box appears.



3. Select “DEVICE”.



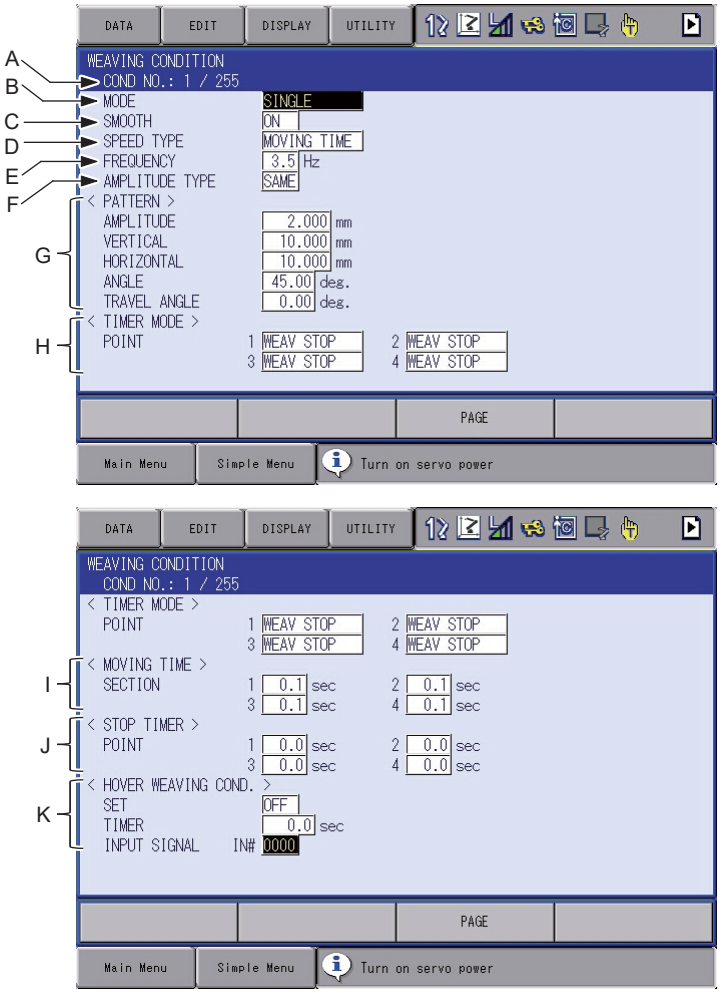
4. Select the “WVOF” instruction.



5. Press [ENTER].
   – The set contents are registered in the job.



9.3.4 WEAVING CONDITION Window

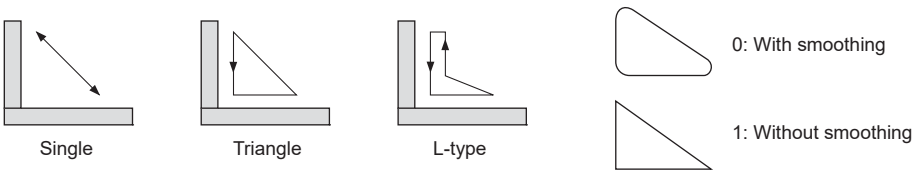


A. COND NO. (1 to 255)

The weaving condition file number between 1 and 255 is shown.

B. MODE, C. SMOOTH

Set the weaving mode to SINGLE, TRIANGLE, L-TYPE, or ELLIPSE. For the SINGLE, TRIANGLE, or L-TYPE mode, ON/OFF of SMOOTH can be set.



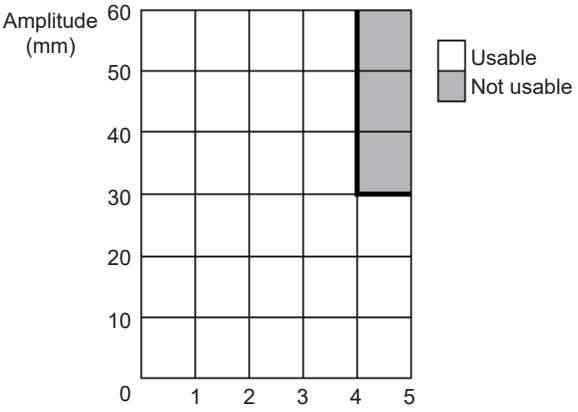
Weaving Modes Smooth

D. SPEED TYPE (FREQUENCY, MOVING TIME)

Specify the setting type of the weaving motion speed.
Two types are available: setting by frequency and setting by the moving time in each weaving section.

E. FREQUENCY

Specify the weaving frequency if “SPEED TYPE” is set to “FREQUENCY”. Note that when the mode is set to “SINGLE” and the speed type is set to “FREQUENCY”, the maximum frequency is determined by the amplitude as illustrated in the graph below. Specify a frequency within the allowable range.

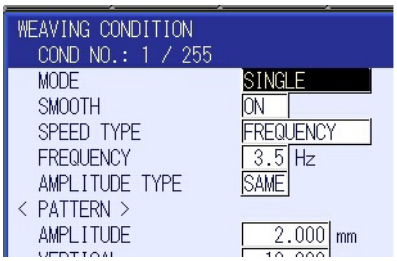


Maximum Frequencies for Different Amplitudes

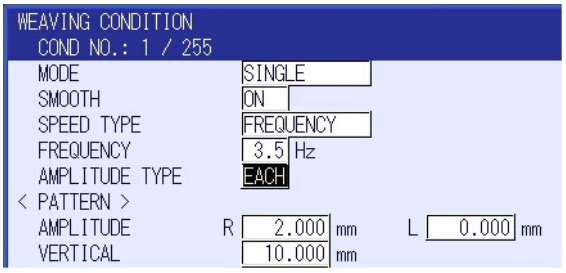
F. AMPLITUDE TYPE (SAME, EACH)

Specify the amplitude type of weaving, SAME or EACH.
When the amplitude type is set to EACH, the right-left amplitude for SINGLE or the lateral-longitudinal amplitude for ELLIPSE (V: semi-minor axis, H: semi-major axis) can be specified.

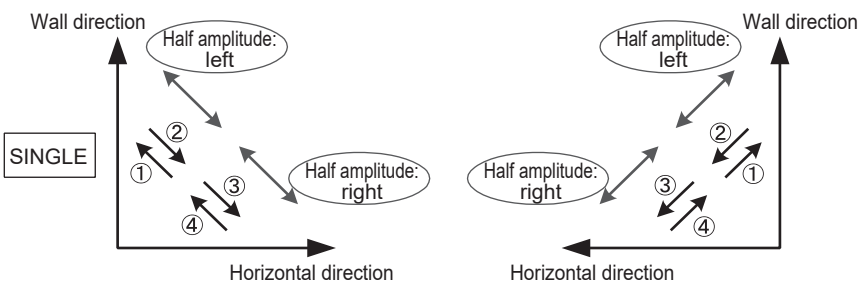
When set to SAME in the SINGLE, TRIANGLE, or L-TYPE mode



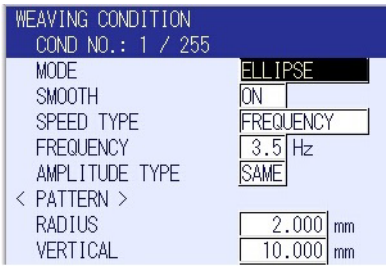
When set to EACH in the SINGLE, TRIANGLE, or L-TYPE mode



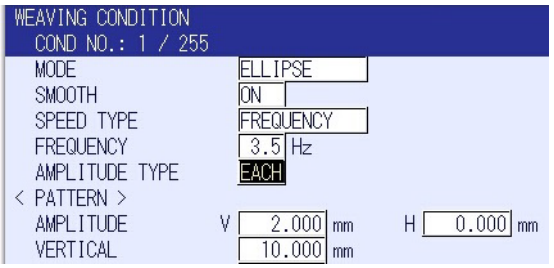
The definitions of “right” and “left” differ depending on the wall direction, and the wall side is defined as “left”.

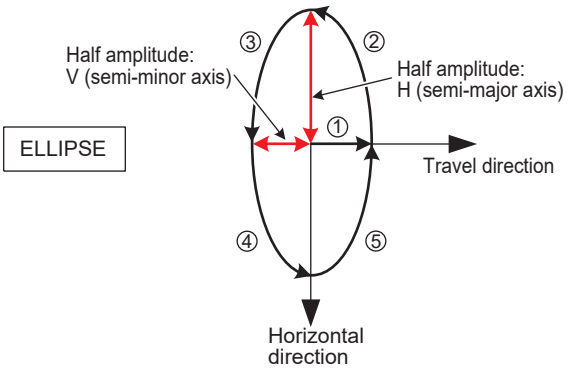


When set to SAME in the ELLIPSE mode



When set to EACH in the ELLIPSE mode

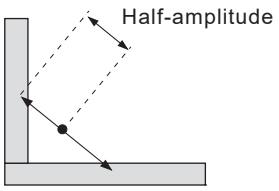




G. PATTERN

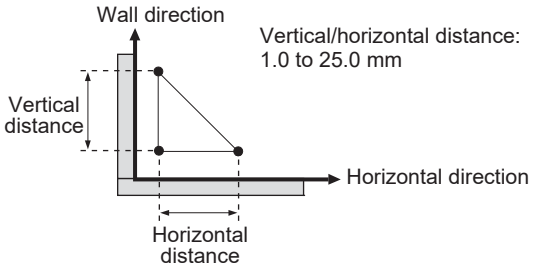
- AMPLITUDE

  Specify the amplitude size at weaving when MODE is set to SINGLE or ELLIPSE.



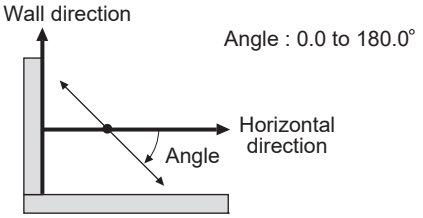
When AMPLITUDE TYPE is set to EACH in the above step F, specify the amplitude size individually for the right-left amplitude for SINGLE or the lateral-longitudinal amplitude for ELLIPSE (V: semi-minor axis, H: semi-major axis).

• VERTICAL, HORIZONTAL
If MODE is set to TRIANGLE or L-TYPE, the data for the triangle must be set to define the weaving pattern.

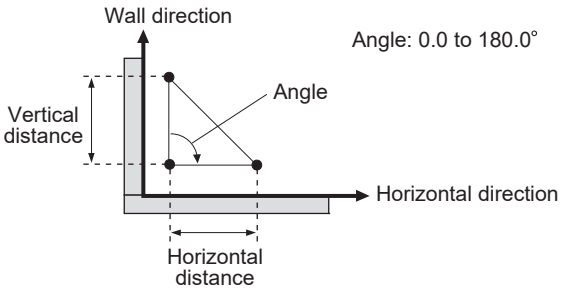


MODE: TRIANGLE, L-TYPE

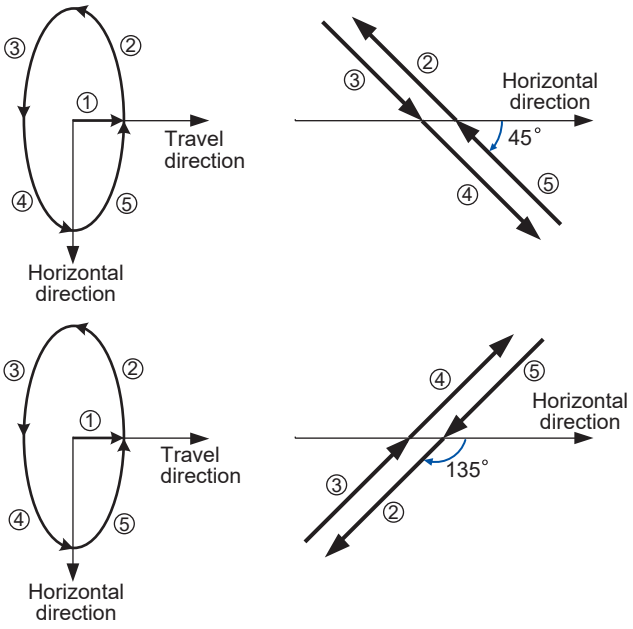
• ANGLE
Specifies the angle of weaving motion.



MODE: SINGLE

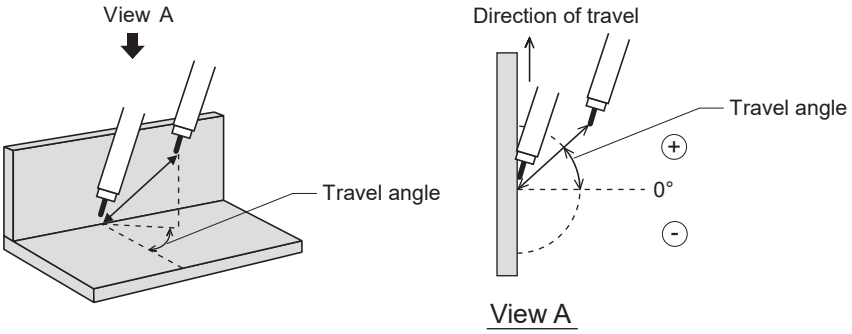


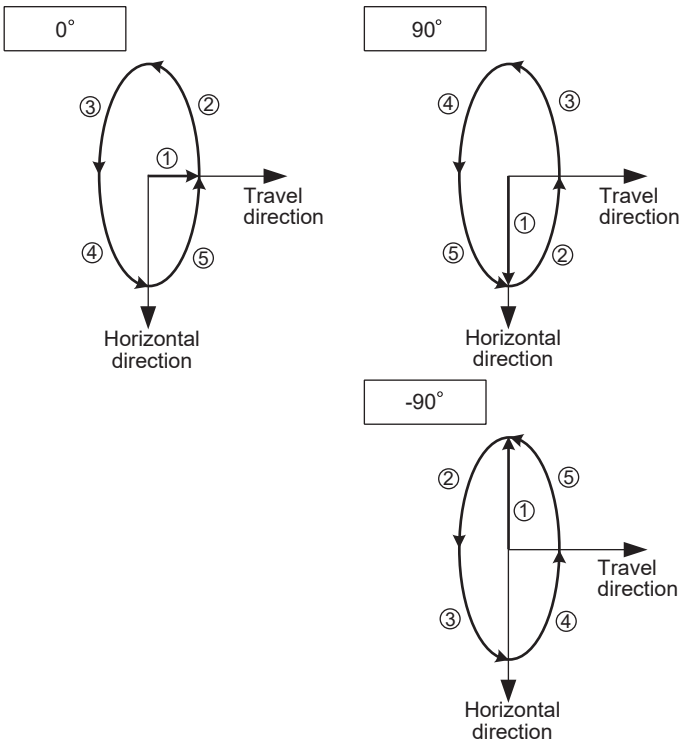
MODE: TRIANGLE, L-TYPE



MODE: ELLIPSE

• TRAVEL ANGLE
Specifies the travel angle of weaving motion.

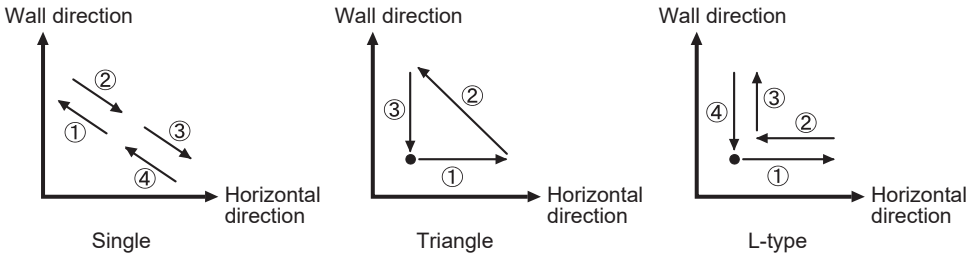




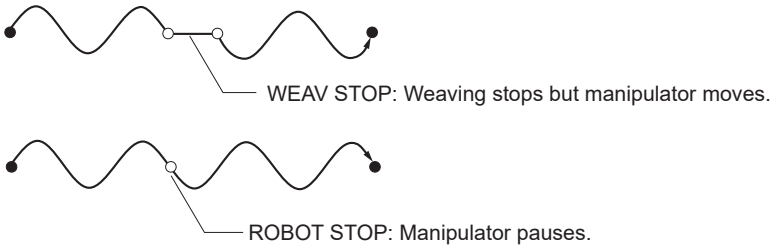
MODE: ELLIPSE

H. TIMER (MODE)

As shown below, a single weaving cycle is divided into three or four sections. The timer mode can be specified for each section.



Set one of the following timer modes:
WEAV STOP: Weaving stops but manipulator moves.
ROBOT STOP: Manipulator stops.



I. MOVING TIME

If “SPEED TYPE” is set to “MOVING TIME”, the moving time specified here determines the moving speed in each of the weaving sections (explained in “TIMER (MODE)” above).

J. STOP TIMER

Specifies the timer to determine weaving stop or manipulator stop for each section (explained in “TIMER (MODE)” above).

NOTE If the corner radius (CR) is specified in the move instruction, weaving operations cannot be performed.

When MODE is set to ELLIPSE, weaving operations can be performed only in MOVL, MOVC, SMOVL, SMOVC, or IMOV.

NOTE ELLIPSE cannot be used when the teaching such as the following is performed in the two-manipulator coordinated system.

- The travel distance of the master-side manipulator is longer than that of the slave-side manipulator.

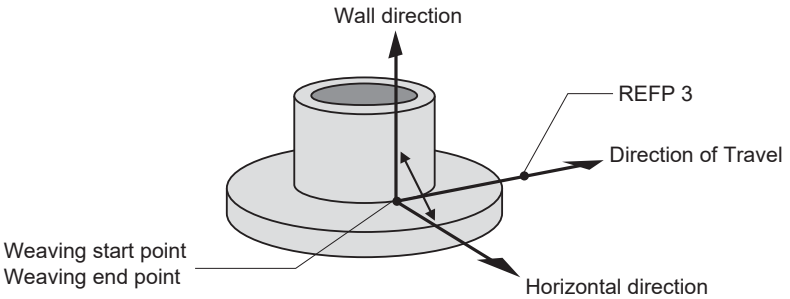
K. HOVER WEAVING COND. (optional)

- SET (ON/OFF)
  Specifies whether hover weaving is used or not.
- TIMER
  Finishes hover weaving when the time specified here ends.
- INPUT SIGNAL
  Finishes hover weaving when the input signal specified here is input.

Reference Job	
NOP	
MOVJ VJ=10.00	
MOVJ VJ=25.00	
REFP 3	
TOOLON	Cutting start point.
WVON WEV#(1)	Reference point for defining the direction of travel.
MOVL V=60	*Teaching by interpolation instruction, not by joint interpolation.
WVOF	The same point with the cutting start point.
TOOLOF	
MOVJ VJ=25.00	
MOVJ VJ=25.00	
END	

NOTE

In hover weaving, the start and end points are the same. Therefore, the weaving direction cannot be determined. For this reason, the user needs to register a reference point (REFP 3) to define the direction of travel.

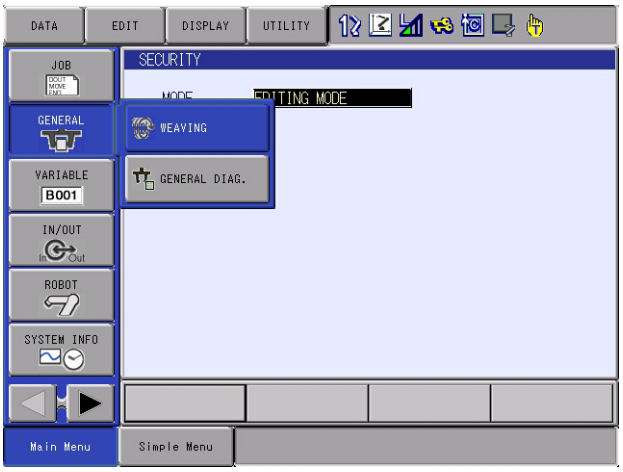


Hover Weaving

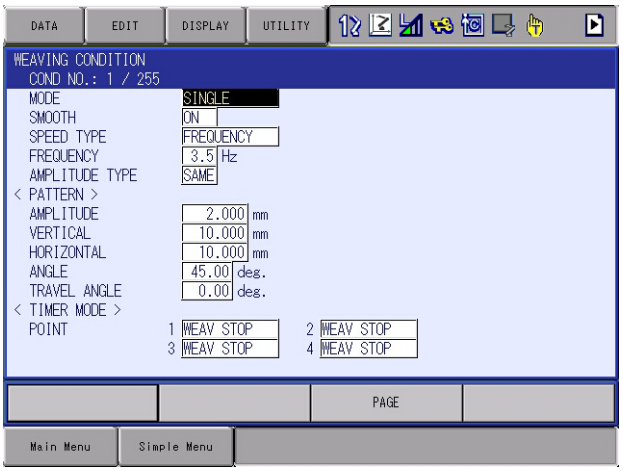
Wall Direction:	Robot axis Z+ direction
Horizontal Direction:	Direction from the wall to approach point
Direction of Travel:	Direction from weaving start point to REFP 3

9.3.4.1 Displaying the Weaving File

1. Select {GENERAL} under the main menu.



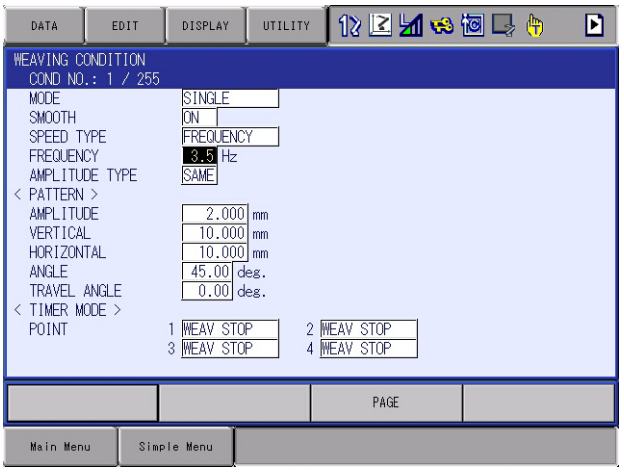
2. Select {WEAVING}.



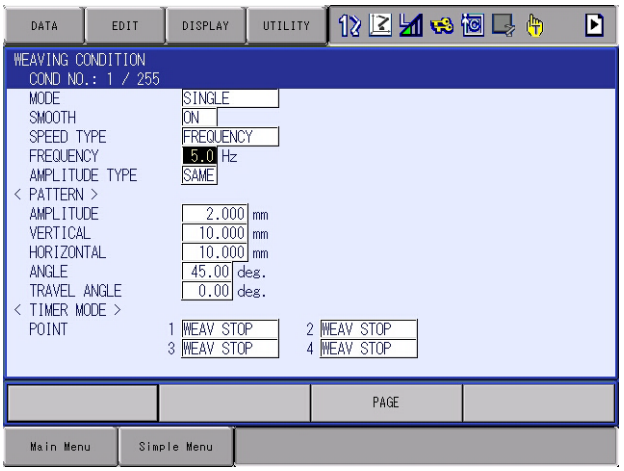
3. Display the desired file number.
   (1) The desired file can be called up by using [PAGE].
   (2) Press [PAGE] to call the next file.
   (3) Press [SHIFT]+ [PAGE] to call the previous file.

9.3.4.2 Editing the Condition Data

1. Select the item to be edited.



2. Input the value using [Numeric Key].



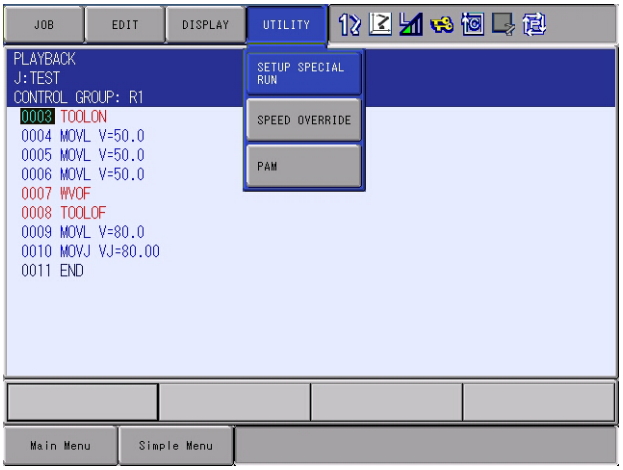
9.3.5 Prohibiting Weaving

If the weaving instruction is registered during the “CHECK” operation in the play mode or “TEST RUN” or [FWD] operation in teach mode, weaving is performed as well as other move instructions.

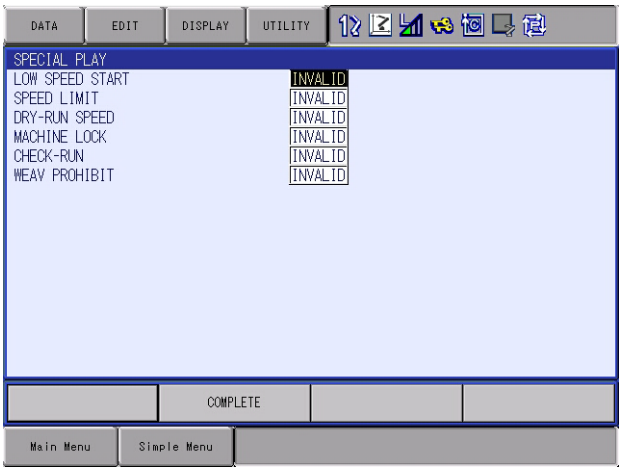
However, in the cases when weaving should not be performed because the manipulator collides with a workpiece, etc., follow the procedure below to prohibit weaving.

9.3.5.1 Method to Prohibit Weaving during a “CHECK” Operation

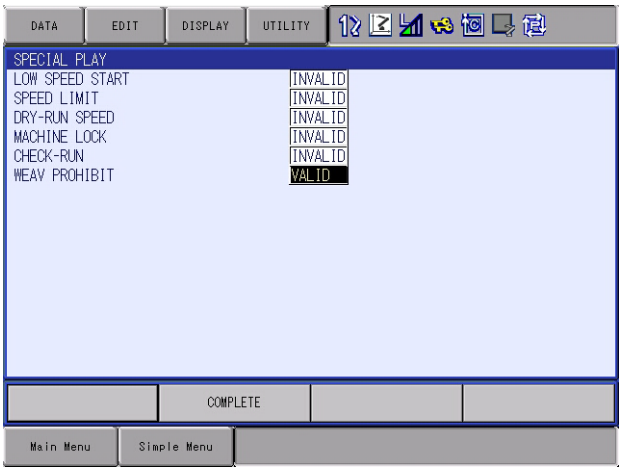
1. Press [AREA] on the PLAYBACK window.
2. Select {UTILITY}.



3. Select {SETUP SPECIAL RUN}.
   – The SPECIAL PLAY window appears.



4. Select “WEAV PROHIBIT IN CHK-RUN”.
   – Each time [SELECT] is pressed, “VALID” and “INVALID” alternate.

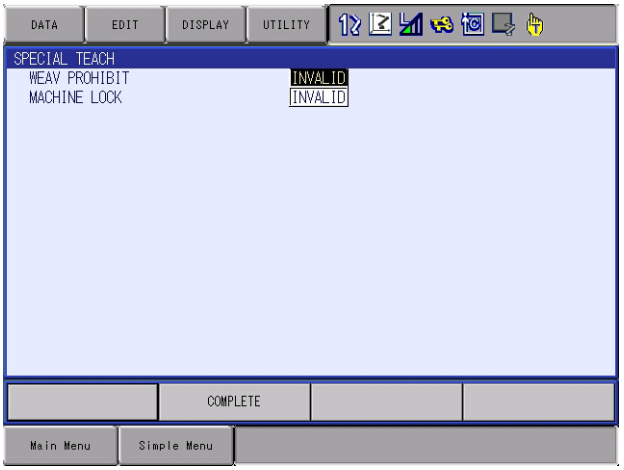


9.3.5.2 Method to Prohibit Weaving during a “TEST RUN” or FWD Operation

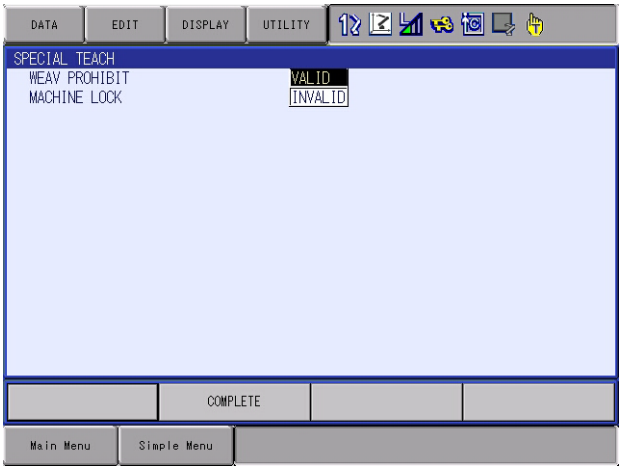
1. Press [AREA] on the JOB CONTENT window in TEACH mode.
2. Select {UTILITY}.



3. Select {SETUP SPECIAL RUN}.
   – The SPECIAL TEACH window appears.



4. Select “WEAV PROHIBIT IN TEST RUN/NEXT”.



9.3.5.3 Method to Prohibit Weaving by Means of a System Input Signal

The system input signal 40047 is used.

9.4 Table of Work Instructions

- < > indicates alpha-numerical data.
- If multiple items are shown in one additional item section, select one.

Table 9-5: Instructions for Material Handling, Press Tending, Cutting, and Other Applications

TOOLON	**Function**	Turns ON work tools (work instructions).	
	Additional Item	UNIT 1 to UNIT 2	Displayed only when using multiple manipulators.
	Example	TOOLON	
TOOLOF	**Function**	Turns OFF work tools (work instructions).	
	Additional Item	UNIT 1 to UNIT 2	Displayed only when using multiple manipulators.
	Example	TOOLOF	
WVON	**Function**	Starts weaving.	
	Additional Item	RB 1 to RB 2	Displayed only when using multiple manipulators.
		WEV#(<weaving condition file number>)	1 to 255
		DIR=(<starting direction of weaving>)	0: Forward 1: Backward
	Example	WVON WEV#(1)	
WVOF	**Function**	Ends weaving.	
	Additional Item	RB 1 to RB 2	Displayed only when using multiple manipulators.
	Example	WVOF	

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.	
	Additional Item	Position data, Base axis position data, Station axis position data	These data do not appear on the screen.
		VJ= <play speed>	VJ: 0.01 to 100.00%
		PL=<position level>	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)=ON	
MOVL	**Function**	Moves to a taught point with linear 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 speed of the posture>, VE=<play speed of external axis> VMAX=<VMAX speed>	V:0.1 to 1500.0 mm/s 1 to 9000.0 cm/min VR:0.1 to 360.0 deg/s VE:0.01 to 100.00% VMAX:50 to 100%
		PL=<position level>	PL:0 to 8
		CR=(corner radius)	CR: 0.1 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 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 speed of the posture>, VE=<play speed of external axis>	Same as MOVL.
		PL=<position level>	PL:0 to 8
		NWAIT	
		ACC=(acceleration adjustment ratio)	ACC: 20 to 100%
		DEC=(deceleration adjustment ratio)	DEC: 20 to 100%
		COORD= (Arc attitude control specification)	COORD: 0 to 1
		FPT: Arc end-point setting	
	Example	MOVC V=138 PL=0 NWAIT	
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 speed of the posture>, VE=<play speed of external axis>	Same as MOVL.
		PL=<position level>	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 position with linear interpolation type.	
	Additional Item	P<variable number>, BP<variable number>, EX<variable number>	
		V=<play speed>, VR=<play speed of the posture>, VE=<play speed of external axis>	Same as MOVL.
		PL=<position level>	PL:0 to 8
		NWAIT	
		BF,RF,TF,UF# (<user coordinate number>)	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 weaving).	
	Additional Item	<reference point number>	wall point 1 for weaving: 1 wall point 2 for weaving: 2
		Position data, Base axis position data, Station axis position data	
	Example	REFP 1 P000	
SPEED	**Function**	Sets play speed.	
	Additional Item	VJ=<joint speed>, V=<TCP speed>, VR=<play speed of the posture>, VE=<play speed of external axis>	VJ:Same as MOVJ. V,VR,VE: Same as MOVL.
	Example	SPEED VJ=50.00	

CAUTION

If the IMOV instruction is stopped during execution by one of the following operations and then restarted, the manipulator moves by linear interpolation from the stopped position by adding the set incremental value to the stopped position, thus the manipulator's travel distance becomes larger than the set incremental value. Thus, in a case where modification in the manipulator's travel distance by a stop causes a problem, do not execute the IMOV instruction.

- External servo OFF signal 2 (#40066)
- Turning OFF the servo power due to alarm occurrence
- Enable signal
- Switching the mode
- Enable Switch

10.2 I/O Instructions

DOUT	**Function**	Turns the external output signals ON and OFF.	
	Additional Item	OT# (<output number>), OGH# (<output group number>), OG# (<output group number>) OGU# (<user group output number>) Number of addressed output signals: OT#(xx)=1; OGH#(xx)=4 (per group); OG#(xx)=8 (per group); OGU#(xx)=32 max. (per group) OGH#(xx) is not subject to parity check; only the binary specification is allowed.	
	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>) OGU# (<user group output number>) Number of addressed output signals: OT#(xx)=1; OGH#(xx)=4 (per group); OG#(xx)=8 (per group); OGU#(xx)=32 max. (per group)	
		T=<time (seconds)>	0.001 to 65.535 s 0.300 s unless otherwise specified
	Example	PULSE OT# (10) T=0.600	
DIN	**Function**	Sets input signals in variables.	
	Additional Item	B<variable number>	
		IN# (<input number>), IGH# (<input group number>), IG# (<input group number>), IGU# (<user group input number>), OT# (<output number>), OGH# (<output group number>), OG# (<output group number>), OGU# (<user group output number>), SIN# (<system input number>), SOUT# (<system output number>) Number of addressed input signals: IN#(xx)=1; IGH#(xx)=4 (per group); IG#(xx)=8 (per group); IGU#(xx)=32 max. (per group) Number of addressed output signals: OT#(xx)=1; OGH#(xx)=4 (per group); OG#(xx)=8 (per group); OGU#(xx)=32 max. (per group) IGH#(xx) and OGH#(xx) are not subject to parity check; only the binary specification is allowed.	
	Example	DIN B016 IN#(16) DIN B002 IG#(2)	

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>), IGU# (<user group input number>), OT# (<output number>), OGH# (<output group number>), OG# (<output group number>), OGU# (<user group output number>), SIN# (<system input number>), SOUT# (<system output number>) B<variable number> Number of addressed input signals: IN#(xx)=1; IGH#(xx)=4 (per group); IG#(xx)=8 (per group); IGU#(xx)=32 max. (per group) Number of addressed output signals: OT#(xx)=1; OGH#(xx)=4 (per group); OG#(xx)=8 (per group); OGU#(xx)=32 max. (per group)	
		T=<time (seconds)>	0.001 to 65.535 s
	Example	WAIT IN# (12)=ON T=10.000 WAIT IN# (12)=B002	

10.3 Control Instructions

JUMP	**Function**	Jumps to the specified label or job.	
	Additional Item	* <label character string>, JOB:<job name>, LABEL:<label elements>, IG# (<input group number>), B<variable number>, I<variable number>, D<variable number>, S<variable number>	
		UF# (user coordinates number)	
		IF statement	
	Example	JUMP JOB:TEST1 IF IN#(14)=OFF	
***** **(label)**	**Function**	Indicates a jump destination.	
	Additional Item	<jump destination>	8 characters or 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>, S<variable number>	
		ARGF<argument 1>	
		ARGF<argument 2>	
		ARGF<argument 3>	
		ARGF<argument 4>	
		ARGF<argument 5>	
		ARGF<argument 6>	
		ARGF<argument 7>	
		ARGF<argument 8>	
		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. In this example, Job 0 cannot be called.)	
RET	**Function**	Returns to the call source job.	
	Additional Item	B<variable number>, I<variable number>, D<variable number>, R<variable number>, S<variable number>, Constant, String	
		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)>	0.001 to 65.535 s
	Example	TIMER T=12.500	
IF statement	**Function**	Evaluates the specified condition and makes a judgment accordingly. Described after an instruction that specifies a certain action. Format:<Item1>=,<>,<=,>=,<,><Item2>	
	Additional Item	<Item1>	
		<Item2>	
	Example	JUMP *12 IF IN#(12)=OFF	
UNTIL statement	**Function**	Monitors the specified input signal during an action and stops the action when the specified signal status is observed. Described after an instruction that specifies a certain action.	
	Additional Item	IN# (<input number>)	
		<status>	
	Example	MOVL V=300 UNTIL IN#(10)=ON	
PAUSE	**Function**	Instructs a pause.	
	Additional Item	IF statement	
	Example	PAUSE IF IN#(12)=OFF	
’ (comment)	**Function**	Displays a comment.	
	Additional Item	<comment>	32 characters or 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 pre-reading instruction processing. Used to adjust the access timing for variable data.	
	Additional Item		
	Example	ADVINIT	
ADVSTOP	**Function**	Stops the pre-reading instruction processing. Used to adjust the access timing for variable data.	
	Additional Item		
	Example	ADVINIT	

10.4 Shift Instructions

SFTON	**Function**	Starts a shift operation.		
	Additional Item	P<variable number>, BP<variable number>, EX<variable number>, BF,RF,TF, UF#(<user coordinate number>)		BF: base coordinates RF: robot coordi-nates TF: tool coordinates UF: user coordinates
	Example	SFTON P001 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>		
	Additional Item	Data1	PX<variable number>	
		Coordinate	BF,RF,TF, UF# (<user coordinate number>), MTF	BF: base coordinates RF: robot coordi-nates TF: tool coordinates UF: user coordinates MTF: tool coordinates for the master
		Data2	PX<variable number>	
		Data3	PX<variable number>	
	Example	MSHIFT PX000 RF PX001 PX002		

10.5 Operating Instructions

ADD	**Function**	Adds Data1 and Data2, and stores the result in Data1. Format:ADD<Data1><Data2>		
	Additional Item	Data1	B<variable number>, I<variable number>, D<variable number>, R<variable number>, P<variable number>, BP<variable number>, EX<variable number>	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>, EX<variable number>	
	Example	ADD I012 I013		
SUB	**Function**	Subtracts Data2 from Data1, and stores the result in Data1. Format:SUB<Data1><Data2>		
	Additional Item	Data1	B<variable number>, I<variable number>, D<variable number>, R<variable number>, P<variable number>, BP<variable number>, EX<variable number>	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>, EX<variable number>	
	Example	SUB I012 I013		

MUL	**Function**	Multiplies Data1 by Data2, and stores the result in Data1. Format:MUL<Data1><Data2> Data1 can be an element in a position variable. If omitted, all elements are specified. Pxxx(1): 1st axis data, Pxxx(2): 2nd axis data, Pxxx(3): 3rd axis data, Pxxx(4): 4th axis data, Pxxx(5): 5th axis data, Pxxx(6): 6th axis data, Pxxx(7): 7th axis data, Pxxx(8): 8th axis data		
	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>)	Data1 must always be a variable.
		Data2	Constant, B<variable number>, I<variable number>, D<variable number>, R<variable number>	
	Example	MUL I012 I013 MUL P000 (3) 2 (Multiply the Z-axis data by 2.)		
DIV	**Function**	Divides Data1 by Data2, and stores the result in Data1. Format:DIV<Data1><Data2> Data1 can be an element in a position variable. If omitted, all elements are specified. Pxxx(1): 1st axis data, Pxxx(2): 2nd axis data, Pxxx(3): 3rd axis data, Pxxx(4): 4th axis data, Pxxx(5): 5th axis data, Pxxx(6): 6th axis data, Pxxx(7): 7th axis data, Pxxx(8): 8th axis data		
	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>)	Data1 must always be a variable.
		Data2	Constant, B<variable number>, I<variable number>, D<variable number>, R<variable number>	
	Example	DIV I012 I013 DIV P000 (3) 2 (Divide the Z-axis data by 2.)		
INC	**Function**	Increments the value of the specified variable by 1.		
	Additional Item	B<variable number>, I<variable number>, D<variable number>		
	Example	INC I043		

DEC	**Function**	Decrements the value of the specified variable by 1.		
	Additional Item	B<variable number>, I<variable number>, D<variable number>		
	Example	DEC I043		
AND	**Function**	Obtains the AND of Data1 and Data2, and stores the result in Data1. Format:AND<Data1><Data2>		
	Additional Item	Data1	B<variable number>	
		Data2	B<variable number>, Constant	
	Example	AND B012 B020		
OR	**Function**	Obtains the OR of Data1 and Data2, and stores the result in Data1. Format:OR<Data1><Data2>		
	Additional Item	Data1	B<variable number>	
		Data2	B<variable number>, Constant	
	Example	OR B012 B020		
NOT	**Function**	Obtains the NOT of Data2, and stores the result in Data1. Format:NOT<Data1><Data2>		
	Additional Item	Data1	B<variable number>	
		Data2	B<variable number>, Constant	
	Example	NOT B012 B020		
XOR	**Function**	Obtains the exclusive OR of Data1 and Data2, and stores the result in Data1. Format:XOR<Data1><Data2>		
	Additional Item	Data1	B<variable number>	
		Data2	B<variable number>, Constant	
	Example	XOR B012 B020		
SET	**Function**	Sets Data2 to Data1. Format:SET<Data1><Data2>		
	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>	Data1 must always be a variable.
		Data2	Constant, B<variable number>, I<variable number>, D<variable number>, R<variable number>, EXPRESS	
	Example	SET I012 I020		

SETE	**Function**	Sets data to an element in a position variable. Pxxx(1): 1st axis data, Pxxx(2): 2nd axis data, Pxxx(3): 3rd axis data, Pxxx(4): 4th axis data, Pxxx(5): 5th axis data, Pxxx(6): 6th axis data, Pxxx(7): 7th axis data, Pxxx(8): 8th axis data		
	Additional Item	Data 1	P<variable number> (<element number>), BP<variable number> (<element number>), EX<variable number> (<element number>)	
		Data 2	D<variable number>, double-precision integer type constant	
	Example	SETE P012 (3) D005		
GETE	**Function**	Extracts an element in a position variable. Pxxx(1): 1st axis data, Pxxx(2): 2nd axis data, Pxxx(3): 3rd axis data, Pxxx(4): 4th axis data, Pxxx(5): 5th axis data, Pxxx(6): 6th axis data, Pxxx(7): 7th axis data, Pxxx(8): 8th axis data		
	Additional Item	D<variable number>		
		P<variable number> (<element number>), BP<variable number> (<element number>), EX<variable number> (<element number>)		
	Example	GETE D006 P012 (4)		
GETS	**Function**	Sets a system variable to the specified variable.		
	Additional Item	B<variable number>, I<variable number>, D<variable number>, R<variable number>, PX<variable number>, S<variable number>		
		$B<variable number>, $I<variable number>, $D<variable number>, $R<variable number>, $PX<variable number>, $RV		System 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 tool		
	Additional Item	Data1	PX<variable number>	
		Data2	PX<variable number>	
		BF, RF, TF, UF# (<user coordinate number>), MTF		BF: base coordinates RF: robot coordinates TF: tool coordinates UF: user coordinates MTF: tool coordinates for the master
		TL#(<tool number>)		
	Example	CNVRT PX000 PX001 BF		
CLEAR	**Function**	Starting with the variable number in Data1, clears (sets to zero) as many variables as specified by a number in Data2. Format:CLEAR<Data1><Data2>		
	Additional Item	Data1	B<variable number>, I<variable number>, D<variable number>, R<variable number>, $B<variable number>, $I<variable number>, $D<variable number>, $R<variable number>,	
		Data2	<number of variables>, ALL,STACK	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 B000 ALL CLEAR STACK		
SIN	**Function**	Obtains the sine of Data2 (unit: deg.), and stores the result in Data1. Format: SIN<Data1><Data2>		
	Additional Item	Data1	R<variable number>	Data1 must always be a real type variable.
		Data2	<constant>, R<variable number>	
	Example	SIN R000 R001 (Sets the sine of R001 to R000.)		
COS	**Function**	Obtains the cosine of Data2 (unit: deg.), and stores the result in Data1. Format: COS<Data1><Data2>		
	Additional Item	Data1	R<variable number>	Data1 must always be a real type variable.
		Data2	<constant>, R<variable number>	
	Example	COS R000 R001 (Sets the cosine of R001 to R000.)		

ATAN	**Function**	Obtains the arc tangent of Data2 (unit: deg.), and stores the result in Data1. Format: ATAN<Data1><Data2>		
	Additional Item	Data1	R<variable number>	Data1 must always be a real type variable.
		Data2	<constant>, R<variable number>	
	Example	ATAN R000 R001 (Sets the arc tangent of R001 to R000.)		
SQRT	**Function**	Obtains the square root of Data2, and stores the result in Data1. Format: SQRT<Data1><Data2>		
	Additional Item	Data1	R<variable number>	Data1 must always be a real type variable.
		Data2	<constant>, R<variable number>	
	Example	SQRT R000 R001 (Sets the square root of R001 to R000.)		
MFRAME	**Function**	Creates a user coordinate using the position data for the given three points as definition points. <Data1> indicates the definition point ORG position data, <Data2> the definition point XX position data, and <Data3> the definition point XY position data. Format: MFRAME <user coordinate> <Data1> <Data2> <Data3>		
	Additional Item	UF#(<user coordinate number>) P<variable number>		User coordinate number: 1 to 63
		Data1	PX <variable number>	
		Data2	PX <variable number>	
		Data3	PX <variable number>	
	Example	MFRAME UF#(1) PX000 PX001 PX002		
MULMAT	**Function**	Obtains the matrix product of Data2 and Data3, and stores the result in Data1. Format: MULMAT <Data1> <Data2> <Data3>		
	Additional Item	Data1	P <variable number>	
		Data2	P <variable number>	
		Data3	P <variable number>	
	Example	MULMAT P000 P001 P002		
INVMAT	**Function**	Obtains the inverse matrix of Data2, and stores the result in Data1. Format: INVMAT <Data1> <Data2>		
	Additional Item	Data1	P <variable number>	
		Data2	P <variable number>	
	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.		
	Additional Item	Contents data of a condition file	WEV#(<condition file number>)(<element number>)	
		Data1	Constant, D<variable number>	
	Example	SETFILE WEV#(1)(1) D000		

GETFILE	**Function**	Stores the contents data of a condition file in Data1. The contents data of a condition file to be obtained is specified by the element number.		
	Additional Item	Data1	D <variable number>	
		Contents data of a condition file	WEV#(<condition file number>)(<element number>)	
	Example	GETFILE D000 WEV#(1)(1)		
GETPOS	**Function**	Stores the position data of Data2 (step number) in Data1.		
	Additional Item	Data1	PX <variable number>	
		Data2	STEP# (<step number>)	
	Example	GETPOS PX000 STEP#(1)		
VAL	**Function**	Converts the numeric value of the character string (ASCII) of Data2 into the real number, and stores the result in Data1. Format: VAL <Data1> <Data2> cardinal number		
	Additional Item	Data1	B <variable number>, I <variable number>, D <variable number>, R <variable number>	
		Data2	Character string, S <variable number>	
		RADIX=<cardinal number>		
	Example	VAL B000 “123”		
ASC	**Function**	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>		
	Additional Item	Data1	B <variable number>	
		Data2	Character string, S <variable number>	
	Example	ASC B000 “ABC”		
CHR$	**Function**	Obtains the character (ASCII) with the character code of Data2, and stores the result in Data1. Format: CHR$<Data1><Data2>		
	Additional Item	Data1	S <variable number>	
		Data2	Constant, B <variable number>	
	Example	CHR$ S000 65		
MID$	**Function**	Obtains the character string (ASCII) of any length (Data 3, 4) from the character string (ASCII) of Data2, and stores the result in Data1. Format: MID$<Data1><Data2><Data3><Data4>		
	Additional Item	Data1	S <variable number>	
		Data2	Character string, S <variable number>	
		Data3	Constant, B <variable number>, I <variable number>, D <variable number>	
		Data4	Constant, B <variable number>, I <variable number>, D <variable number>	
	Example	MID$ S000 “123ABC456” 4 3		

LEN	**Function**	Obtains the total number of bytes of the character string (ASCII) of Data2, and stores the result in Data1. Format: LEN<Data1><Data2>		
	Additional Item	Data1	B <variable number>, I <variable number>, D <variable number>	
		Data2	Character string, S <variable number>	
	Example	LEN B000 “ABCDEF”		
CAT$	**Function**	Combines the character string (ASCII) of Data2 and Data3, and stores the result in Data1. Format: CAT$<Data1><Data2><Data3>		
	Additional Item	Data1	S <variable number>	
		Data2	Character string, S <variable number>	
		Data3	Character string, S <variable number>	
	Example	CAT$ S000 “ABC” “DEF”		

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